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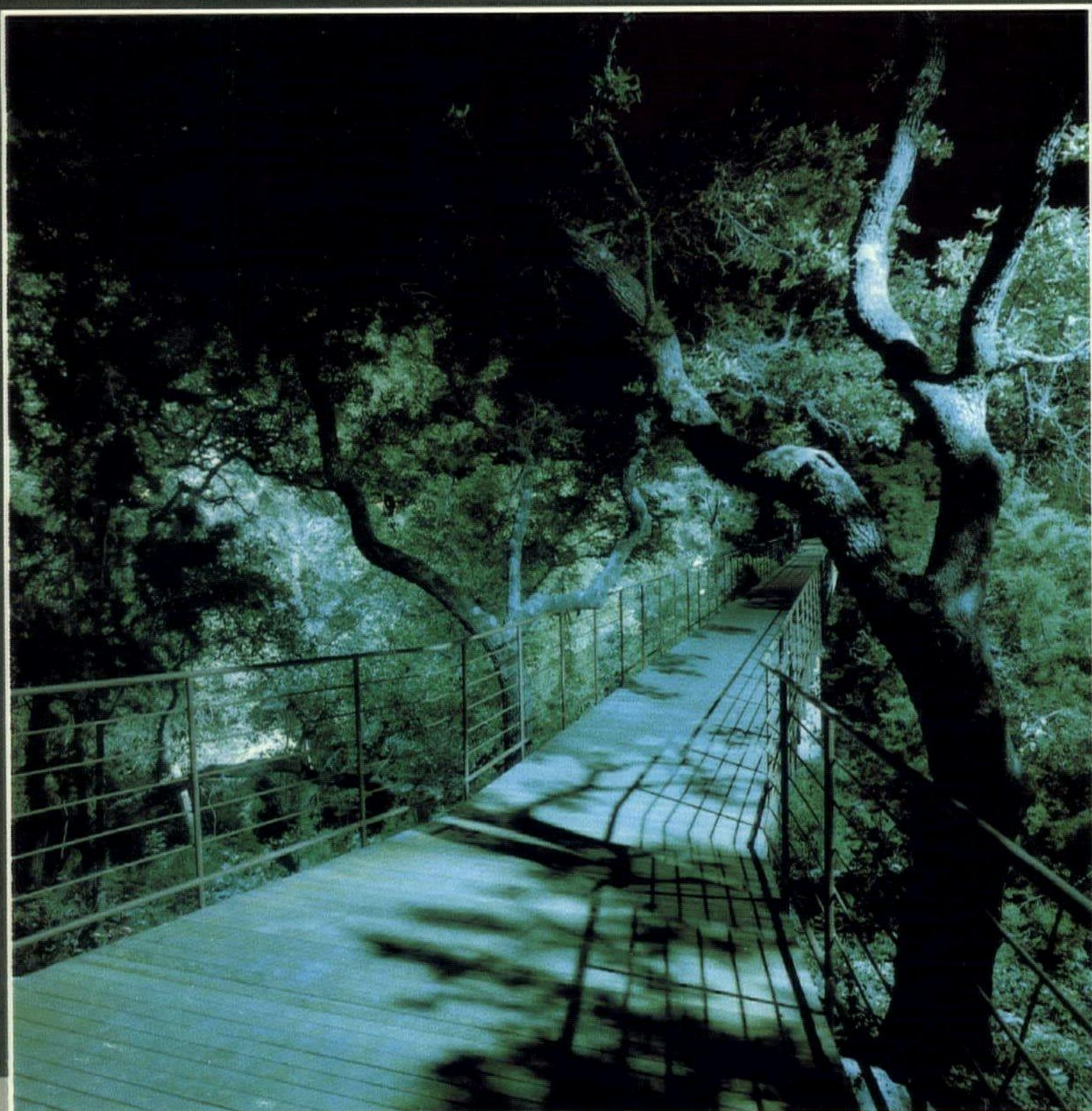

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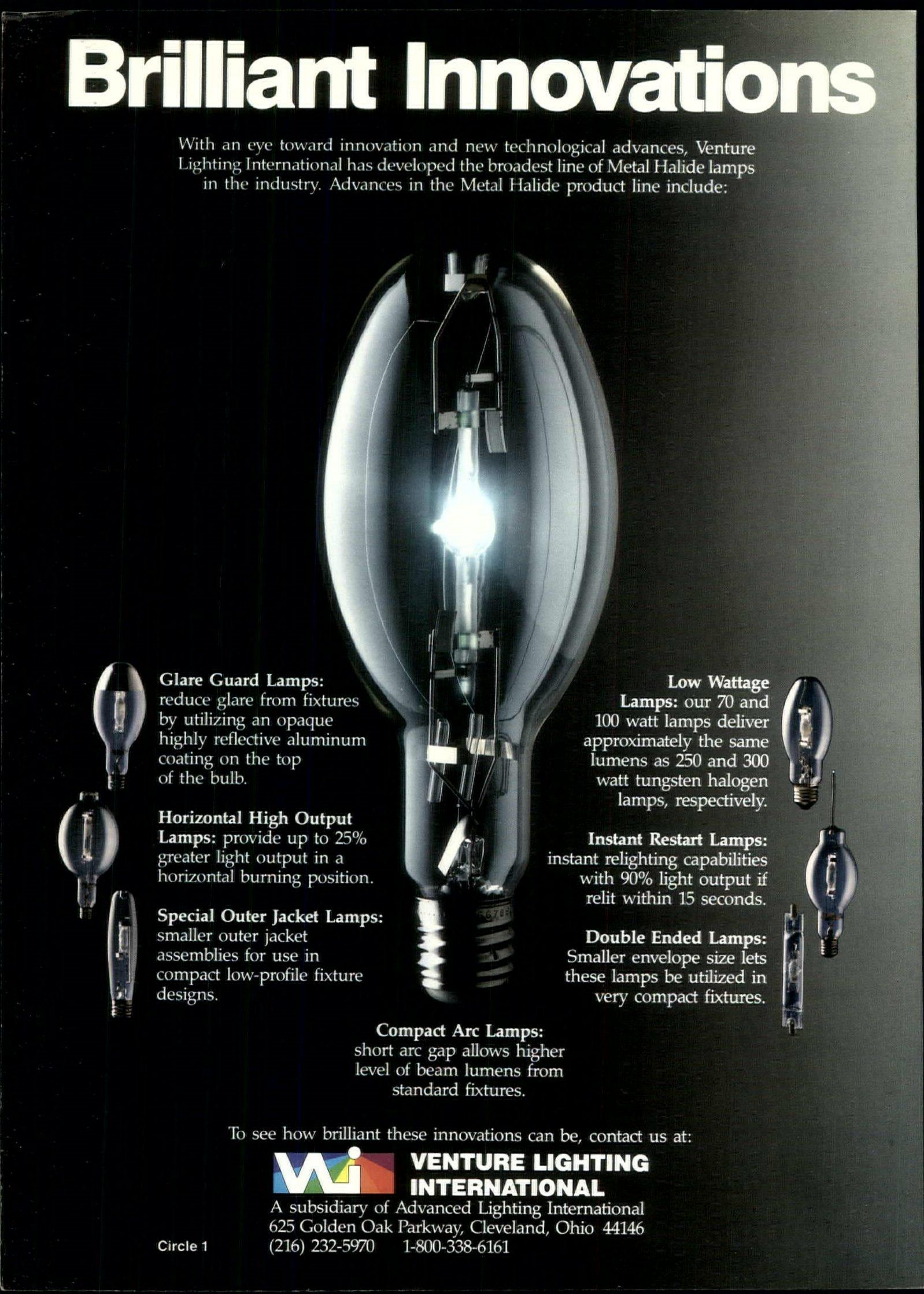

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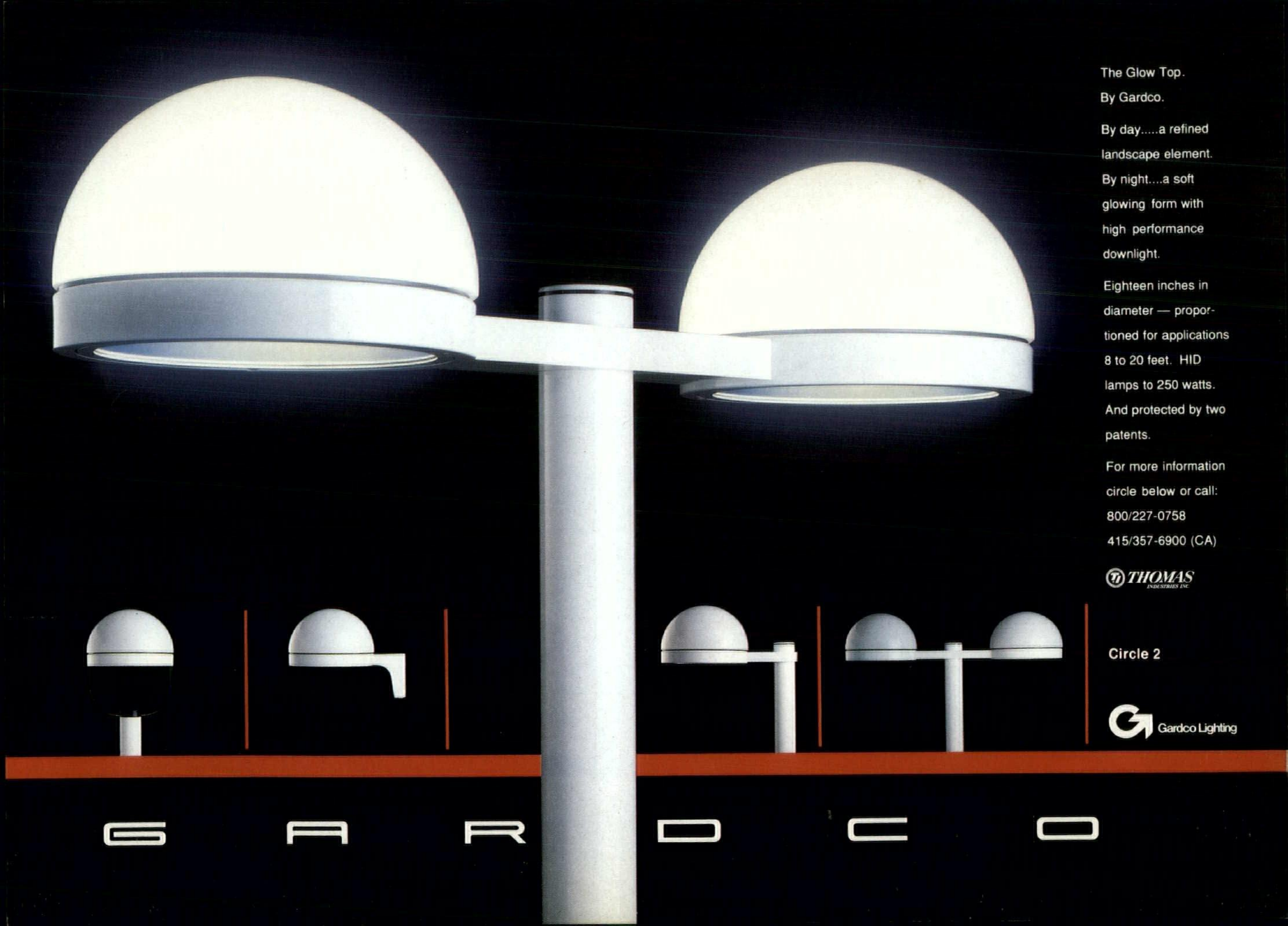

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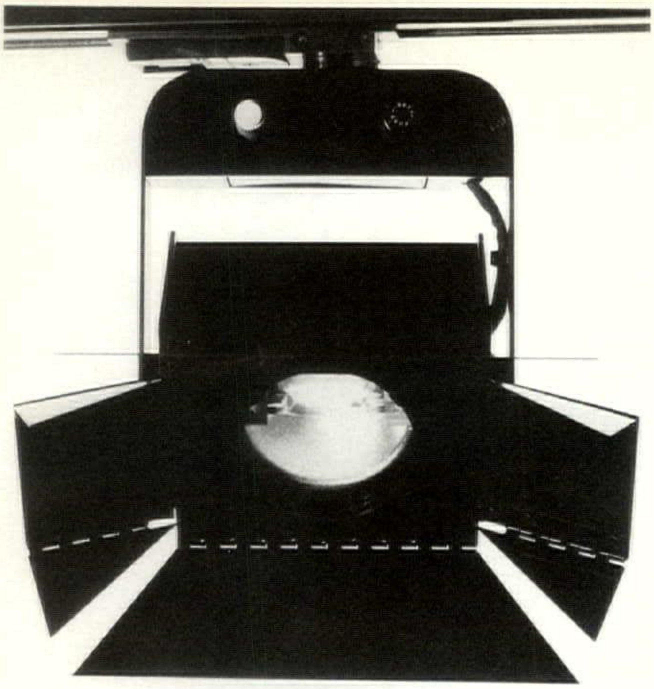

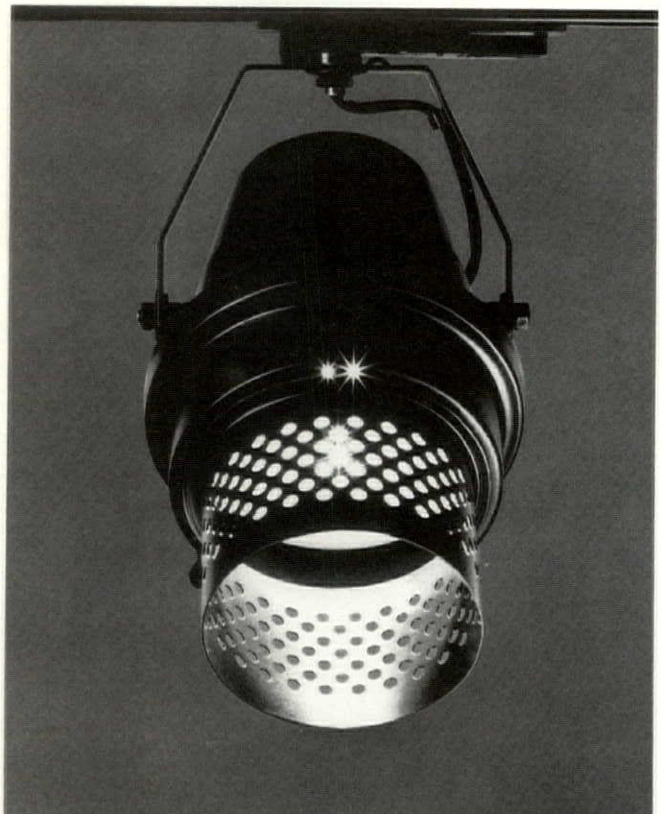

ARCHITECTURAL LIGHTING

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ARCHITECTURAL LIGHTING

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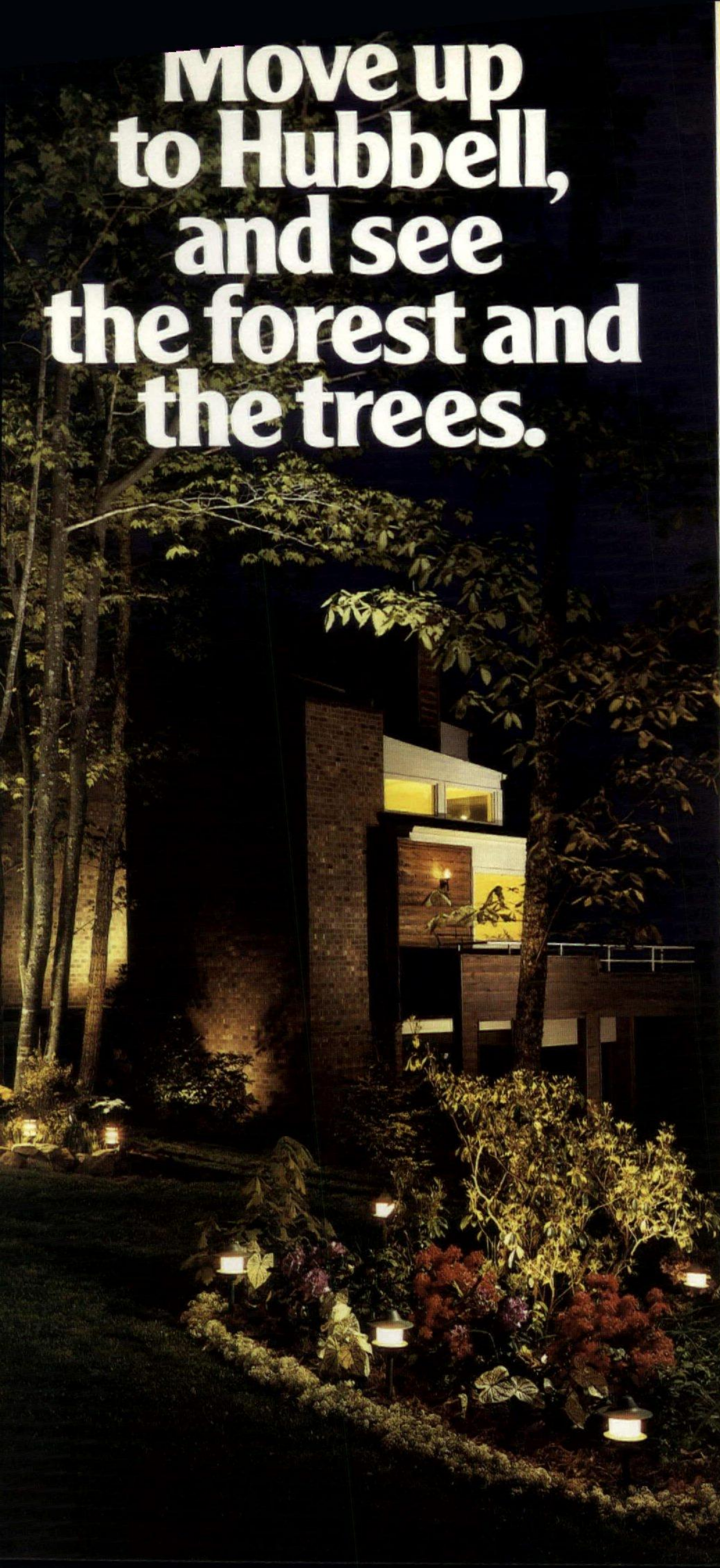

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ARCHITECTURAL LIGHTING
October 1987
Volume 1, Number 9

THE RIVIERA

From the Editor

VDT Glare. It's got to be the most talked about problem in lighting design today. Everywhere I go — conferences, trade shows, interviews — everybody talks about it. And the opinion is nearly universal: VDT glare is a very, very bad thing. And it appears that more and more people everywhere are suffering from it. I know this because "severe VDT glare" recently replaced "not having a computer terminal" in the "Worst Thing That Could Happen to Spoil Your Day Poll" I conduct weekly here in my office.

I used to think that VDT glare was a pretty terrible thing too, but recently I've opened my eyes to what a useful thing it can be. VDT glare has done a lot for everyone involved in lighting, and I for one am pretty darned thankful for it.

Look on the Bright Side

First, I thank VDT glare for making everybody who uses a computer aware of just exactly what glare is. People say to me all the time, "What is this glare you're always writing about?" Now I can reply, "It's those white blobs on your computer screen," and they know exactly what I mean. And they tell others, "See those blobs? They're glare. VDT glare. You have a glare problem." More people are aware that their lighting is inadequate than ever before.

The second thing that I'm really thankful about is that VDT glare has caused designers and manufacturers to become united in a kind of "War on Glare." It's great to see everybody pulling together again, the way they did back during the energy crisis, and I know great things will happen because of it.

Finally, I'm thankful that a victorious War on Glare will mean an end to all eyestrain and any cases of headache and nausea in the electronic office not caused by leaking radon gas. Good. Sign me up. I'm very thankful, but almost out of medicine, and I can hardly see what I'm doing.

Charles Linn, AIA

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Circle 12

Letters

Twin Cities DLF alive and well

I was delighted to see the article "Groups are sources of lighting information" [May 1987]. Visibility of these groups is very important — visibility not only to your readers but to all related trades and the average consumer. The IALD, DLF, IES, and DNNA are so closely associated that it would benefit all to support a joint visibility campaign, since the profession of lighting is "coming of age."

I was, however, disappointed that the Twin Cities DLF chapter was not listed as having an active membership. It has been very active for the past eight years. During the past few years we have sponsored some excellent programs, such as annual panel discussions to include the "Design Team and Its Players" (the architect, lighting designer, interior designer, electrical engineer, electrical distributor, electrical contractor), "The Aging Eye" by Jim Nuckolls, "Light and Color" by Carlton Wagner, lighting with a theatrical twist by Abe Feder, and several presentations on light as an art form by John David Mooney. We have had a very lively response in our community.

We are delighted to find out about all the other Designers Lighting Forums in the country, but would like to encourage *Architectural Lighting* to make a complete listing of all DLF chapters. Our phone number is (612) 471-7007; annual dues are $40.00.

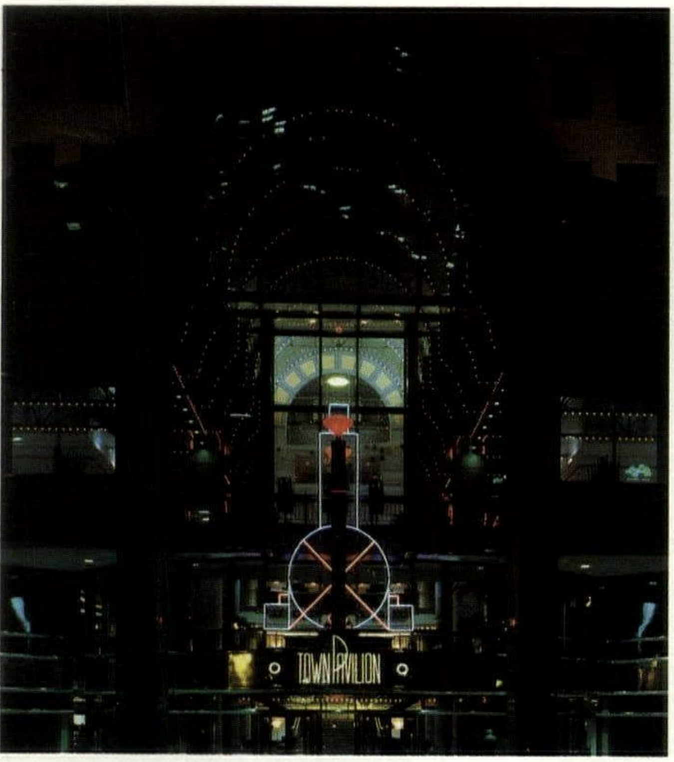
Patricia Yorks, ASID, IES
President
Designers Lighting Forum of the Twin Cities
2825 Casco Point Road
Wayzata, Minnesota 55391

We're glad to lengthen our list of Designers Lighting Forums and sorry we missed you in May. Because DLFs are independent local organizations, current nationwide information is hard to come by. Most of the forums lost touch with each other after the DLF committee of IES disbanded about seven years ago. Maybe it's time for DLFs to pull together again.

Our Calendar section is one way to keep in touch. Lighting groups that send program schedules and event announcements help us keep our readers up-to-date.

The Editor

Industrial struts decorate Main Street rotunda



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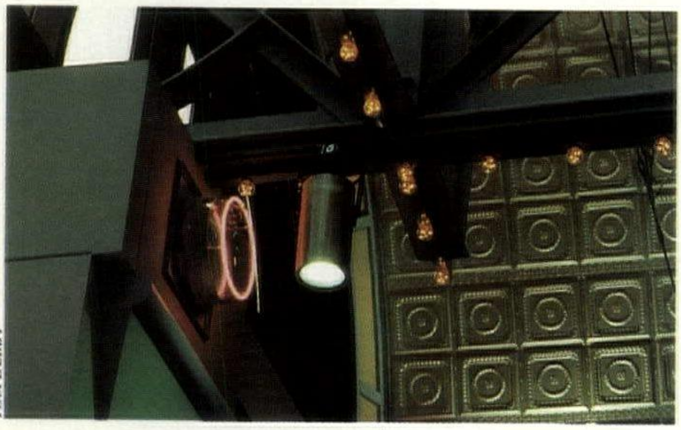


TOM DERBY

Project: AT&T Town Pavilion
Location: Kansas City, Missouri
Client: RMC/OP Office Venture
Architect: Howard Needles Tammen & Bergendoff
Electrical Engineer: Smith & Boucher, Inc.

An industrial track lighting system usually seen in manufacturing plants is dressed up for Main Street at the AT&T Town Pavilion. The eclectic five-story rotunda is the centerpiece of a downtown office and retail complex, an ambitious project incorporating a new 38-story tower and two rehabilitated historic buildings in downtown Kansas City, Missouri.

Architects at Howard Needles Tammen & Bergendoff developed the concept for the rotunda and worked with electrical engineers Smith & Boucher to design the lighting. The team identified two basic requirements: general lighting to provide minimum levels for circulation and exciting feature lighting to show off the space. The engineers realized that the strut system, which has a self-contained flat power cable, could support both kinds of lighting.

For general lighting, HNTB architects wanted cylindrical can downlights with a profile as slim as possible. The engineers recommended a mercury vapor fixture with deluxe white lamps. "Generally, we would use metal halide because it's more efficient," says Jim Ricketts of Smith & Boucher. "This type of fixture dictated a reflector type lamp, which is not available in metal halide."

The strut system and the swivel-mounted fixture make a flexible combination. Lights can be mounted, aimed, and focused anywhere along the track. Later, they can be moved, or new fixtures can be added. The strut system has three separate circuits for control. Since the space was intended to be a special place for performances, this adaptability is a big plus.

Low-voltage marquee lamps punctuate a custom-configured aluminum extrusion that fits along the bottom of the struts and outlines architectural features in the rotunda. Tim Cahill, project designer at HNTB, likes the way the incandescent glow contrasts with neon accents that "blast out" intense colors.

The architects stayed involved throughout the design process. The HNTB staff reviewed a presentation of typical footcandle levels, fixture spacings, and other illuminating engineering data. Then they discussed the project with Smith & Boucher, reviewed a schematic of the fixture placement, and helped select fixtures to specify.

"It was a challenge to incorporate lighting as an integral part of the design," Cahill says. He remembers the project as a constructive learning experience. The result is a unique, functional lighting system with enough class to go to town. ■

For product information, see the Manufacturer Credits section on page 70.

Circle 15

Users gradually adapt to indirect lighting

Project: Wisconsin Electric Power Co. Public Service Building Annex
Location: Milwaukee, Wisconsin
Architect: Flad & Associates
Lighting Designer: Robert Bucci, PE, Affiliated Engineers
Photos: Joe Paskus

Indirect fluorescent lighting might seem an unusual choice for a utility that wants to demonstrate the state of the art in energy-efficient lighting. Nonetheless, that was the primary lighting system that the Wisconsin Electric Power Company chose when it built a 415,000-square-foot annex to accommodate its corporate headquarters.

The lighting design team at Affiliated Engineers made both quantitative and qualitative evaluations of alternative systems. The engineers calculated lumens per watt and watts per square foot, then balanced the hard numbers with a consideration of visual comfort for VDT users in the main office areas. Their conclusion: indirect fluorescent would provide the most effective light per energy dollar.

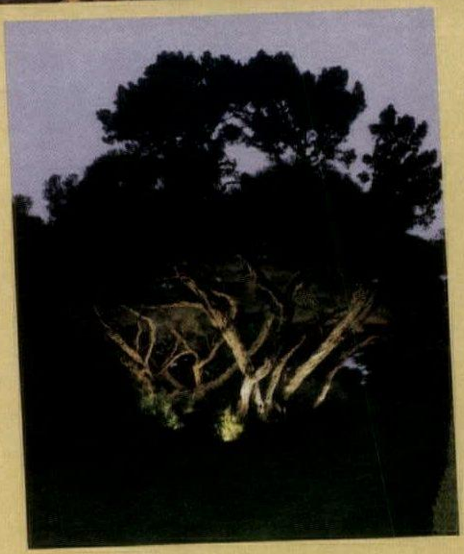
"The T8 lamp with any parabolic reflector, whether indirect or direct, has excellent system efficiency," says Bob Bucci, PE, lighting designer for the project. "In this situation, the only suitable lighting system more efficient than indirect fluorescent is parabolic fluorescent downlighting." To demonstrate the quality of light achieved with the slightly less efficient indirect system, Affiliated Engineers took WEPCO officials on tours of local banks and insurance companies. "We selected indirect fluorescent applications similar to the WEPCO space in terms of furniture configurations and density of VDTs," Bucci says. After the tour, the client agreed that indirect lighting was the best system for the job.

Evaluation continued in the form of on-site tests and user surveys. Indirect fixtures were installed in three areas of an existing building, and employees were surveyed after working there for one month, three months, and six months. Again covering both quantity and quality issues, the engineers took light meter readings and asked for subjective impressions.

The survey results are intriguing. "In the first survey, a lot of people said they disliked the lighting — maybe half," says Bucci. "In the second survey, nobody admitted they disliked it, but many were sure their neighbor disliked it. Finally, in the third survey, no negative comments emerged at all. Apparently, it just takes time to get used to it." Later, the same pattern of results occurred among employees who moved into the completed annex.

A programmable controller enhances the system's efficiency. The program sets lights at half level early in the morning as people begin to arrive, goes to full at regular starting time, and reverses the pattern at quitting time and in the evening. Workers burning the midnight oil can use local switching to keep lights at full power. The controller periodically sweeps the building at night, turning off all locally switched lights except those operated from priority stations such as managers' offices. ■

For product information, see the Manufacturer Credits section on page 70.



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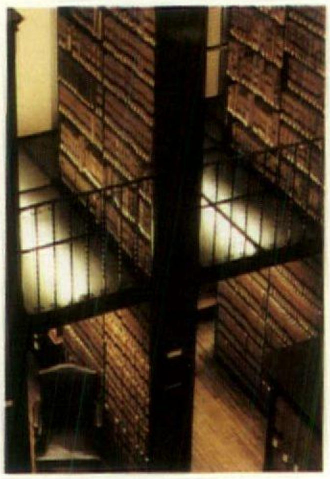
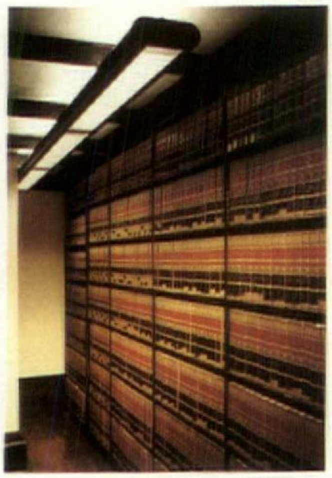
Circle 16

Chief Justice helps designers light court library





Project: Missouri Supreme Court Library
Location: Jefferson City, Missouri
Architect: George Johannes, The Christner Partnership
Electrical Engineer: Harry Auman, McMichael Auman Consultants
Photos: Sam Fentress

Pooling their talents, an engineer and an architect improved the lighting in the Missouri Supreme Court Library. They reduced power density from 4.0 to 2.8 watts per square foot, brought the space up to code by installing emergency egress lighting, and enhanced the elegant French Renaissance architecture — all within a budget of $5.50 per square foot.

Architect George Johannes and electrical engineer Harry Auman started by touring the 80-year-old library. "We spent a couple of hours walking around, visually studying the space, and discussing possibilities," Auman recalls.

"It's my feeling that whoever designed the space intended it to be used during the day, and to have sufficient daylighting," he says. The 10,000-square-foot room faces north and has 11 huge windows. Glass floors on the second level of the shelving stacks help admit light, and mysterious glass panels in the high, gold-trimmed ceiling may have been designed as skylights, although the designers could find no evidence that they ever functioned.

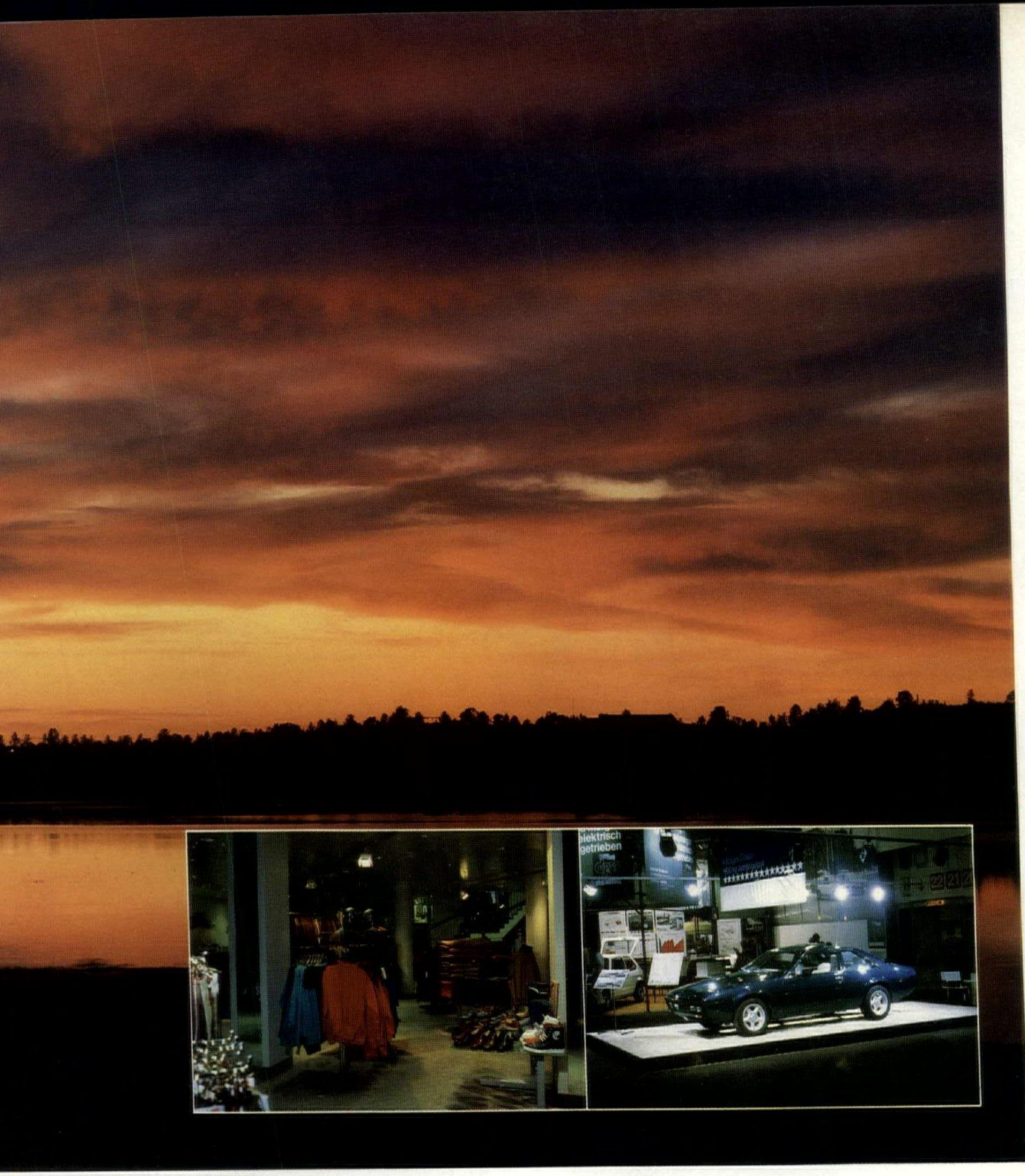
Bulky, boxlike chandeliers were installed in the 1950s, creating a dimly lit space below and a gloomy, cavernous vault above. Auman and Johannes quickly decided to replace the obtrusive chandeliers. "We tried to find some period chandeliers or fixtures, but there weren't many light fixtures in use back then," Auman says. "We also thought of indirect lighting. After all our analysis, we took some fixtures to the site to check their performance. We really liked what we saw when we put an indirect dual-source unit on top of the stacks."

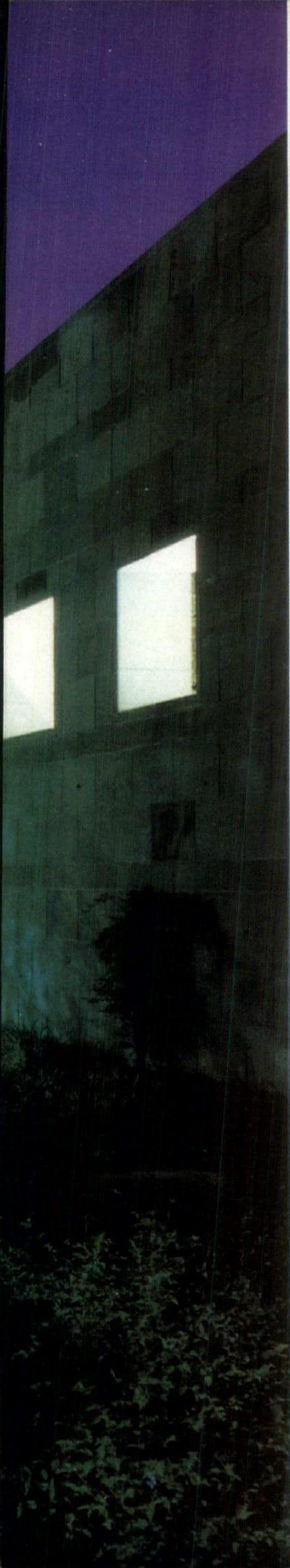
Each of the fixtures has two lamps, one high pressure sodium and one metal halide. "This application is perfect for a dual-source unit because the ceiling is so high that the light mixes totally, and you don't see a yellow spot and a blue spot side by side," Auman says.

Auman and Johannes agreed that the existing fluorescent strips used for stack lighting should be replaced with something less glaring. They were testing a louvered fluorescent unit on the lower level when the Chief Justice suggested they turn the fixture upside down, thus lighting the upper level through the glass floor. "We did, and then we removed the metal top of the fixture and held it up again, right side up this time, to see how the light from both the top and bottom would illuminate the shelves. It worked, and this allowed us to entirely eliminate fixtures on the upper stacks." Johannes turned another fixture upside down when he selected a ceiling-mounted stem fixture to be adapted as a table-mounted task light.

"The finished job turned out better than I ever anticipated," Auman says. "Taking one or two prototype fixtures to the site doesn't show you the full effect of what the end product is going to be; you have to be able to envision it. That's where an architect really lends a hand."■

For product information, see the Manufacturer Credits section on page 70.

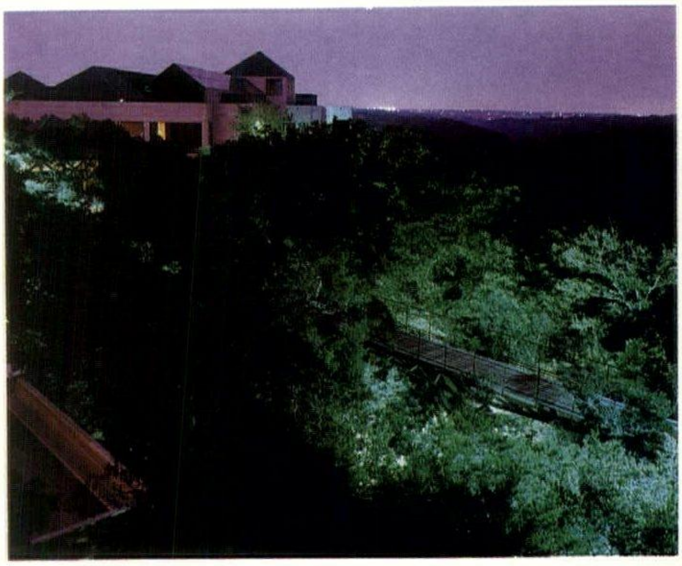




Outdoor lighting philosophy considers plants, technology, people

ARTICLE BY
CHARLES LINN, AIA

PHOTOGRAPHS BY
RICK PATRICK PHOTOGRAPHY



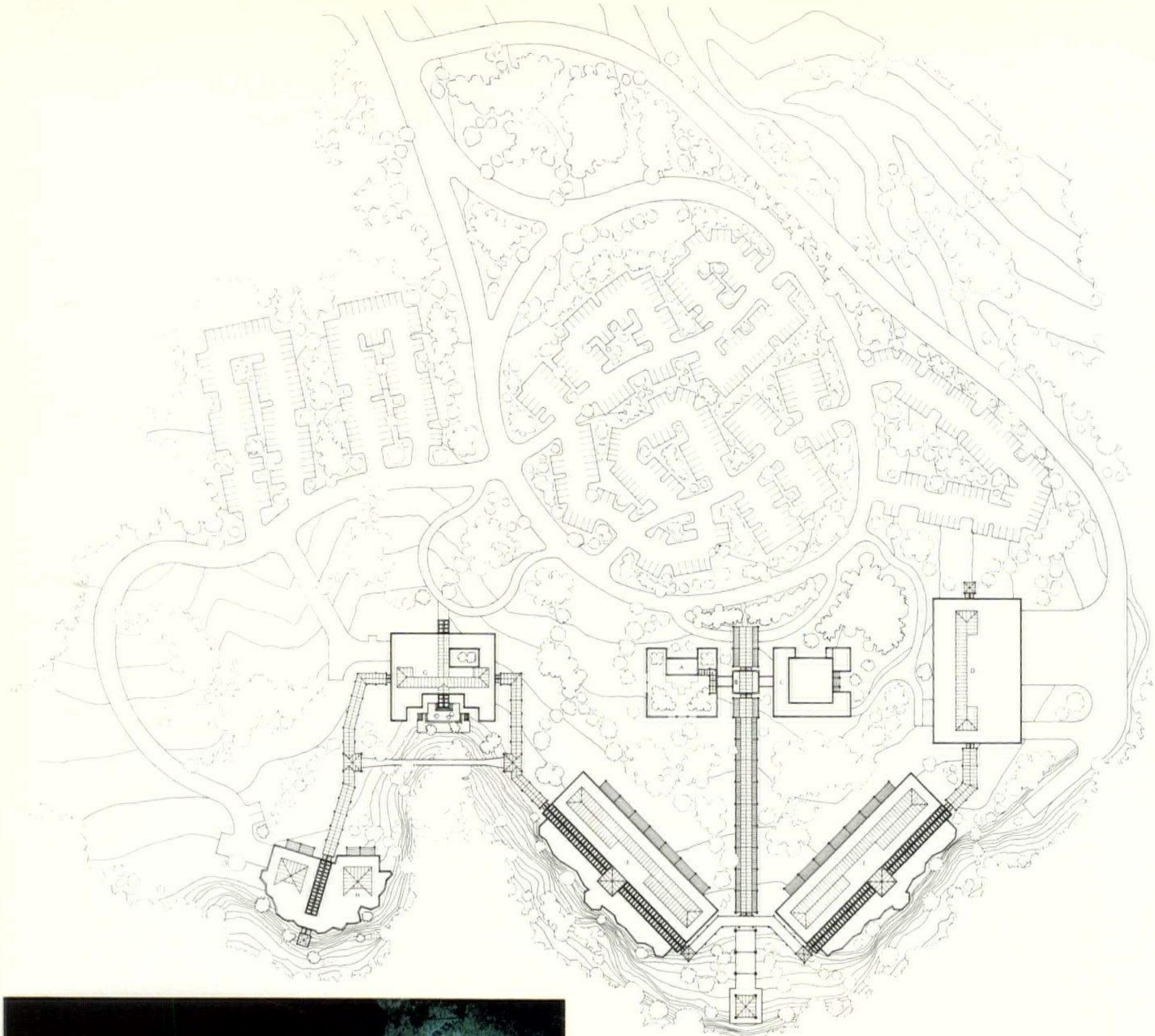
Schlumberger Well Services, a division of Schlumberger, Ltd., is the largest provider of "wireline" measurement services to the oil and gas industry. When the company decided to build a new facility for engineering computerized surface systems, its management wanted to provide architecture in a setting that employees would enjoy and look forward to working in. Managers wanted to build an atmosphere that would be conducive to creative thought and innovative development.

The company chose to build the complex on a densely wooded site overlooking a canyon in the hills west of Austin. Here, employees could work in a natural setting isolated from the noise, traffic, and distractions common to most office complexes. Properly locating and designing buildings to be compatible with the site's complex topography and vegetation required extensive collaboration between architects Howard Barnstone and Robert Jackson and landscape architect J. Robert Anderson.

"From the air," says Jackson, "the facility looks like some mythical acropolis, half covered by the jungle. As you walk through the complex, you discover that the pattern and rhythm of the campus plan follows and embraces the shape of the canyon. The strong presence of the bluff projects like a wave into the buildings, creating a harmonic balance between man and nature."

For Anderson — and Saleem Jehangir, the project manager for Schlumberger — the exterior lighting became a major element in the process of reconciling this large building complex with the land. Early in the project, they established that there would be no pole- or building-mounted fixtures used in the lighting design, and that tree-mounted up- and down-lighting and ground-mounted uplighting would make up the entire exterior lighting

Project: Austin Systems Center
Client: Schlumberger Well Services
Location: Austin, Texas
Architects: Howard Barnstone, FAIA, and Robert Jackson, AIA
Landscape Architect: J. Robert Anderson, ASLA
Project Manager: Saleem Jehangir, PE, Schlumberger Well Services
Lighting Design: J. Robert Anderson and Jim Janik, MIES
Contractor: Showcase Lighting



The road leading into the site is illuminated with tree-mounted mercury vapor downlights. The light increases in intensity as drivers get farther into the site.

Schlumberger Well Services Austin Systems Center. A: Training. B: Lobby. C: Auditorium. D: Shipping-Receiving. E: Office-Lab. F: Office-Lab. G: Cafeteria. H: Office-Lab.

vocabulary.

"Nothing is more beautiful and intriguing than nature's own haphazard patterns of growth in the wild," says Jehangir. "The infinite arrangements and variety that one finds can never be paralleled by homemade versions of the landscape — how can people enhance nature's genius? The whole philosophy of the night lighting went along with the entire theme of this project: leave nature undisturbed and put few man-made things in it. So we decided that putting up poles on the site simply would not fit into the natural randomness of the site. Although we also discussed direct and indirect lighting, lighting from the trees and the ground seemed to be our only reasonable choice."

Landscape Scenes

Anderson used the lighting to define specific elements of the landscaping and architecture, and to compose what he calls "landscape scenes." The scenes, according to Anderson, "express the ecological habitat existing on the site and carry through to include the struc-

tures." By carefully placing and aiming fixtures, designers can emphasize specific elements and control the visual experience. "We wanted the lighting to reflect the overall feeling of the campus — it's in the trees, it's of the landscape. The landscape glows in and of itself. But you can't do that very well with pole-mounted fixtures." Anderson also chose a light source that would be compatible with the vegetation: "We chose mercury vapor because its bluish white color brings out the greens of the foliage better than any other high intensity discharge source."

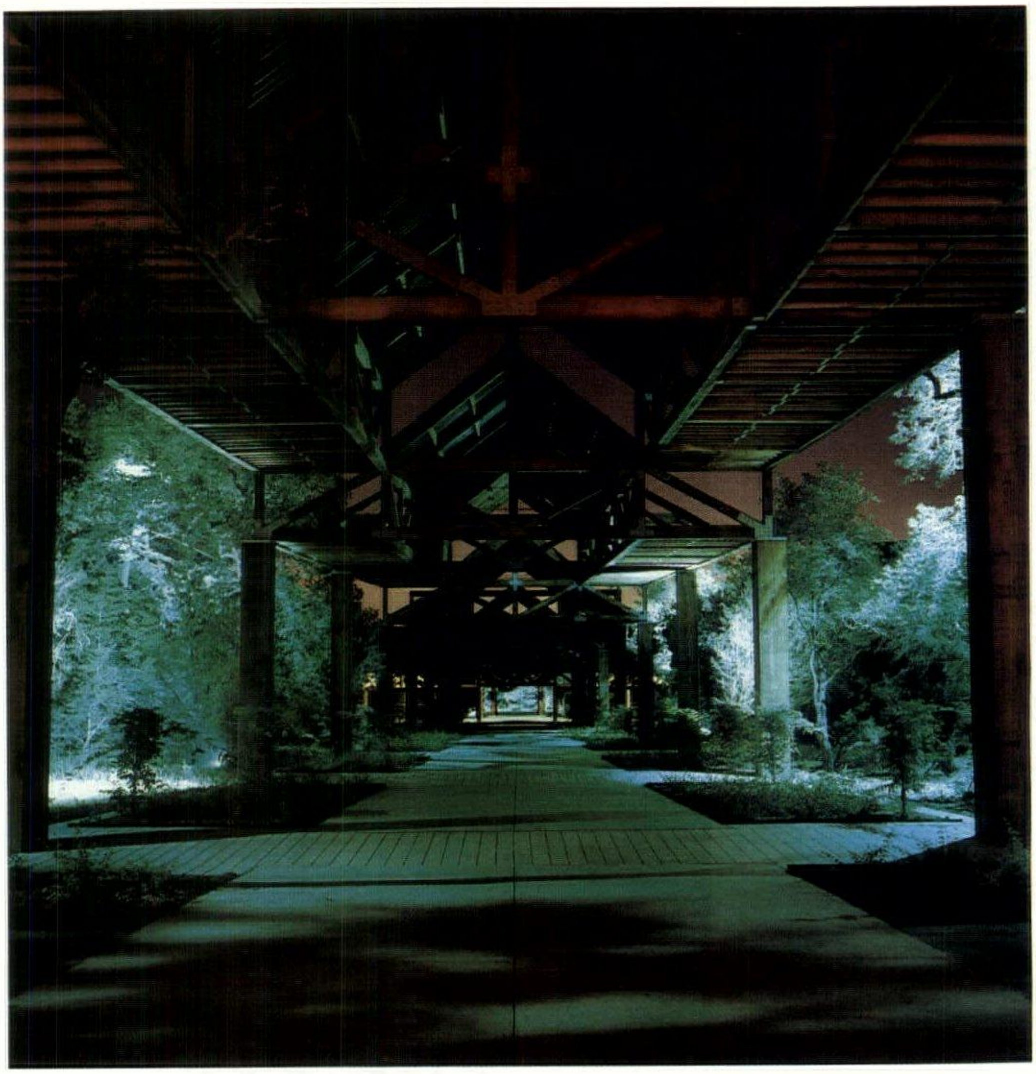
The scheme is workable because a wealth of old-growth live oaks, red oaks, and cedar elms on the site provide places to position light fixtures. Mercury vapor up- and downlights with directional shielding were attached to the live oaks — which do not lose their leaves in winter — high above the ground. The fixtures highlight the massive limb structure of the oaks, while creating a play of light and shadow on the ground reminiscent of moonlight. In complement, 175-watt wide-angle mercury vapor uplights were placed in the trees and at the bases of the trees, providing a lustrous wash of the leaves and tree canopy. Pools of light seem to flow into one another instead of creating uniform patterns. The lighting emphasizes the spectacular trees and the naturally irregular rhythm of the site.

One first experiences the landscape illumination when driving into the site down a long winding road. The light comes through the trees at low levels at first, increasing as one is drawn more deeply into the site. In the main parking lot, the light comes primarily from downlights mounted in the trees, 20 to 40 feet above the paving. The downlighting gives the entire parking lot a soft glow. Higher wattage lamps were used to produce increased light levels near important areas, such as road intersections and walkway entrances.

Light from trees near the walkways orients pedestrians and guides them toward the building complex, which is not visible from the parking area. A pergola extends toward the parking area from the lobby of the main entry building; it is flanked by a formal garden and a restored cliff habitat. The pergola itself is not lit, but ambient light spills onto the walkway from these nearby gardens.

Immediately adjacent to the entry lobby is a formal courtyard, created by walls of 20-foot-high adoquin, a light-colored stone imported from Mexico and used throughout the project. Here, Anderson designed a partial grid of Bradford pear trees, which are backlit by light reflected off the courtyard walls. In time, wisteria vines will climb up the walls to provide another contrasting element.

The pergola continues beyond the entry building lobby, terminating in a pavilion that overlooks the canyon. Here, the forest is lit by 175-watt mercury vapor floodlights, ground-mounted below the pavilion, giving the viewer a full appreciation of the expansiveness of the abyss beyond and a nighttime look at the Austin skyline. The two main research buildings adjacent to the pavilion are floodlit on the canyon side by other ground-mounted uplights. These are located close to the buildings so that fixture glare does not interfere with the view of the skyline from inside the buildings.



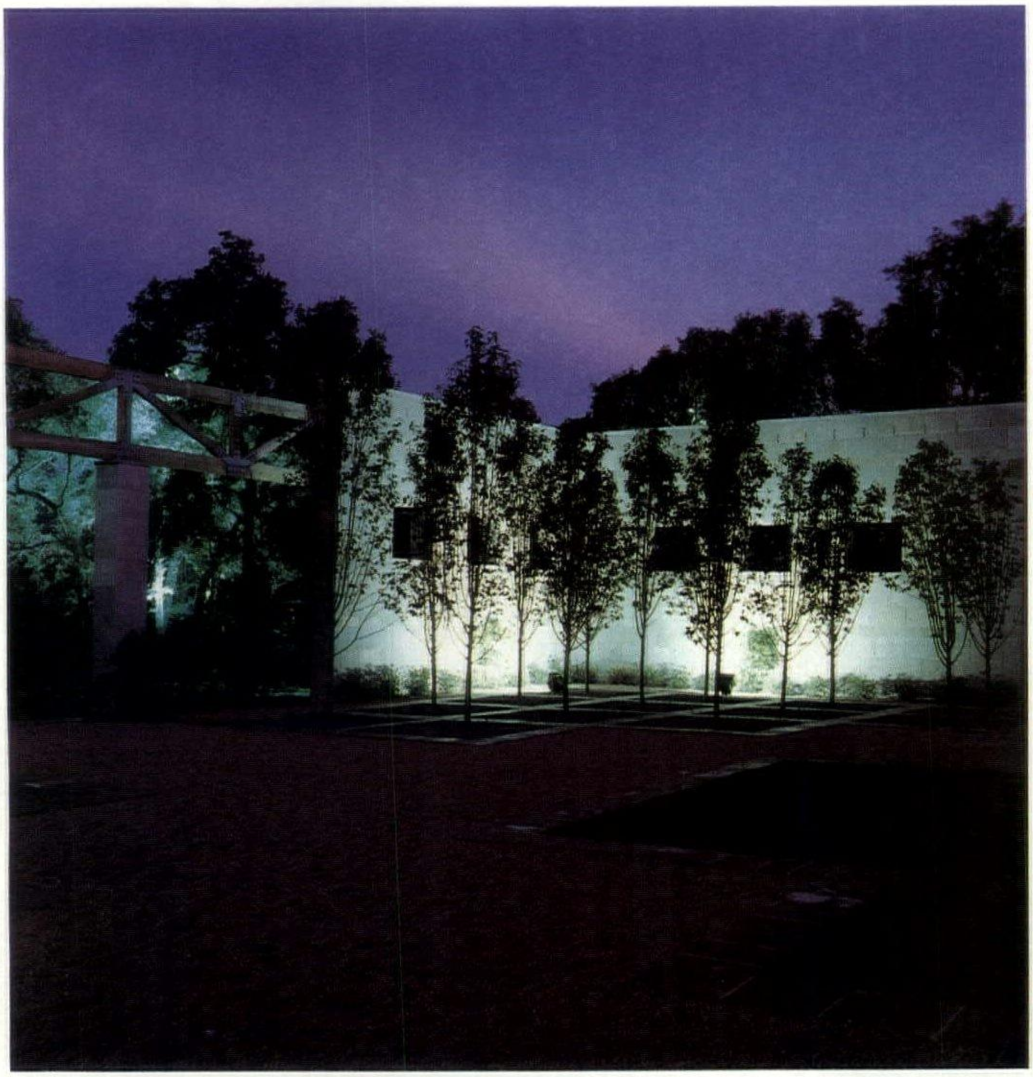
The pergola contains no lighting itself, but is lit from mercury vapor downlights hung in nearby trees.

Outside the cafeteria, a deck opens onto a live spring that spills out of a limestone formation into a ravine, the most ecologically unique area of the site. The ravine contains over 200 species of ferns, flowering plants, and trees. A pedestrian bridge spans this ravine, and the bridge structure and the area below are lit with a combination of tree-mounted uplights and downlights. "The bridge is an area of transition between buildings," says Anderson, "and from it you can experience the entire theme of the landscape and the architecture: the balance between the abundant ecological diversity, and the simplicity of that which is man-made."

System Layout and Construction

Deciding where to locate fixtures for this system was a bit trickier than for conventional exterior applications, where poles can be placed nearly anywhere the designer desires and the results of the lighting are relatively predictable. "I started out with the paths and walkways already laid out on the site," says Anderson. Then he walked the paths, identifying the scenes he wanted to establish and determining which trees would need to have fixtures to illuminate them.

Once these trees were located, the electrical supply system was laid out. "Installing the conduit and electrical cables was probably the most difficult part of this job," says Anderson, "because the entire system is routed underground. We were careful to install it in such a way as to avoid any unnecessary damage to tree roots or vegetation — that required over 15,000 feet of rock sawing and hand excavation." Trenches were dug to the minimum depths and widths required to carry the concrete-encased conduits.



A partial grid of Bradford pear trees is backlit by light reflecting off a wall constructed of adoquin stone imported from Mexico for the project.

All circuitry for the 200-amp, 120/208 volt, three-phase system was calculated and installed to compensate for voltage drop and to allow for future expansion of the lighting system. All of the power originates from one building and is photoelectrically controlled, with manual override for use by security personnel.

Contractor Coordination

Anderson and contractor Jim Janik worked together to locate over 220 mercury vapor fixtures. Over 150 weathertight 100-watt mercury vapor downlights with custom fabricated directional shields were used as the basis for the overall illumination. Another 50 175-watt uplights with custom glare shields and louver controls provided lighting backgrounds and highlights, while 20 in-ground well lights were used to illuminate newly planted specimen trees. "The project would have been impossible without the cooperative effort between designer and contractor," says Anderson, "considering the amount of coordination that was required for the trenching, for the cables, and for fixture placement."

In most cases, the light fixtures were located so that they would not be visible during the daylight hours, nor glare into the eyes of pedestrians at night. "We had to look at each tree, each branch, the wattage of the fixture, and the aiming angle of the fixture," says Janik. "We had to make pinpoint locations to prevent hot spots on nearby branches and to light the most possible vegetation below it. Other criteria for selecting a location are a tree's height, uniqueness, and proximity to a pathway or building."

Conduit ties weathertight junction boxes to the underground cables at the base of each tree. The boxes are located on the side of the tree opposite normal viewing angles and are painted brown, even though they are out of sight. Between the junction box and the fixture, the electrical cable is simply stapled to the tree, with enough slack to compensate for future tree growth. Members of two tree climbing crews secured the fixtures to the trees with lag bolts.

The unique landscape lighting of Schlumberger's Austin Systems Center is the result of a carefully thought-out philosophy and untiring devotion to that philosophy by the client, landscape architect, and contractor. The product speaks fluently of that philosophy: to blend the natural with the manmade through lighting. "The light is not a complete uniform intensity, but that's why it works so well with this site," says Anderson. "It blends in with the ecological diversity of the plants and topography."■

For product information, see the Manufacturer Credits section on page 70.

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Circle 18

Catching some rays: New device delivers filtered sunlight indoors

Stephen Mallery

Stephen Mallery is an editorial assistant with Architectural Lighting*'s publisher, Aster Publishing Corporation.*

Resting gracefully atop a downtown Tokyo skyscraper, a new kind of sunflower catches the full light of the sun in its course across the sky, constantly turning its round face to receive, process, and transmit downward the sun's life-giving rays. This sunflower — or himawari in Japanese — is not a plant but an exciting new lighting idea created by Kei Mori, PhD, of Keio University in Tokyo.

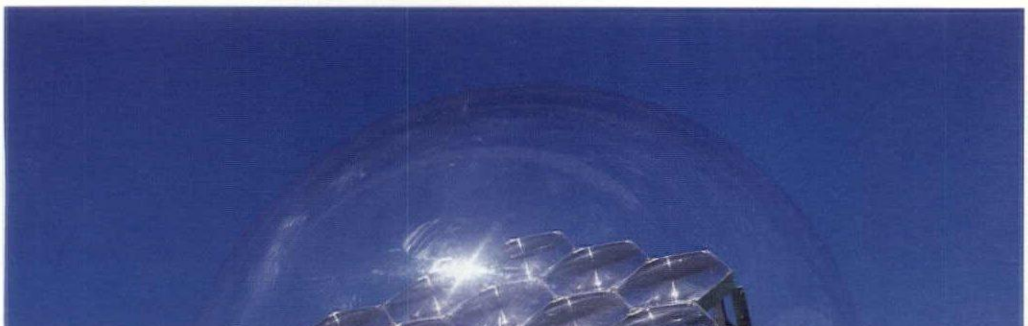
The idea for the himawari was sparked by a problem that is both basic and acute in many of Japan's cities — poor availability of daylight in burgeoning city centers. The problem is one that affects people who work in the city and who live in nearby suburbs. In rapidly expanding city centers, little sunlight reaches ground levels and northern exposures; windowless interior offices have no daylighting options. In northern latitudes, where the sharper angle of the sun casts a larger shadow, residential areas are being eclipsed by the increasing number of downtown skyscrapers.

Japanese public policy acknowledges the problem for residential daylighting; regulations require that new homes admit a minimum of four hours of sunshine per day. But public policies are not perfect. In this case, the four hours are measured on the shortest day of the year, December 21, when the sun is at its lowest point in the sky. Japanese architecture, however, makes extensive use of wide eaves. Soon after the new year, the sun travels much higher in the sky, admitting little sunlight into homes.

The challenge of managing access to daylight for suburban residences has increased under the shadows of the city. The problem in Tokyo is so acute that regulations that require residential access to daylight have been relaxed to require only two hours of daylight availability in homes instead of four. Regulations do not completely assure that people have enough sunlight.

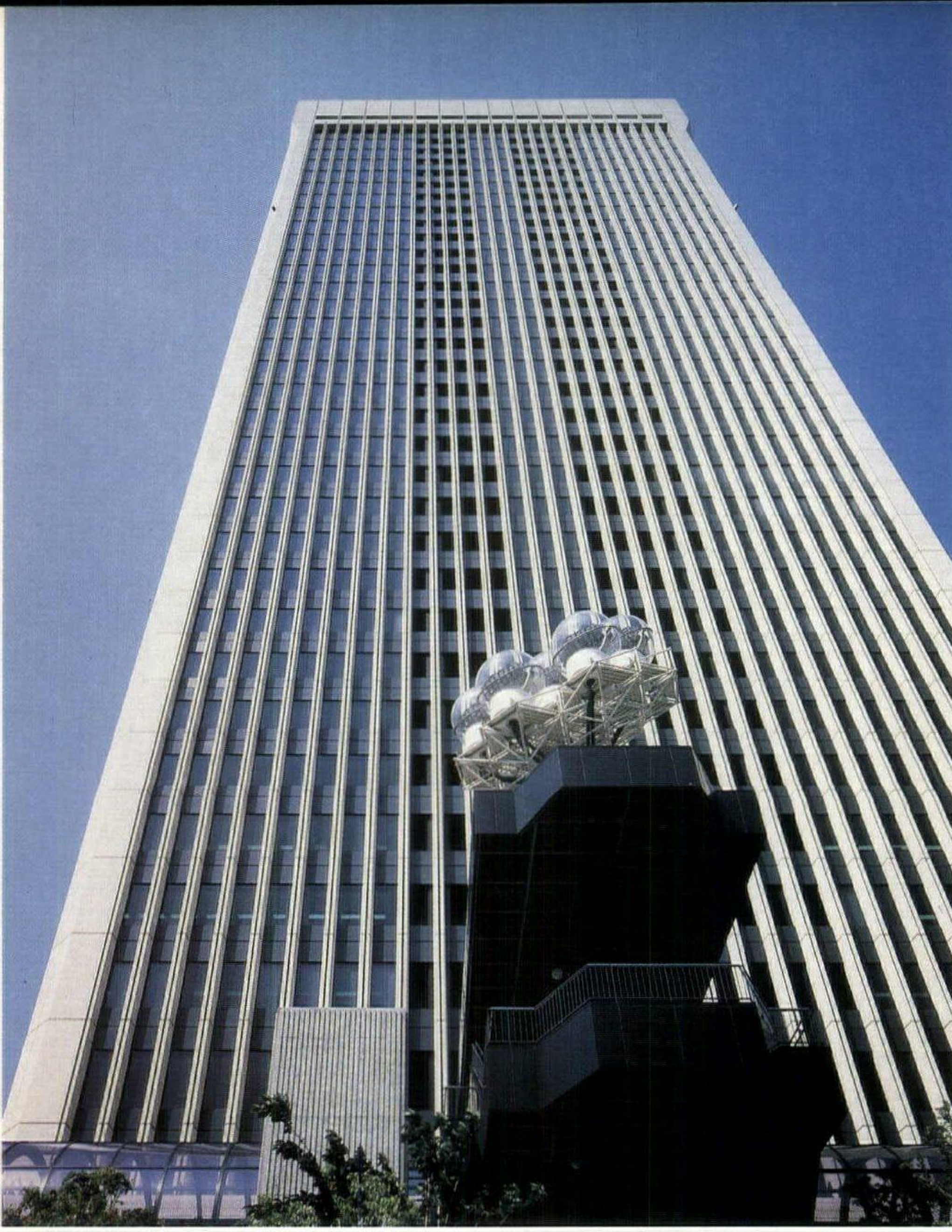
Mori began a campaign for access to sunlight in the late 1970s, which led to the development of the himawari fiber optic light transmission device in 1980. This device can deliver sunlight to the remotest corners of architectural space.

But the himawari is more than a light-delivery system. It is a light filter that can improve the usefulness of daylight for many applications. With this device, sunshine is purged of most of its ultraviolet and infrared rays, and the transmitted light is nearly heat-free. Mori has coined a term for this light: "value-added solar rays." The himawari filtration and transmission system holds promise not only for architectural illumination but also for applications in health care, agriculture, horticulture, space exploration, space-based



BIWAKO PHOTO STUDIO

The 19-lens unit measures about 7 feet across and 10 feet high and weighs about 1500 pounds. Enclosed in its base is the pulse-motor system that constantly turns the lenses to face the sun while (black) fiber optic cables transmit sunlight to its destination.


HIDETOYO SASAKI

Perched atop the roof of an open-air staircase, this seven-unit cluster catches the day's sunlight and transmits it to the building's interior.

research, biotechnology, and hazardous high-technology environments.

Benefits of Filtered Light

Perhaps the greatest benefit of fiber optic transmission is its ability to deliver daylight of a high color temperature with very little heat gain. The potential energy savings resulting from such a system — in the form of switched-off air conditioners and electric lights — may, in the long run, justify its relatively high cost.

But there are other, less easily quantifiable, benefits of himawari-filtered daylight. It prevents overexposure to ultraviolet and infrared rays, which is known to harm people by burning and aging skin, depleting immunological responses, and contributing to cancer. These rays also inhibit photosynthesis in plants.

Mori suggests that light filtered by the himawari can be used in preventive and prescriptive health care. He says the healing effects of himawari light are being researched for use in safe sunbathing and holistic regimens for the treatment of depression, neuralgia, and rheumatism.

Himawari-altered light has a number of qualities that make it uniquely useful for certain applications. Museums can illuminate paintings and other artwork while keeping them safe from the pigment discoloration caused by ultraviolet and infrared rays. Similarly, retailers may benefit from the color qualities of materials displayed under daylight, free from worry about product deterioration.

The system can deliver daylight not only to the darkened interiors of urban office buildings but also to underground spaces. Daylight can also be supplied to hazardous locations, where a spark from an electric fixture could ignite dust or flammable gases. Because no metal parts are needed in the system's delivery end, it can be used safely in certain high-technology applications that require metal-free environments.

Mori reports success in growing food and rare botanicals indoors, using only the himawari system with supplemental xenon lighting. His extensive research in growing algae has helped him develop systems for intensive algae production, both under terrestrial waters and in space. Space exploration may one day use a variation of the Fresnel lens–based system for illuminating living spaces and growing food.

A Simple Concept

The design's concept is simple. Light enters the collection system through a protective acrylic resin capsule. Inside the capsule, hexagon-shaped, honeycomb-patterned Fresnel lenses capture incoming parallel light rays. These rays are focused onto the highly polished input ends of fiber optic cables.

The capsule filters out some ultraviolet light, but the prismatic qualities of the Fresnel lenses filter out almost all of the remaining ultraviolet and about 60 percent of the infrared rays. Light that passes through a lens is divided into its component wavelengths, which refract at different angles in the space behind the lens. Ultraviolet refracts at the most acute angle, infrared at the most obtuse, and visible light refracts between these extremes.

The fiber optic cable is set at the focal point for green light, which is at roughly the center of the visible spectrum. The cable's diameter is wide enough (4 millimeters) to catch the full visible spectrum while leaving the remaining ultraviolet and infrared focused out. The focusing of visible-spectrum light through a Fresnel lens concentrates it by a factor of 10,000 and puts it into a form that can be delivered anywhere daylight is desired.

Electric light, such as xenon, can be integrated into the system for use on cloudy days or when nighttime lighting is desired. Electric light enters an

KAWASUMI ARCHITECTURAL PHOTOGRAPH OFFICE

This large tree lives on sunlight inside the Kofu Station Building, Kofu City, Japan. Fiber optically transmitted light washes it from above and spotlights it from below.

arrangement of Fresnel lenses the same way that sunlight does. This light, filtered of its ultraviolet and infrared rays, passes through cables that merge with those of the primary daylight system. The lamps can be activated in various ways: manually, by a timer, or by a sensor that detects that sunlight levels have fallen below a predetermined value.

Certain advantages of fiber-optically delivered sunlight have not yet been realized in other daylight delivery systems. Fiber optic cables can be wired like common electrical outlet wiring so that fixtures can be plugged into lighting outlets. Changing the cabling can be relatively easy, as can retrofitting the system into existing structures.

To stretch the flexibility and applicability of this system to the limit, light can be transmitted in reverse — using the supplementary xenon lamps as input. Light can be focused out of the Fresnel lenses and directed onto an adjacent building for decorative effect, complete with color options.

The Tracking System

A microprocessor-controlled tracking system keeps the lenses trained on the sun throughout the day and returns the sunflower to face the sunrise after the last of the day's light has passed beyond the horizon. A sensor, set flush with the Fresnel lenses, "sees" the sun's position. The sensor sends information to a small internal computer, which directs the movements of the lens array inside the capsule. Tracking is accomplished by pulse motors that move the lenses in azimuthal and horizontal directions.

When the sun is too obscured for the sensor to register its light, a backup clock-controlled mechanism engages, and the himawari estimates the position of the sun and tracks it accordingly. When the sun reappears, the himawari is trained on it, or near enough to allow the sensor to make the final adjustment.

Counting the Costs

Unfortunately, the sunlight transmitted indoors through this system is not as free as the light that falls into it. The system requires energy to turn the lenses toward the sun. But the ratio of energy input to energy output improves as lenses are added to the system. A single lens requires 60 watts or less, a seven-lens array requires a maximum of 150 watts, and a 19-lens array requires 180 watts maximum.

Mori suggests the following values for calculated energy output for each array — 100 watts, 700 watts, and 1900 watts respectively. Actual energy output and luminous intensity will vary greatly depending on location, time of day, and the distance that light must travel through fiber optic cables. According to his figures, Mori's system provides more energy than it consumes.

Supplemental xenon lighting, of course, also requires energy, and energy savings are minimized while this light is used. The ultimate value of the himawari is likely to be measured in terms of overall energy savings — the number of electric lights and air conditioners that can be turned off — and in the benefits for certain applications that are attributable to the himawari-altered light.

The himawari system currently suffers the fate of many new technologies: high cost and low marketplace competition. The cost of the fiber optic cabling itself can account for as much as half the cost of the system — or more, depending on how much cabling is required.

The future of fiber optic technology will figure greatly in determining the cost-effectiveness of this system. Quartz-based fiber optic cable is sold by the meter and comes in two grades, natural and synthetic. Natural quartz cable costs one tenth of the cost of synthetic cable, but its quality is suitable for transmitting light only over short distances. Long cables cost more not only for the extra length, but also for the higher quality of synthetic quartz.

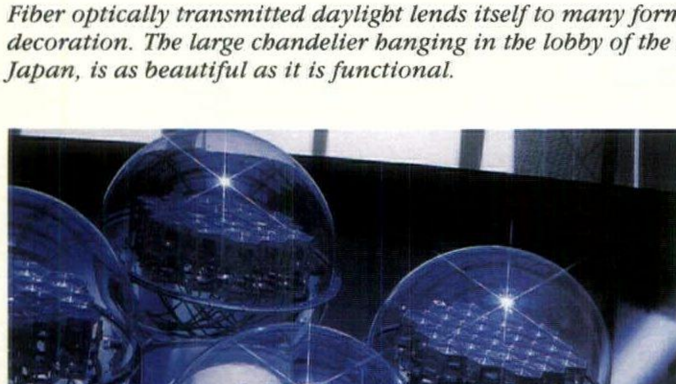
Mori says that the high price simply reflects low demand. As demand increases, he says, or if one especially large order is made, prices will drop. According to Mori, costs can also be cut by doubling the quantity of

HIDETOYO SASAKI

Exhibit at the Tsukuba Expo '85 shows enclosures in which chlorella algae, fish, and plants thrive under filtered sunlight.

KAWASUMI ARCHITECTURAL PHOTOGRAPH OFFICE

Fiber optically transmitted daylight lends itself to many forms of interior illumination and decoration. The large chandelier hanging in the lobby of the Ark Mori Building, Minato-ku, Japan, is as beautiful as it is functional.



HIDETOYO SASAKI

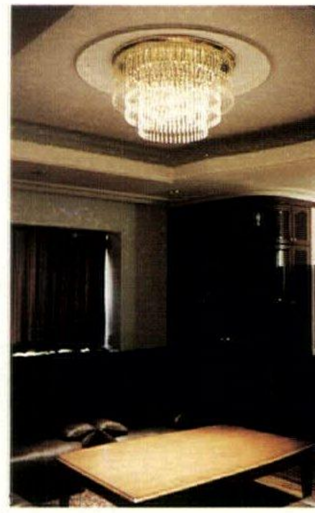
A cluster of seven 19-lens units at the Tsukuba Expo '85.

light carried by each cable.

State of the Art

Currently, 79 himawari systems are in use in private homes, museums, office buildings, hospitals, schools, resorts, and nursing homes, most of them in Japan. Mori says that others are getting into the act, and that already parts and accessories — such as titanium-oxide-coated delivery rods and woven-cord acrylic cables — are available from distributors in the United States. Mori's own company, La Foret Engineering and Information Services, is planning to open an assembly factory in the United States in the near future.

Many misconceptions have arisen over this new device,



LA FORET ENGINEERING & INFORMATION SERVICES

according to Mori. He is quick to point out that the himawari is not intended as a primary lighting system, but is best used for supplemental or specialized illumination. Its primary function is to make best use of energy. Sunlight has unique qualities that make it invaluable in many situations. Until now, the relative abundance of sunlight has been matched only by our inability to make efficient use of it. The himawari concept provides a new option for appropriating this energy.

"Some time will have to pass before the general public can become accustomed to this form of lighting," says Mori. He is currently focusing his energies on educating the public about the benefits of sunlight and on the proper use of his system. Toward that end, he is beginning formal experiments in the medical benefits of sunlight. He also is devoting considerable energy to developing the biotechnological, marine, and space applications of the system.

Whether or not there is a sunflower ready for your housetop remains to be seen. But even if the sunflower's applicability is limited at this time, Mori's concept gives indoor lighting the newest option under the sun. ■

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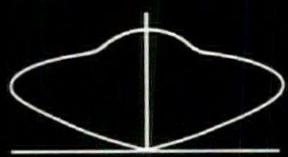

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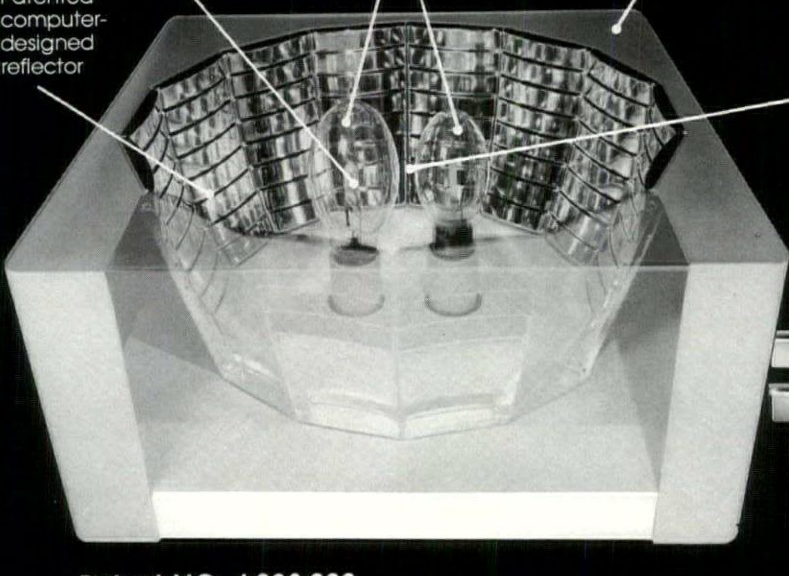

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Designers' secrets of success for neon, cold cathode lighting

Alongside the elegant, exciting neon lighting increasingly seen throughout the country, there are installations with flickering lamps, buzzing boxes, and sinister electrical connections wrapped in black tape. Other installations are so bland that they fail to catch the eye at all. Some designers realize the full potential of neon and its upscale cousin, cold cathode. Many of them say that the key to a creative, productive design process and a top-quality finished product is close collaboration with the fabricator.

Neon and cold cathode are two distinct but similar light sources. Both use hand-shaped glass lamps filled with inert gas that glows when a high-voltage current is applied. The gases most commonly used are neon, which glows red, and a mixture

Gareth Fenley

Gareth Fenley is senior assistant editor of Architectural Lighting.

of argon and mercury, which glows blue. Colored glass and phosphor-coated clear glass yield other colors.

The major distinction between neon and cold cathode is tube diameter. Neon tube sizes typically range from 10 to 20 millimeters; most signs use a 15-millimeter size. Cold cathode is almost always 25 millimeters in diameter. The makers of these lamps tend to focus on different markets. Suppliers of cold cathode architectural lighting systems offer standard and custom removable lamps that fit into sockets. Neon fabricators permanently install their own work — mostly local advertising signs.

The first part of this two-part series appeared in February and introduced the basics of neon lighting and the vocabulary used by those who make it. This conclusion presents tips and techniques from four designers who successfully integrate neon and cold cathode lighting with architecture.

Selecting a Source

Lighting consultant Jim Benya, principal of Luminae, designs extensively with both neon and cold cathode. Benya suggests that designers compare them with fluorescent, another low-pressure discharge source. Neon and cold cathode offer longer life, more color options, more saturated colors, superior dimmability, and much more flexible detailing with custom lamp shapes. They are also more expensive to install and provide less light output per foot of lamp.

"Neon," says Benya, "is appropriate when you're looking for a color effect or a linear lighting effect that requires a lot of finesse in detailing, especially within a confined space. Neon provides brilliant color, but is not designed for illuminance. Cold cathode supplies more light." For a warm white color, Benya estimates you can expect 60 to 150 lumens per foot of lamp for neon, 330 to 440 for cold cathode, and 725 for a T8 fluorescent. Lumen variations reflect electric current and tube diameter choices.

With saturated colors, says Benya, lumens are not as important; the designer needs to be able to balance the appearance of the colored light through dimming. Fluorescent dimming is expensive, noisy, tends to flicker at the bottom end, and can deplete lamp life. Properly engineered, neon and cold cathode dimming avoids all these problems.

Neon detailing is much more flexible and precise than fluorescent. Cold cathode is somewhere between the two because the sockets must be concealed by architectural detailing, which also must allow for room for changing lamps.

Any of the three sources could have been used in the Tower Records corridor that doubles as an after-work

MARY BACHMANN

Lamps that link skylight and stairwell in Christopher Sproat's Lightfall were handmade on site.

meeting and party area. The space was to be lively and playful, with bands of colored light suffusing coffers. Luminae's Jan Moyer, principal in charge of the project, wanted shadowless detailing and colors balanced through dimming, so fluorescent was out of the picture.

Because recessed MR16 and PAR 36 lamps would provide warm light for the corridor's people space, the colored light levels didn't need to be high, and Moyer specified neon. During the bidding process, however, cold cathode was substituted because of an unexpectedly low price quote. Because cold cathode provides a wider range of light output to work with, it was easier to balance the three independently dimmed colors of light in the corridor coffers.

Glass Bending

Some of the most striking designs for neon and cold cathode use exposed lamps fitted snugly along architectural elements. Christopher Sproat, an artist who designs light pieces that integrate with architecture, explains why technically sophisticated designs require an understanding of glass bending.

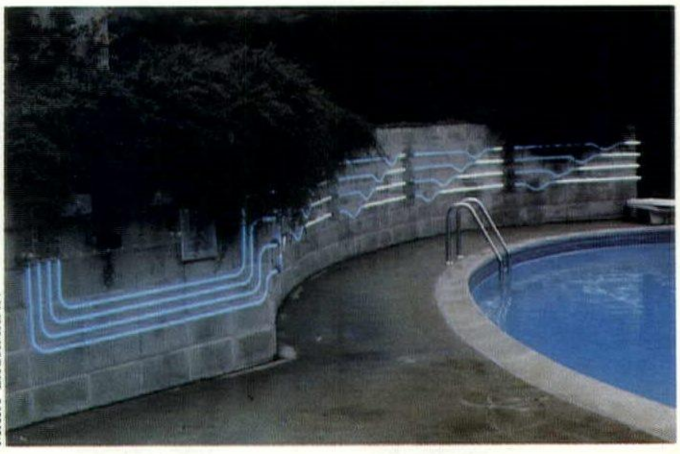
"Every glass tube has its own bending radius," says Sproat. "As the tube is bent, the outside wall stretches and the inside wall bunches up somewhat. So each size of tube has limits on how sharp a bend you can get. A novice would have to ask a glass bender to draw out the actual shape. When you're making a plan, you can just make a right angle, but you have to realize that the glass bender will make a rounded corner."

Sproat prefers to use clear glass for lamps with tight bends. "With the coated tubes, over time you get some brown that looks like wear on the inside of the bends," he says. He also notes that phosphor particles spread out somewhat on the outside of bends. White, for example, becomes blue-white on a tight curve. "I do use coated tubes," he says, "but I prefer to keep them in straight areas because I'm looking for very high aesthetic appeal."

Choosing tube diameter is an important design decision. "The thinner the glass tube, the more intense the light," says Sproat. "When you put your hand behind a lit 25-millimeter tube, you can see your hand; you get a glow down the center of the tube that gradually hazes

© PETER MARCUS, 1987

Cold cathode in Luminae's lively design for a Tower Records headquarters corridor.



MARY BACHMANN

Neon by Sproat ripples alongside a swimming pool.

out. If you do it with a 10-millimeter tube, you'll see the light slice through your hand."

Larger tube diameters also allow designers to use more footage per transformer. Sproat asked a neon fabricator to work with 25-millimeter glass — cold cathode size — to create Lightfall, a piece that illuminates a skylight and stairway in a San Francisco home. The lamps require only two transformers, one for each loop extending from the skylight down three stories of the stairwell and back.

"If you are trying to fit a precise architectural detail, think in terms of flat shapes as much as possible," says Sproat. The tube bender works with a flat pattern, so shapes in two or more planes are difficult to achieve. For Lightfall, Sproat wanted four "oddball" tubes with tricky angles to reach from skylight to stairwell. After several attempts in his shop, fabricator Bill Concannon of Aargon Neon took a portable glass-bending apparatus to the site to try fitting the shapes there — a very unusual arrangement. Concannon got the right shapes after more experimentation.

Finding a Fabricator

The right fabricator can provide two things to a designer: technical assistance and a high-quality final product. It's a good idea to find a helpful fabricator even before sketching a design on paper. Bill Concannon likes to talk with architects early in the lighting design process so he can familiarize them with what can and cannot be done cost-effectively. "Rather than having to solve a problem, you can avoid the problem by designing something that works," he says.

Architectural lighting projects involve detailing requirements not typically seen in day-to-day sign jobs, so the fabricator's attitude and competence are important. Christopher Sproat, who works with local fabricators wherever he has a commission, looks for someone who responds to the technical challenge in a positive way.

To evaluate a fabricator, Sproat recommends visiting the shop where the work is done and examining samples. Splices where tubes are joined should be the same diameter as the rest of the glass, free of discoloration and bubbles, and curves should be smooth. Sproat likes to watch a glass bender at work, looking for a slow, steady process. "You can somewhat tell by the way a craftsman looks when he works," says Sproat. "He just works at a certain smooth pace. You shouldn't see him throwing a lot of glass away."

Working Together

Architect Ken Jones, principal of Jones & Speer, relied on a fabricator for technical assistance when designing the renovation and expansion of a stainless steel diner moved from Canton to Cincinnati, Ohio. Jones wanted soft ambient light to accent and color the diner's high-gloss interior surfaces without creating distracting reflections. For a nostalgic look, he wanted to use neon, although he had never tried it before on a major project.

City Lights Neon helped Jones explore possibilities and refine details. City Lights demonstrated available parts and colors, showed how to achieve the light levels Jones wanted, set up sample light strips on site, and suggested dimensions. "They really engineered all the neon work," says Jones. "We basically did the graphic design and indicated where we wanted the neon, and worked directly with them to make it happen."

Because the client wanted the neon turned on only at night, Jones picked imported red and blue colored glass that would show the color accents during the day. He also believed that the color of light produced was superior to that of clear or coated tubing. The color mix creates a vivid magenta in the stainless steel original interior and a pink in the new courtyard with its glass block walls and translucent fabric roof.

All electrical connections and hardware are concealed or integrated into the design. City Lights provided dimensional data for custom-designed stainless steel transformer boxes that are incorporated into a decorative motif in the courtyard. To install interior signage at focal points over mirror and glass block, City Lights also coordinated special mounting details with subcontractors that drilled holes and installed the glass.

Details, Details

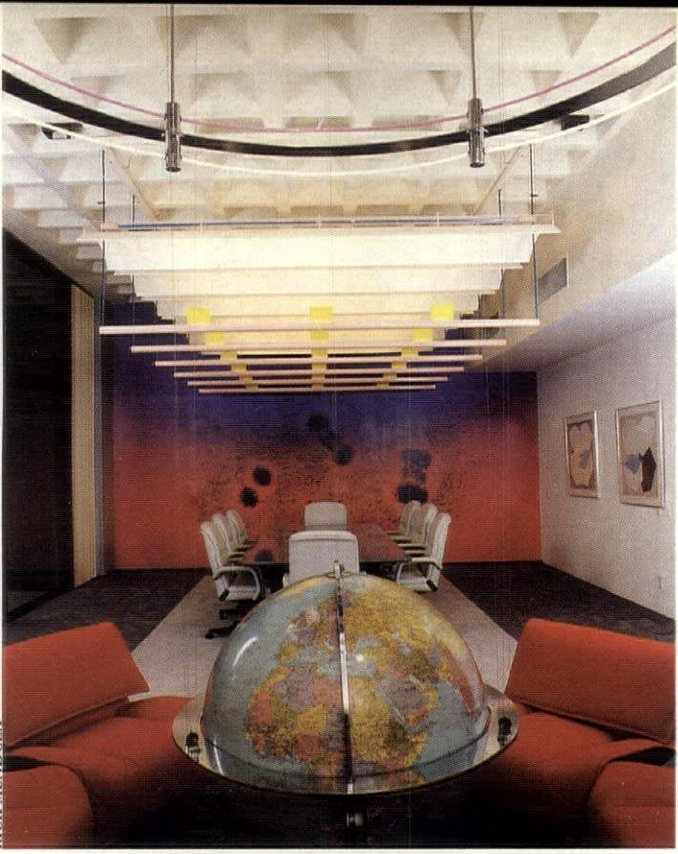
"Traditionally, neon signs and graphics were built to be viewed from a distance," says Eric Zimmerman, who designs

RON FORTH

Jones & Speer revived a 40-year-old diner with ruby red and bromo blue neon.

RON FORTH

In the diner's new courtyard, light diffused through a fabric roof softens the color effect.



Conference room features neon lighting designed by Eric Zimmerman.

and fabricates neon and cold cathode. "Details such as the way the connections were made, the appearance of the housings, and other cosmetic touches were for the most part ignored." Drawing on the resources of his own production plant, Zimmerman has developed techniques that go beyond the purely functional to satisfy aesthetic requirements.

For an entrepreneur in Southern California, Zimmerman created a conference room interior designed to be comfortable, yet stimulate an interchange of ideas. The room's custom luminaires are built of custom components, including the hardware used to connect and support the lamps.

A circular neon fixture incorporates a unique descending globe. The cables and rings that support the globe also transmit power to a low-voltage electronic lighting system inside. The globe can be rotated on both axes, yet stay powered. "You could illuminate just the globe and study it with all the other lights out," says Zimmerman. The double neon ring looks deceptively simple, but it is a complex assembly. Twelve lamps and six segments of flat aluminum plate fit into cylindrical nodes that bear weight, house the electrical connections, and contribute to the fixture's streamlined appearance.

A luminaire group over the conference table incorporates halogen uplights and acrylic diffuser panels that lower the ceiling to a more intimate level. The neon lamps above the diffuser are designed to create an illusion of dusk when the halogen uplights are dimmed — "a cool, soft, before-night effect," says Zimmerman, who chose halogen for its lumen output and color rendition. "It's one of the best task light sources, I think. Using it for ambient light creates a very soft effect with no hot spots, making it even more pleasant to work under."

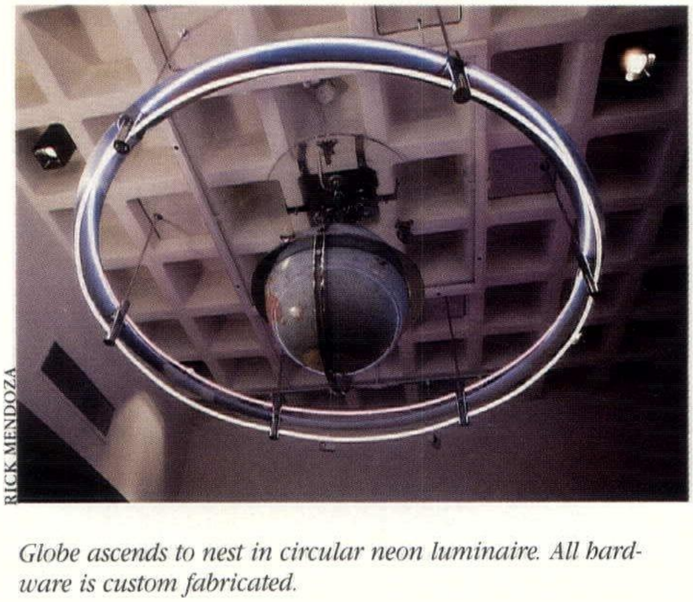
The neon above the panels is enclosed in acrylic tubes capped with retractable nodes. "We could have cut corners there," Zimmerman admits, "but those details gave the whole lamp a more stable, finished presence."

Finishing Touches

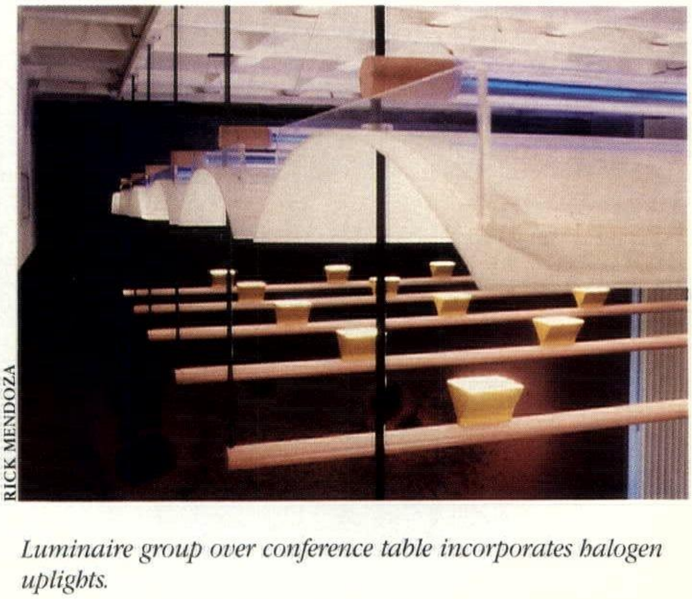
For designers who depend on other firms to execute designs, neon and cold cathode can bring about unfamiliar partnerships. According to Jim Benya, close coordination among all parties involved is the best way to get architectural quality on the finished job. Benya points out that although the process may seem cloaked in mystery and black magic, "it's not hard to do a quality job, as long as you know what you're doing."

Generally, neon is fabricated and installed by the same firm, which simplifies coordination. "The problem with neon shops is most often the detailing of the lamps," says Benya. Quality can vary from shop to shop and from worker to worker within the same shop. One pumping apparatus may be clean and another one dirty, or a single lamp could go bad because someone failed to spot a defect, he says. Designers should always inspect lamps after installation and reject defective ones.

Cold cathode is usually fabricated by a supplier and installed by an electrical contractor, which presents a different set of problems. Benya makes a point of educating contractors to work with cold cathode. He arranges a meeting with the contractor and supplier and shows how parts fit together



Globe ascends to nest in circular neon luminaire. All hardware is custom fabricated.



Luminaire group over conference table incorporates halogen uplights.

Tricks of the Trade
by Jim Benya

Every architectural neon and cold cathode application should follow these eight layout and installation practices, which are especially crucial for dimming.

- Reject defective tubes. A spiral or raccoon-tail pattern that persists after a few hours of operation indicates a dirty tube or bad pumping job.
- Use low-voltage or inductive rated dimmers. Solid-state dimmers work much better than the variable transformers.
- Use normal power factor (NPF) series transformers when dimming.
- Use dimmers and transformers that are slightly overrated for the load.
- Keep transformers as close to the load as possible, no farther than 25 feet away.
- Ensure that all secondary wiring connections, including any sockets, are good, clean, and tight.
- Keep secondary wiring, sockets, and tubes away from grounded metal; it could bleed off high voltage.
- Run the secondary lines in separate PVC conduits to minimize inductive losses. Enclose the PVC with a nonferrous metallic conduit, preferably aluminum, if required by local code. Don't pull both secondary lines through the same conduit.

right on the conference table.

Designers should monitor the exchange of drawings on a cold cathode project. The supplier makes shop drawings from the architectural drawings, then furnishes sockets, wiring, and transformers to the contractor. The contractor should install them, measure the actual distance between the sockets, and then return the shop drawings to the supplier complete with exact measurements for the lamps. "Some contractors may want to push the job through and order everything at the same time. Don't let them do it," Benya warns.

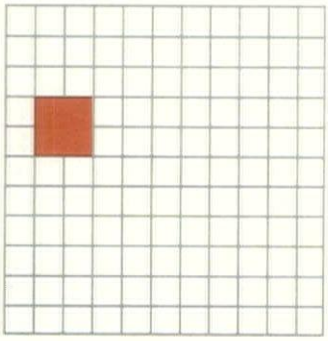
"Tower Records was a classic case of installing cold cathode the right way," says Benya. His lighting design firm made drawings and carefully coordinated dimensional requirements with the architect. "The sockets were shipped; they were installed; the measurements for the tubes were taken; the tubes were made and installed; and everything came out perfectly the first time around."

Both creativity and caution will serve designers who venture into work with neon and cold cathode. With luck, everything can turn out perfectly the first time.

"Don't be afraid to give it a try," Eric Zimmerman advises. "Visualize it as a line form that comes in various increments of width, and remember that this line form can be curved and bent, but it doesn't like really sharp corners. Within that framework, you can do anything imaginable, from free-form shapes to elements that accent architecture, special sculptural elements that incorporate other materials, or more utilitarian light fixtures. The opportunities are endless." ■

For product information, see the Manufacturer Credits section on page 70.

Lighting Graphics



Sam Mills, AIA, IES

Sam Mills is an architect and lighting consultant with his own firm in Oklahoma City. In this column, he draws on 25 years of experience in lighting and architecture to offer design ideas, technical data, and graphic details that can be used to design coordinated lighting and architecture.

The *color* of white light is often overlooked by designers. Electric light sources that we identify as white are used in most of today's general lighting applications. These light sources are not white in the sense of containing equal amounts of all colors in the visible spectrum, as in the diagram of the electromagnetic spectrum. Each is deficient in some portion of the spectrum, which affects the appearance of colors and the apparent warmness or coolness of the environment.

This shift in the appearance of colors — or change in our perceived environment — in most typical situations is very subtle and often unnoticed. Some scientists believe the shift to be a temporary condition of adaptation. For example, when we move back and forth between an exterior with full spectrum natural light and an interior with a color deficient source, we perceive the colors to be the same under both conditions. On the other hand, an article purchased under one light source may look altogether different when viewed at home under another source.

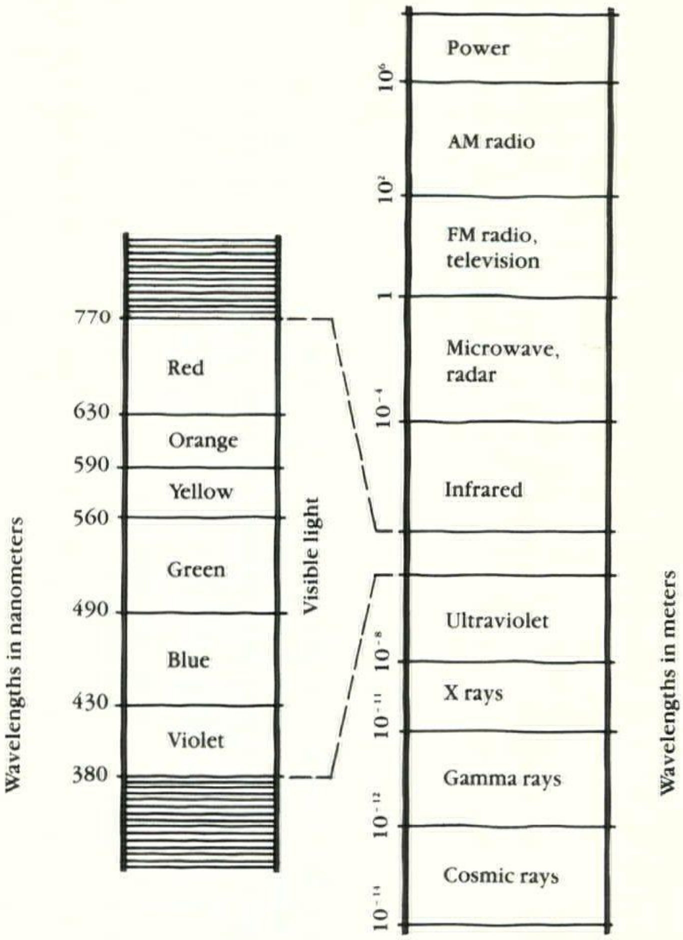
White light is a mixture of all colors in approximately equal amounts.

Light is technically a form of electromagnetic energy. Objects give off this energy in the form of radiation — a result of internal agitation of atoms and molecules. This agitation is caused by the heating of the objects until they are warmer than absolute zero — the absence of all heat at minus 459 degrees Fahrenheit.

Electromagnetic energy exists as many different frequencies and is identified by categories of frequencies, such as gamma rays, X rays, ultraviolet rays, and so forth. The eye is sensitive to only a small portion of the total spectrum, identified in the accompanying diagram as visible light.

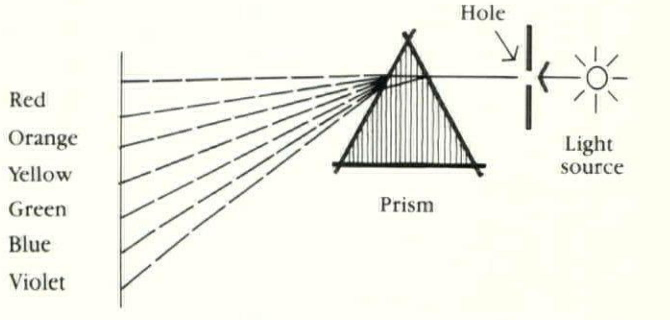
The colors are arbitrarily divided into six monochromatic colors. A seventh color is often added between blue and green, and called cyan. These colors are more closely identified by using their specific wavelengths, measured in billionths of a meter or nanometers. They range from violet, at about 400 nanometers, to red, at about 700 nanometers.

The *perceived color* of white light is determined by the energy emitted at each wavelength of the visible spectrum, with a mixture of all colors in approximately equal portions providing the appearance of white light. As specific wavelengths are removed or added, the color changes. White light sources have traditionally been identified as being warm or



The electromagnetic spectrum

The electromagnetic spectrum contains many different wavelengths that are identified in categories of frequencies, such as gamma rays, X rays, ultraviolet rays, and so forth. The human eye is sensitive to only a small part of the total identified as visible light.



Isaac Newton found that a narrow beam of sunlight passing through a glass prism would disperse to show all the colors in the visible spectrum. This effect was known, but it was thought that the glass somehow filtered or tinted the light.

cool as a result of a larger or smaller spectral distribution in the red or blue range.

A graphic representation of the energy emitted in the visible spectrum for a specific light source is called a *spectral energy distribution curve.* These curves provide a comparative evaluation of different sources for both their color appearance and their color rendering capabilities. Color appearance is the color of the predominant wavelengths; color rendering capability is the ability to furnish energy in all colors of the spectrum. The accompanying diagrams show the spectral curves for average noon daylight and five general categories of electric light sources.

Electric light sources that we call "white" don't contain equal amounts of all colors in the visible light spectrum.

The diagram for incandescent lamps shows a typical increase in the red wavelengths, actually peaking in the infrared range beyond the visible spectrum. The two curves shown represent a standard incandescent lamp and a tungsten halogen lamp. Tungsten halogen lamps, such as low-voltage and photoflood lamps, have smaller portions of red energy and larger portions of blue energy for more uniform distribution across the spectrum. Therefore they appear whiter than the slightly yellow-appearing standard lamps.

The fluorescent lamp diagram also shows different lamp types, the standard cool white and the newer 4100K triphosphor lamps. Most of the energy generated by the arc inside a fluorescent lamp is in the invisible ultraviolet range, at about 254 nanometers. The phosphor coating on the inside of the lamp converts this energy into visible light with the type of phosphor determining the color of light.

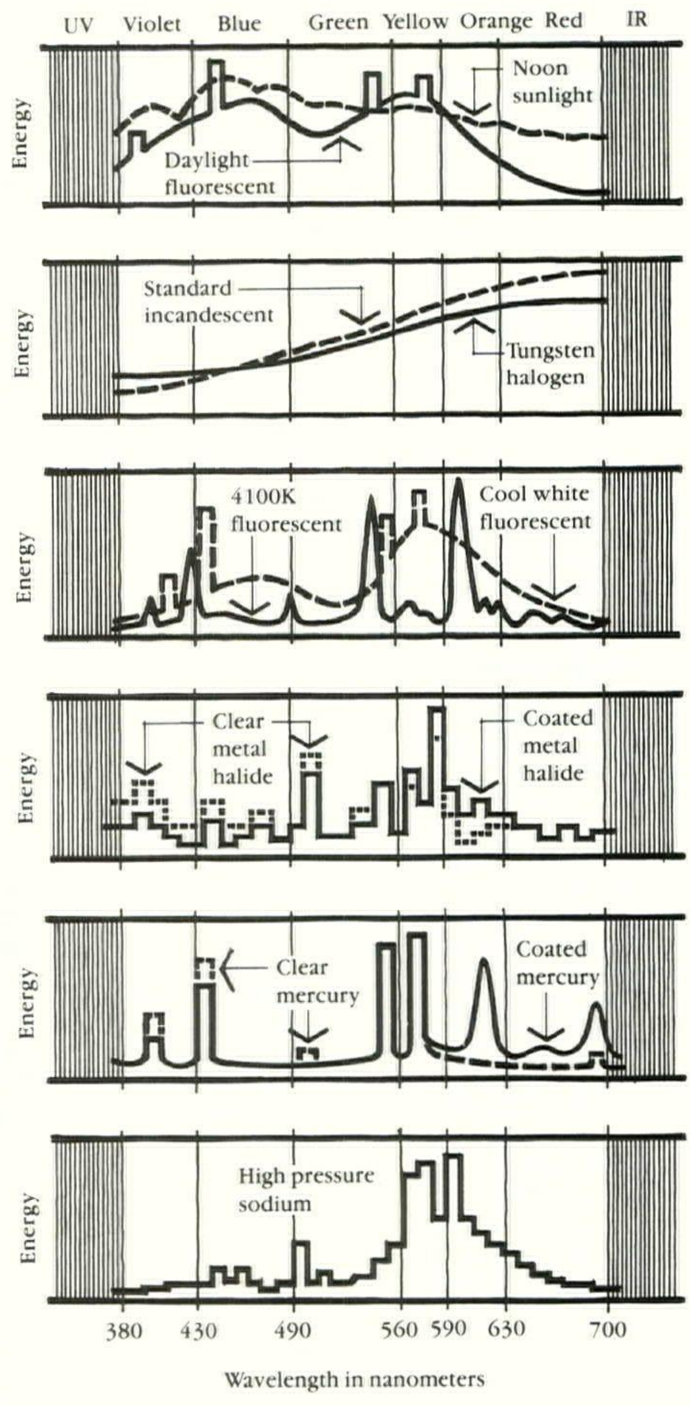
The standard cool white lamp uses a coating of halophosphor for a continuous spectrum with energy peaks at blue, green, and yellow wavelengths. The 4100K lamp also uses this phosphor along with a triphosphor that gives the energy peaks shown in the diagram at the three primary colors: blue, green, and red.

These peaks of energy at the primary color wavelengths give an effect similar to a continuous spectrum, with the added advantage of improved efficiency over phosphors previously used for improved color rendition. The color of a fluorescent lamp can be varied from warm to cool by altering these phosphors to enhance the energy at specific wavelengths. The two lamps shown in the diagram have the same general color appearance; the 4100K lamp has better color rendering characteristics.

Metal halide lamps generate most of their light in peaks of energy in the violet, green, and yellow range, with smaller peaks across the entire spectrum. A combination of metal additives vaporized in the arc tube produces light more evenly across the spectrum than do mercury or high pressure sodium lamps, resulting in whiter light.

Use of phosphor-coated bulbs, like fluorescent lamps, enhances the color and whiteness even further. Notice the increased energy levels in the yellow to red range on the diagram; there is some corresponding reduction in the blue range for the coated lamps, which produces a warmer, more incandescent-like color.

Both mercury and high pressure sodium lamps are relatively



Light source spectral distribution

Graphic representations of the energy emitted at different wavelengths of the visible light spectrum for typical light sources are shown above. These diagrams furnish comparative information on the general color appearance of the sources and the color rendering characteristics compared to daylight.

poor sources of white light, especially when compared with other sources. Clear mercury lamps have a characteristic blue-green color — with energy peaks in the blue, green, and yellow wavelengths — and little energy at other colors. Consequently, they produce light that enhances blues and greens but distorts most other colors.

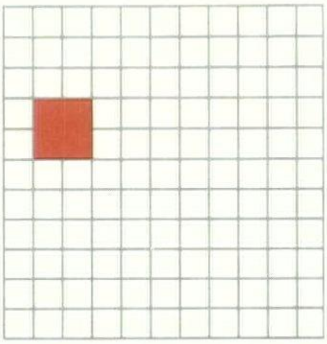
A spectral energy distribution curve provides a comparative evaluation of the color appearance and color rendering capabilities of different sources.

Phosphor-coated mercury lamps have added energy in the red wavelengths for some improvement, but the spectrum is continuous only at low energy levels, so the whiteness of the light remains comparatively low. At the opposite end of the spectrum is the high pressure sodium lamp with its immediately apparent yellow-red color. Because most of its energy is in the yellow and red range — there is a very small continuous distribution — a very yellow white light results.

With white light sources containing this variation and range of visible wavelengths, it is difficult to measure or specify the relative warmness or coolness by wavelengths or nanometers. Another Lighting Graphics column will cover methods developed to assist in the identification of subtle color variations and color rendering characteristics of typical electric light sources. ■

The Computer Department

In this month's column, two programs are reviewed: Holophane's comprehensive electrical lighting analysis program, CALA, and a simple outdoor lighting program from Emco Environmental Lighting, called Emcolite.



David Lord

David Lord is a professor of architecture at California Polytechnic State University, San Luis Obispo.

CALA

CALA is an acronym for computer aided lighting analysis; the most recent release is version 6.0. The program was written by John Hibbs and is a descendant of his earlier Photon program. CALA is suitable for any electrical lighting application, including roadway lighting, indoor area lighting, and indoor or outdoor sports or industrial lighting. Any luminaire layout can be entered and the illumination results for vertical or horizontal surfaces will be calculated. A special feature allows the input of sketches in three dimensions so that unusual shapes can be analyzed.

Users can select points, lines, or areas for analysis: up to 4000 points, 200 line segments, or 2000 panels. Data may be entered using a digitizer or the keyboard. Feedback from CALA is in three-dimensional wire-frame perspective views of the design layout. The program supports either a monochrome or color graphics adapter, with printed output going to an Epson dot-matrix printer.

Though sometimes obstinate, CALA is essentially friendly and well-meaning.

CALA is sometimes obstinate and cumbersome, but it is essentially friendly and well-meaning if you take the time to get to know it. Documentation is complete and well-written, and it will eventually get you where you want to go. To make operation a little easier, I used the Install batch file to transfer the program onto a hard disk. CALA can also be run with a two–diskette drive system, but I can't imagine anyone wanting to do that with the price of hard disks now below $200.

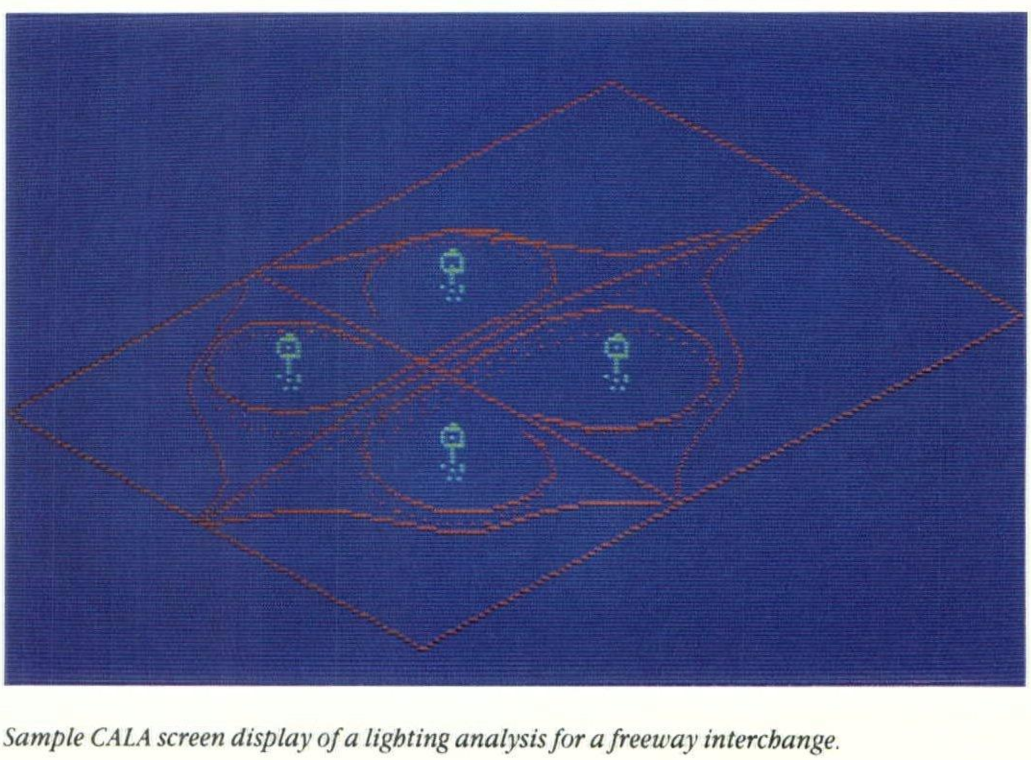
During installation, the program automatically creates subdirectories for photometric data files. Along with CALA, Holophane sends a separate package of photometric data on 12 diskettes. Photometric data in the standard IES format from other manufacturers can also be used with CALA.

Once you have reached CALA's main menu, the structure of the program and its capabilities become clearer. Job files are automatically arranged on a "current disk" or an "old jobs disk"; several examples are included to help beginners. One interesting feature that made me nervous at first: there is no "save" command while running an analysis; CALA saves information automatically at predetermined points in the program. Although this feature worked flawlessly, I am old-fashioned enough to prefer a manual override for my own peace of mind.

Up to 50 help screens and 200 messages help keep the user on track throughout a CALA session. Just as with any powerful computing routine, however, sophistication and precision in results demands a fairly deep understanding of the program's operation. This requires an investment of time that is especially well rewarded if work is often repeated. When rerunning a project, you need enter only the new data; calculations are performed only on the revisions. A toll-free CALA Hotline is available when problems arise. When I called, an experienced staff person quickly answered my questions.

The accuracy of version 6.0 is significantly improved over previous editions, especially for the analysis of larger spaces. If you purchased an earlier version of CALA less than one year ago, updates are free.

Missing from CALA is a simple, quick calculation routine, the kind that is available in complimentary programs from some lighting manufacturers. Instead, CALA aims for a more



Sample CALA screen display of a lighting analysis for a freeway interchange.

refined analysis and presentation of lighting designs to give designers an accurate picture of the final effect. The drawback of such precision is that it requires extra time in setting up the analysis and in calculating the results. Holophane is contemplating including a simple analysis option in a future version.

Two benefits of investing in CALA are its high-caliber technical support and the company's plans for future development. CALA deserves a place in the software library of a lighting designer who needs a flexible electrical lighting analysis program that will be around for some time to come.

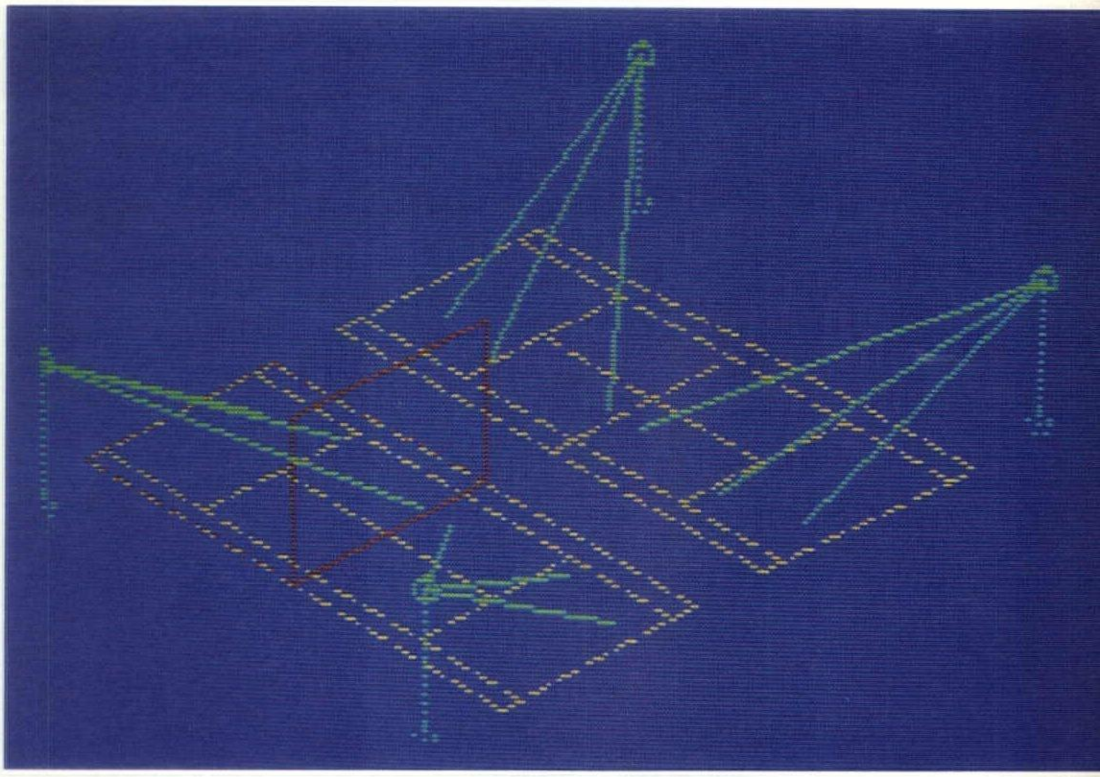
Emcolite

In contrast to the comprehensive and complex nature of CALA, Emcolite is a nifty little outdoor lighting program from Emco Environmental Lighting. Despite its simplicity, Emcolite offers a sophisticated range of functions, including the ability to mask out unwanted areas and to tilt fixtures above or below the horizontal.

The point-by-point scaled results of the outdoor lighting analysis can be viewed on the screen — in high resolution color on EGA monitors — or sent to the printer. The printout scale can be specified to match a plot plan. In addition, the program calculates the maximum, minimum, and average footcandle levels.

I found Emcolite's editing feature to be simple and quick, so that design components such as poles or luminaires or lamp size or tilt could be changed, analyzed, and recalculated in a matter of minutes. As far as I could determine, however, only Emco luminaires may be used in the lighting analysis.

The manual is well-written and thorough enough that an experienced user who is familiar with DOS and lighting principles should be generating useful results on Emcolite in an hour. Emcolite is provided at no charge to lighting specifiers. Emco has a toll-free number for technical assistance, and Emcolite seminars are available.



Sample CALA screen display of a lighting analysis for a tennis court, showing arrangement of lighting standards. Illumination is calculated for a vertical plane at the net.

Featured programs

CALA, $595

Requires an IBM PC/XT or AT with two diskette drives or one drive with a fixed disk. Available through Holophane sales representatives. Demonstration disk free on request; Holophane photometric package on 12 diskettes, free to designers.

Manville Sales Corporation
Holophane Division
214 Oakwood Avenue
P.O. Box 3004
Newark, OH 43055-7195
(614) 345-9631

Emcolite

Requires an IBM PC/XT or AT, 256K RAM, math coprocessor recommended, two diskette drives or one drive with a fixed disk. Available through Emco factory representatives.

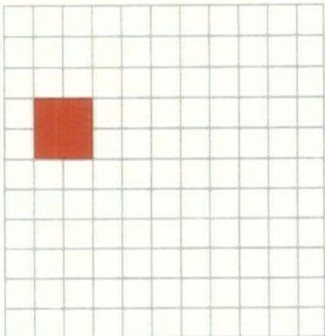
Bob Gletty, Applications Engineering Manager
Emco Environmental Lighting
7300 50th Street
Milan, IL 61264
(309) 799-3111 (in Illinois)
(800) 336-7654 (outside Illinois)

To Be Reviewed

The Computer Department has received the following programs for future review: Calpas 3, from Berkeley Solar Group, Berkeley, California; Micropas for DOS, from Energy Toolworks, Kentfield, California; Point, from Lighting Analysts, Littleton, Colorado; and Microcomputer Assisted Heat Transfer Analysis, from Compress, Wentworth, New Hampshire. ■

The Computer Department welcomes reader comments. Write to David Lord, Architecture Department, Cal Poly, San Luis Obispo, CA 93407.

The Daylighting Department



Norbert M. Lechner

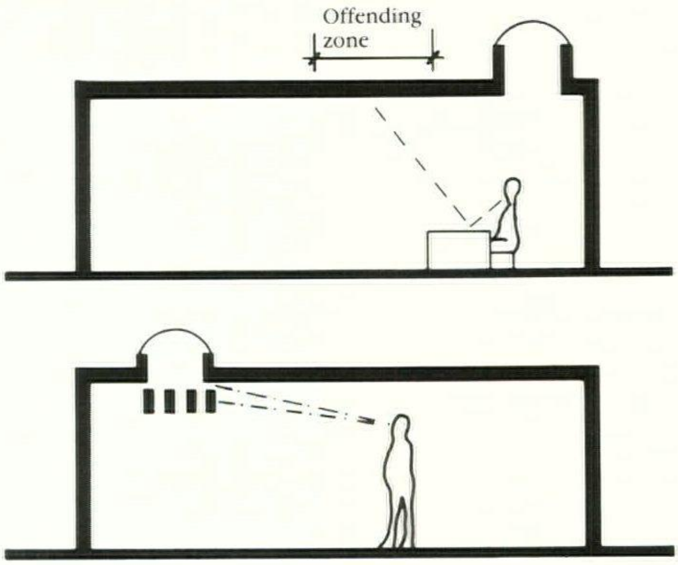
Norbert Lechner is an associate professor in Auburn University's School of Architecture, Auburn, Alabama. The daylighting column is adapted from his forthcoming book, Heating, Cooling, and Lighting: The Architectural Approach, *to be published by John Wiley & Sons.*

Skylights, monitors, and clerestories are all methods of toplighting, and all make possible a uniform, high level of illumination. Unfortunately, however, toplighting also has some serious drawbacks. It is not workable in multistory buildings, and, because it does not satisfy the need for view and orientation, it should supplement rather than replace windows.

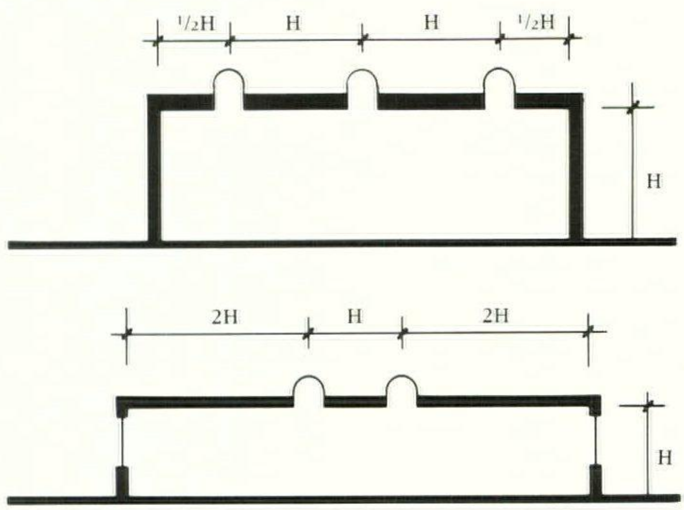
Toplighting also presents potential glare problems; all overhead sources have the potential to create veiling reflections. Veiling reflections are best avoided by keeping light sources out of the offending zones. This is possible, however, only when the location of the seeing task is fixed and the roof openings can be appropriately placed.

In many spaces, the best solution is to carefully diffuse the light so no bright sources exist that can cause veiling reflections. The diffusion can be accomplished by reflecting the light off the ceiling or by using baffles to shield the light sources. Both of these strategies also solve the problem of direct glare from the bright openings overhead. Because skylights behave differently from monitors and clerestories, they are discussed separately.

Skylights, monitors, and clerestories are all methods of toplighting.



Some drawbacks to toplighting can be avoided by careful planning. Skylights placed outside the offending zone, for example, prevent veiling reflections. Direct glare can be controlled by a system of baffles.



Rules of thumb for spacing skylights in buildings without windows (above) and with windows (below).

Skylight Strategies

Skylights are horizontal or slightly sloped openings in a roof. As such, they see a large part of the unobstructed sky-dome and consequently transmit very high levels of illumination. Because beams of direct sunlight are undesirable for difficult seeing tasks, the entering sunlight must be diffused in some manner. For skylights, translucent glazing can be appropriate; unlike windows, skylights usually have no view to block, and translucent glazing can help to prevent direct glare. Some common skylight strategies follow.

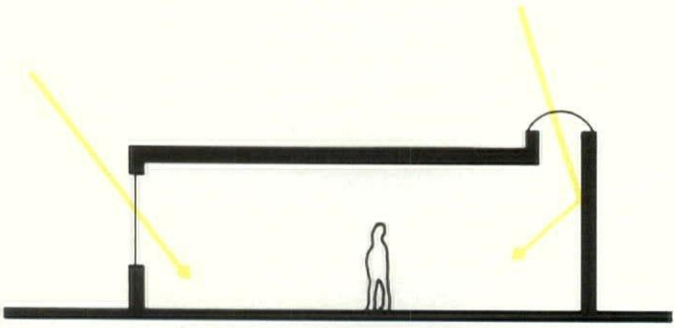
Spacing for uniform lighting. Two figures illustrate rules of thumb for spacing skylights in spaces with and without windows. In spaces with windows, the skylights can be further from the perimeter.

Skylights over back wall. Any wall, but especially a back wall, can be used as a diffuse reflector for a skylight. The bright wall makes the space appear larger and more cheerful. The illumination level will also be more uniform throughout the space.

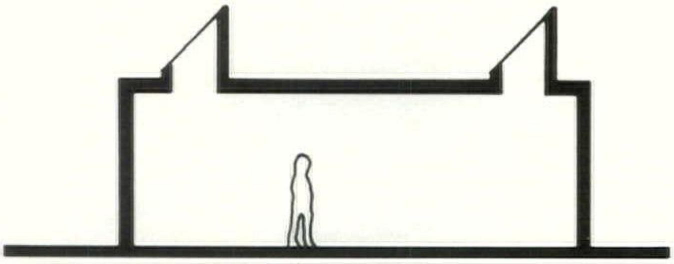
Sloped skylights improve summer-winter balance. Horizontal skylights collect more light and heat in summer than in winter; skylights sloped toward the north or south supply light more uniformly throughout the year. As the slope is increased, the skylights eventually become monitors or clerestories (described in the next section).

Splayed openings increase apparent size of skylights. When the walls of a light well are sloped, the result is better light distribution and less glare.

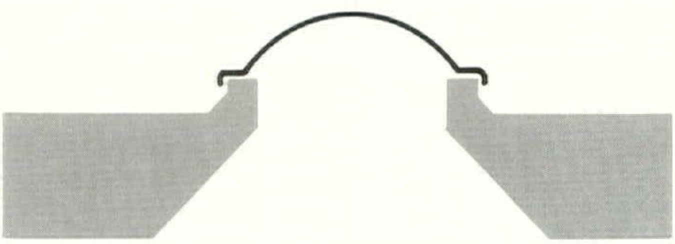
Shades and reflectors improve summer-winter balance. Shade the skylight from the summer sun, and use reflectors to collect more winter sunlight. A white diffusing reflector is less sensitive to sun angles than a specular reflector, so a white reflector can remain



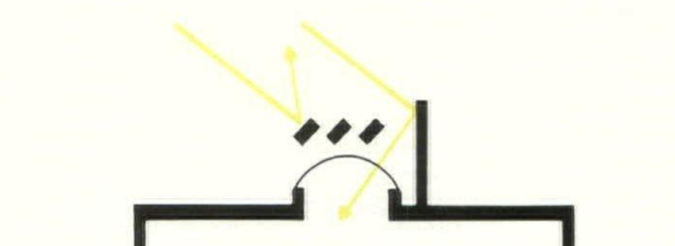
A back wall acts as a diffuse reflector for skylight, for more uniform lighting and less glare.



South-facing sloped skylights collect more winter light and less summer heat.



Splayed openings distribute light better and cause less glare.



Baffles shade the skylight from some of the hot summer sun, and a reflector increases winter light collection.

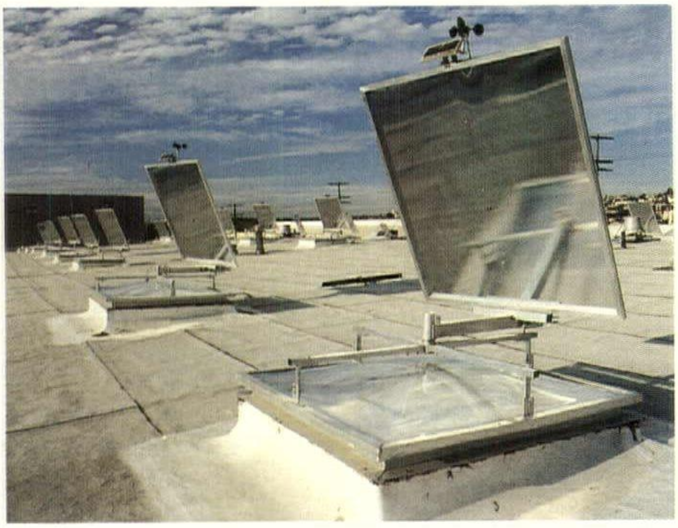
In the Kimbell Art Museum (Fort Worth, Texas), Louis Kahn diffused light and eliminated direct glare by using "daylight fixtures."

fixed and still give good performance. A specular reflector requires periodic adjustment.

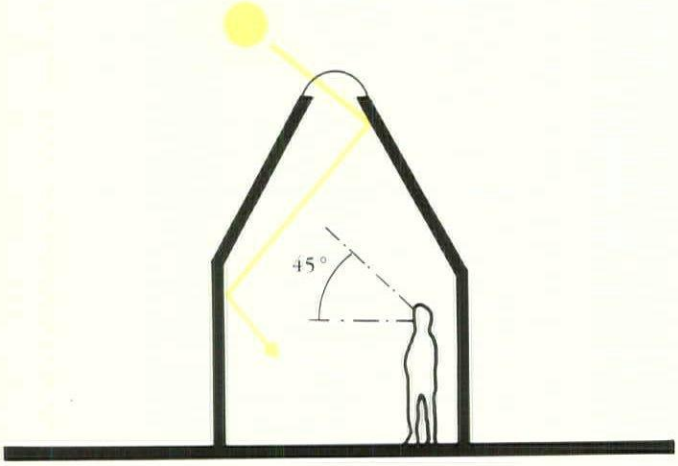
Interior reflectors diffuse sunlight. A skylight can deliver very uniform and diffused light when a reflector is suspended under the skylight to bounce light up to the ceiling. Louis Kahn used this strategy very successfully in the Kimbell Art Museum in Fort Worth, Texas. A "daylight fixture" reflects the light entering a continuous skylight onto the underside of the concrete barrel vault. The result is extremely high quality lighting. There is no direct glare because the daylight fixture shields the skylight from view. Small perforations in the daylight fixture allow some light to filter through, so the fixture does not appear dark against the bright ceiling.

Skylight high in space. A skylight mounted high above a space allows the light to diffuse before it reaches the floor. Direct glare is also largely avoided because the bright skylight is at the edge of the observer's field of view.

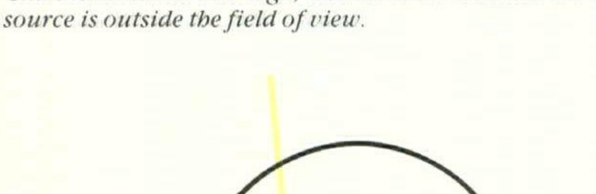
Heliostat-mounted reflectors. A reflector mounted on a heliostat can track the sun and always reflect a vertical beam of light through the roof, regardless of the sun's angle. Because the sunlight enters at a constant angle, it can be easily and effectively controlled. Such devices are commercially available for individual sky-



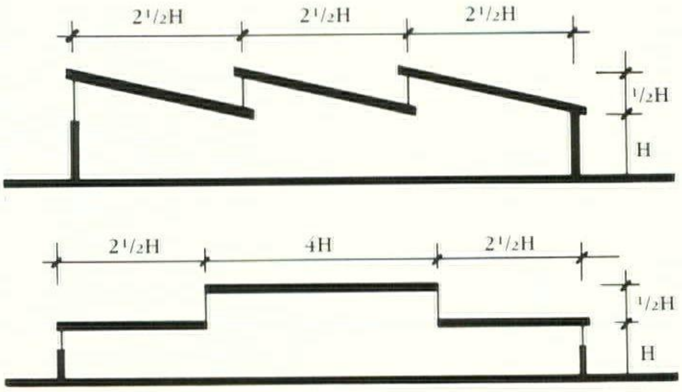
A *mirror mounted on a heliostat projects a fairly constant beam down into a skylight.*



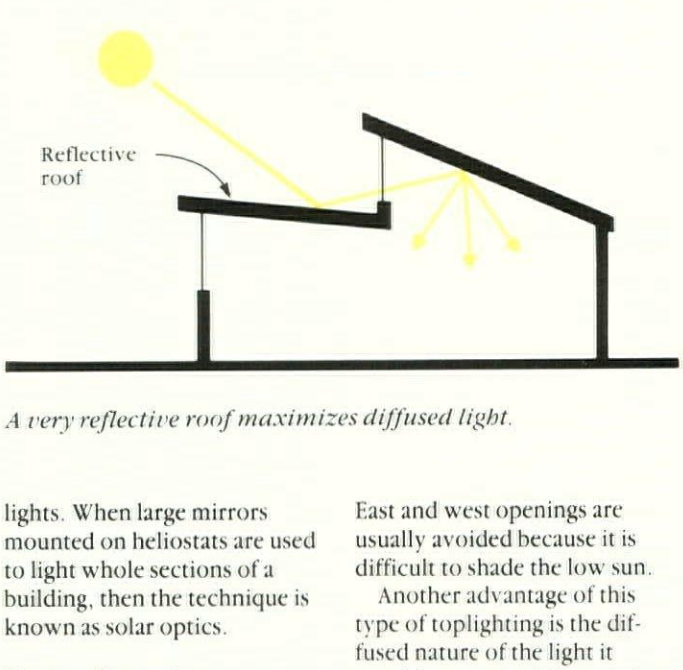
Glare is minimal in a high, narrow room because the light source is outside the field of view.



Interior reflectors, also called daylight fixtures, diffuse sunlight and reduce glare.



Two rules of thumb for spacing clerestories are illustrated. It is usually best to face clerestories either north or south.



A very reflective roof maximizes diffused light.

lights. When large mirrors mounted on heliostats are used to light whole sections of a building, then the technique is known as solar optics.

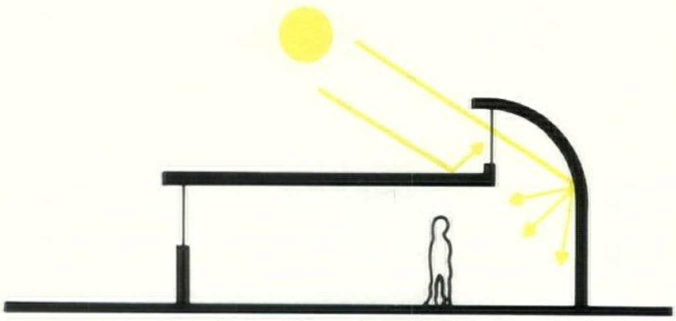
Monitor Strategies

Monitors, clerestories, and sawtooth clerestories all use vertical or steeply sloped glazing on the roof. Their main advantage is that they allow controlled collection of daylight for the interior of one-story buildings. When they face south, they collect more sunlight in the winter than in the summer, which is generally the desired situation.

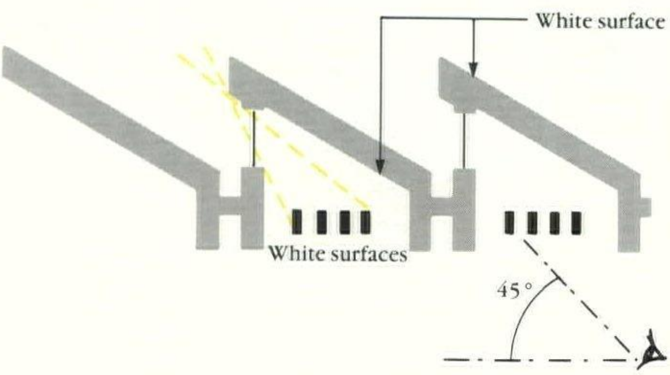
Vertical south-facing openings can easily be shaded from unwanted direct sunlight and north-facing openings deliver a low but constant source of skylight with little or no glare. East and west openings are usually avoided because it is difficult to shade the low sun.

Another advantage of this type of toplighting is the diffused nature of the light it provides; much of the entering light is reflected off the ceiling. Because the light can easily be diffused once it is inside, the glazing can be transparent. The main disadvantage of any vertical opening is that it sees less of the skydome than a horizontal opening does, and consequently it collects less light. As is the case with skylights, direct glare and veiling reflections can be a serious problem. Some of the more common strategies for monitors, clerestories, and sawtooth clerestories follow.

Spacing and orientation. Typical monitor and sawtooth clerestory spacing is illustrated



Clerestory light reflected off an interior wall; south-facing clerestories work best for this effect.



Baffles for the Mount Airy (North Carolina) Public Library not only prevent the entry of direct sunlight but also prevent glare within the normal field of view.

in the accompanying figures. The clerestories face south, usually the best orientation for constant year-round lighting and winter solar heating. When the roof is very reflective, light from the roof can enter the clerestories and illuminate the ceiling for low-brightness, high-quality lighting.

Reflecting light off interior walls. Walls can act as large low-brightness diffusers. Well-lit walls appear to recede and, thus, make a room seem larger and more cheerful. Furthermore, glare from a direct view of the sky or sun can be completely avoided.

Overhang and diffusing baffles for high-quality lighting. Very diffuse, glare-free, and high-illumination level light is possible when south-facing clerestories are protected by an overhang and baffles. The Mount Airy library is a good example of this strategy. The baffle spacing must be designed to prevent direct sunlight from entering the space and to prevent direct glare in the field of view below 45 degrees. The ceiling and baffles should have a high-reflectance matte finish.

Light scoops. Use light scoops — usually a variation of the sawtooth clerestory — over areas with difficult seeing tasks. Alvar Aalto, the master of daylighting, made extensive use of this device. ■

The Parts Department

Sidney M. Pankin

Sid Pankin, the principal of Pankin & Associates, Inc., is a lighting applications engineer who specializes in lighting design, energy conservation, and the design and fabrication of retrofit components.

Retrofitting 2-foot by 4-foot fluorescent fixtures with reflectors to permit the removal of lamps can be an excellent energy conservation measure. Retrofit reflector application is also a controversial and sometimes emotional matter. No lighting retrofit should be undertaken if it represents a major compromise in the quality of life in any company's building. On the other hand, minor objections should not impede a company's efforts to economize.

It's not the purpose of this column to endorse the retrofit concept or tell you what to buy or specify. The column tells you about the different reflective materials available. It suggests evaluation methods — including the use of certified test data and field applications — that can provide a reasonable basis for selecting a reflector system. Dollars spent on field testing may prevent a mistake or may be the first step in a successful energy conservation program.

Retrofit reflectors are not a panacea, but they can save lighting energy dollars.

Simply delamping a four-lamp fixture to leave two lamps per fixture has not been an overwhelmingly popular energy management strategy. Delamping may drastically alter the appearance of a fixture, especially one with a prismatic lens or 18-cell louvers. Prominent shadows may appear where lamps are deleted. Generally, tenants in commercial buildings won't put up with it. In single-occupancy buildings, employees frequently equate the change with unfavorable company economics. Delamping could have an adverse effect on retail sales or plant productivity if people have insufficient light to perform tasks efficiently.

By applying retrofit reflectors to a 4-lamp 2 × 4 fixture, you can take out two lamps, deliver a light level equivalent to that of three lamps, and retain the appearance of the fully lamped fixture. Reflectors may not be a panacea, but they can save lighting energy dollars.

Don't expect to get the light of four lamps with two lamps and retrofit reflectors. It just won't happen unless the lamps, ballasts, and reflective finish of the fixture you're planning to retrofit are completely expended. The degree of equivalence to three lamps will depend greatly on the properties of the reflective material. The bottom line is this: what you see is what you get. Either the space is lighted properly or it isn't; either you like the appearance of the fixture or you don't. The economic advantages of the 4:2 retrofit can be excellent, but they should not come at the expense of the environment of the lighted space.

Reflective Materials

Three families of reflective materials are used for retrofit reflectors: anodic aluminums, specular silver, and enhanced aluminum. The anodics go back to the early 1960s. The first commercial application of silver reflectors took place in June 1982. The use of enhanced aluminum in fluorescent fixtures dates back to the late 1970s; an improved version has been available for reflectors since 1986.

Anodic aluminums. The anodic aluminums are created by the process of anodizing, which puts a clear protective oxide film on a highly polished aluminum sheet by an electrolytic process in which the aluminum serves as the anode. Two types of this material are available. The West German Brite sheet has a 2-micron-thick anodized coating, and the American product has a heavier oxide coating created by the Alzak process of anodizing. Anodic aluminums have been used to make semispecular and specular louvers for 25 years or more and have also been used as reflectors in new fixtures. Their surface is hard and resists scratching.

Specular silver. The late Dan Finch, professor emeritus at the University of California at Berkeley, introduced the idea of using specular silver film to improve luminaire efficiency in the late 1970s. The basic ingredient of this material is clear polyester film, which has been used for about 30 years as a solar window film. It resists deterioration by ultraviolet rays, and it can handle high and low temperature extremes.

Polyester does not discolor or crack and resists most chemicals, although it is possible to melt a hole in the film by directly applying an acid or caustic. The film is laminated with epoxy to an aluminum substrate.

Two processes are used to apply elemental silver to the polyester: evaporation and sputtering. The evaporation process applies the silver to the top of the film, producing a top-coated, front-surfaced mirror. The silver is then covered with a very thin, clear acrylic film incorporating ultraviolet screens to protect the silver surface. The sputtering process embeds the silver in the back of the polyester, preventing any migration of the silver and producing a back-coated, second-surfaced mirror. An adhesive coating then covers the silver. Both processes protect the silver from oxidation. The total reflectivity of the front-surfaced mirror may be slightly more efficient because the acrylic overlay is 1 to 1.5 mils thinner than that of the sputtered polyester film.

Enhanced aluminum. Enhanced aluminum is made of a highly polished aluminum sheet modified with special evaporated coatings that improve the total reflectivity of the aluminum. The coatings may reduce the diffuse component, although I have not seen test data to prove this.

Because the anodic aluminums absorb light, the blue-gray color of the aluminum will affect lamp color. The silver films do not absorb light and are termed "flat," meaning that they do not affect lamp color. The coatings of enhanced aluminum may modify the blue-gray color of aluminum to some degree. All of the reflective materials resist the accumulation of dust and dirt, and all have excellent thermal conductivity. To decide which reflective material is best for your lighting needs, I suggest that you work with the test methods that follow.

Comparative photometric test results for 2 × 4 recessed fluorescent fixtures with and without retrofit reflectors

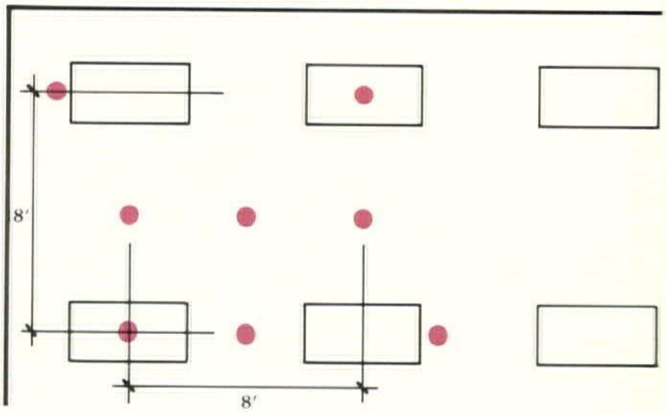
Reflective finish	WP*	SS**	WP
Number of fixtures	100	100	100
Number of lamps	200	200	300
Lumens	3150	3150	3150
Coefficient of utilization	0.76	0.86	0.72
Light loss factor	0.75	0.85	0.75
Space (square feet)	8000	8000	8000
Footcandles	45	58	64
Input watts	82.2	82.4	125.5
Module (square feet)	80	80	80
Watts per square foot	1.03	1.03	1.57
Footcandles/watt/square foot	44.7	56.3	40.8

**WP = white painted surface*
***SS = specular silver retrofit reflectors*

The room cavity ratio (RCR) is 1.0 and the coefficients of utilization are the highest listed for the RCR.

Light loss factor (LLF) higher for silver because of thermal properties of silver film on aluminum. Lamp wall temperature is reduced and dirt and dust rejected because of flow of warm air from fixture. Specular aluminum reflector would have LLF of 0.80; 34-watt lamp would reduce LLF by 0.05 because of shorter lamp life.

Calculations are based on certified photometric test reports generated by Lighting Sciences, Inc., Scottsdale, Arizona.



Reflected ceiling plan for a lighting test area shows eight locations for light readings. The number of readings can be increased above this minimum, depending on the objectives of the test.

Laboratory Testing

Manufacturers should supply the results of two laboratory tests that will help you to compare reflective materials or to select a specific reflector system. The tests should be completed by certified testing laboratories for maximum objectivity.

The *hemispherical spectral reflectance test* (HSRT) measures the reflectivity of a flat sheet of a particular reflective material over the visual light spectrum. Two important readings are developed. *Total reflectivity* ranges from approximately 86 to 95 percent for the various reflective materials used for reflectors. The *diffuse component of reflectivity* describes the amount of light that is diffused or scattered. A combination of the highest total reflectivity and the lowest diffuse component should indicate the best performing reflective material for both quality and quantity of light.

This particular test is important in the standardization of data for reflectors. Reflectivity can be measured in a number of ways that share no real common denominator for comparison. One test method may indicate a 91 percent total reflectivity while another yields 86 percent. The HSRT (ASTM-E424-71, Method A) performed by a certified testing lab puts uniformity into the evaluative process.

Reflector design is critical to the performance of any fixture. The effectiveness of the reflector design in a specific fixture can be determined by *photometric* testing. Reflector manufacturers should provide photometric test data that indicate how a generic retrofitted luminaire performs with respect to the quantity and the quality of light emitted — the amount of light produced and the distribution of that light. For an objective comparison, you need to see the results of two photometric tests: one of an unmodified fixture and the other of the retrofitted version of that fixture.

Be sure to carefully read all of the descriptive information about the test fixture at the top of the first page of photometric test data. This will include the type of fixture (2 × 4), type of light shield, reflector (if any), ballast, and lamps and their lumen ratings. Be sure that you're comparing apples with apples.

Elsewhere, you will find other critical information, including the spacing to mounting height ratio (S/MH), fixture efficiency, and input watts of the fixture. The data form should include the name of the certified testing laboratory, the test number, and the date. The two tests should be run at a similar time of day.

You can make several comparisons with the data. The candlepower summary and the zonal lumen chart are concerned with the distribution of light and spacing to mounting height ratio. The coefficients of utilization (CU) table can be used to compare the light output of the test fixtures. I find it valuable to do light calculations for a specific space to determine footcandles, watts per square foot, and footcandles per watt per square foot.

The accompanying table compares a new two-lamp 2 × 4 recessed fluorescent fixture, the same fixture with retrofit reflectors, and an equivalent three-lamp fixture. The chart provides considerable comparative data, which should be proportionate to field results. Remember that lighting calculations are highly dependent on the reflective surfaces found in the space. For this chart, we used the maximum CU for a room that has a room cavity ration (RCR) of 1.0.

Field Testing

The final step in the evaluative process is to see how the retrofit reflector concept works on site. It is important to measure the quality and quantity of light and to evaluate the physical appearance of the retrofitted fixture. Another important function of the test area is to refine reflector design and to select lamp color. It may also be used to compare different reflector materials.

The test procedure is the same as the one described in the June Parts Department column on ballasts. Establish test objectives and select a test site that relates to your objectives. You can start small and expand to larger areas for additional verification. You will need a footcandle meter, a watt meter, and a reflected ceiling plan of the space on which to record the light readings. Be sure to mark the specific locations in the room where readings are to be taken. Include corners and other areas as well as locations directly under fixtures.

Take light readings and the input wattage of the existing system. Clean the fixtures, lamps, and light shields, and repeat the readings. Then change lamps using the lamp type to be used with the retrofit reflectors, and take readings. This should be followed by the reflector retrofit.

When the data are recorded, evaluate the test site from an environmental viewpoint. Consider how the space feels for visual comfort, color rendition, the ability to see, and so forth. Remember, what you see is what you get; footcandle readings aren't everything.

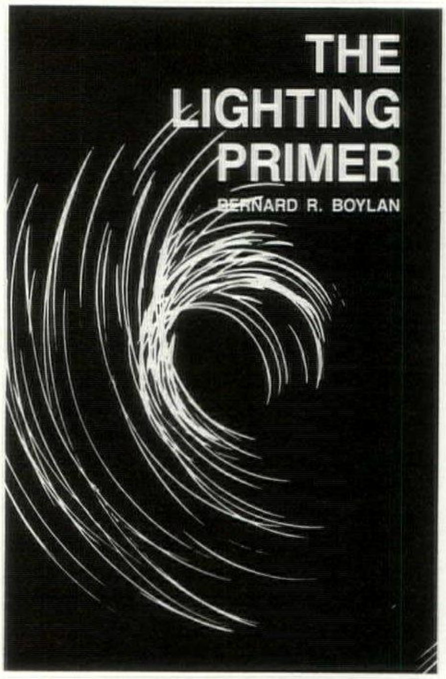
If the space looks and feels good, then you may have your answer. If it doesn't, then it's back to the drawing board — the test area. If you fail to meet all your objectives, look for revisions that will accomplish what you set out to do. ■

The Parts Department welcomes reader comments. Write to Sid Pankin, Architectural Lighting, *P.O. Box 10460, Eugene, OR 97440.*

Book Reviews

The Lighting Primer, by Bernard R. Boylan. Ames: Iowa State University Press, 1987. 150 pages (paperback), $15.95.

According to Bernard Boylan, "The goals of every lighting design should be to provide enough of the right kind of light to perform all seeing tasks easily, enhance design features, and still keep the occupants unaware of the light source." This is a model that he uses throughout *The Lighting Primer,* a new elementary introduction to the principles of lighting design.



Boylan says the need for a primer became clear when he tried to find an appropriate illumination textbook for novices.

Boylan says that the need for this primer became clear when he taught an interior design course on illumination and tried to find an appropriate textbook for novices. Available books often contained confusing and unessential data, were full of jargon, lacked clear explanations of terms and concepts, and were rife with illustrations that contributed little to a basic understanding of the subject. At the same time, he says, these books overwhelmed readers with data and terminology; they downplayed the "human aspects of lighting."

For reasons such as these, Boylan keeps calculations in his primer to a minimum and explains formulas and concepts in clear, straightforward language. He simplifies calculations when it is possible to do so without sacrificing the accuracy needed to provide reasonable forecasts of illumination levels. Informative charts, tables, and illustrations throughout the book supply additional information for designers to use in creating successful lighting systems.

The *Primer* proceeds logically, beginning with explanations of what light is and ending with Boylan's recommendations for different lighting applications. The chapters in between cover such topics as lamps, fixtures, costs, lighting calculations, and physical placement of lighting elements.

The first four chapters introduce basic information on the physical nature of light, essential terms used in the industry, conditions that make objects visible to humans, and the color of light. They are followed by a detailed discussion of three major electric light sources: incandescent (including halogen and infrared), fluorescent, and high intensity discharge (HID). Boylan explains how the various types of lamps produce light and analyzes the advantages and disadvantages of each. Numerous lamp charts and illustrations are also included.

Building on this solid background, Boylan continues with several short chapters on ways to control the amount and direction of light. First, he explains the physics of manipulating light distribution by reflection, refraction, and other methods. He then surveys types of fixtures for various lamps and discusses structural elements that direct or shield light, such as cornices, coves, and soffits. A chapter on devices for adjusting illumination levels — switches, dimmers, and timers, for example — rounds out the discussion on controlling illumination. Following this overview of basic lighting system components, Boylan turns his attention to costs and calculations.

A short chapter on costs equates energy savings with money savings. The author reminds readers that electrical rates continue to rise, making it important to consider both initial costs and operating costs during the design phase.

He carries over the concern for costs into a chapter on lighting design calculations that includes formulas for work planes, room ratios, coefficients of utilization, spacing to mounting height ratios, and maintenance factors. A sample design problem illustrates the way all these formulas link together. By the end of this chapter, readers should be well prepared to calculate the total number and layout of lamps and fixtures for ordinary applications.

The final three chapters of *The Lighting Primer* contain Boylan's recommendations for specific applications in residences, offices, and public buildings — stores, restaurants, and schools, for example. Designs for these spaces should meet two important goals, according to Boylan: provide enough quality light to perform seeing tasks comfortably and help meet the visual goals of the project's architect or designer. Many designs fail to meet these goals, he believes, because the multitude of necessary calculations often cause designers to forget about the ultimate user.

***The author offers guidelines for solving the problems discussed in* The Lighting Primer.**

Boylan cites the case of a drafting room designed with white walls and floors as an example; it met the Illuminating Engineering Society's recommendations for such spaces. An abundance of white surfaces, compounded by the white of employees' shirts and of papers on work surfaces, created so much brightness that no one could perform tasks comfortably. "Use of the space," comments Boylan, "alters the definition of 'proper' reflectances."

In the final chapter, Boylan offers guidelines for solving the problems he discusses in the primer: identify the seeing tasks for each setting, set and follow selection criteria for lamps and fixtures, and, where possible, provide sufficient flexibility for controlling lighting levels.

A catalog in the book's appendix lists lamp sizes and bases, ordering numbers, voltages, descriptions, lamp life, initial lumens, and lumens per watt for all the lamps Boylan discusses. Readers should need little more than this catalog and the tables in the book to begin designing a simple lighting system. A seven-page glossary of basic terms provides a useful supplement, as does a one-page list of reference books and periodicals.

The book suffers from a few minor shortcomings. Some drawings, for example, lack precision; others contain busy backgrounds and conceal measurements within them. As with many lighting textbooks, illustrations and photos appear to be derived from manufacturer sources; they are dated in appearance and disappointing.

Several chapters have summaries, some of which seem to address content indirectly. In one case, a simple but important example with a formula is incorrect because of a typographical error. In the third chapter, the reference to a table of reflectance percentages in the glossary is misleading; the table, reproduced in color, is actually on the back cover of the book. Such problems may momentarily confuse readers, but they do not overshadow the value to novice lighting designers of the knowledge available from the book.

That this book is intended to provide a general background for those new to lighting design is a fact underscored by the way Boylan limits the information he provides to tried and true components available industrywide. For example, aside from a captioned photograph, Boylan barely mentions the new compact fluorescents and even advises caution in specifying such new devices until their use becomes more widespread. His prudence in cautioning novices against following fads is admirable, but the rapidly increasing numbers of compact fluorescent lamps and fixtures on the market may cause him to reevaluate his skepticism toward them in the future.

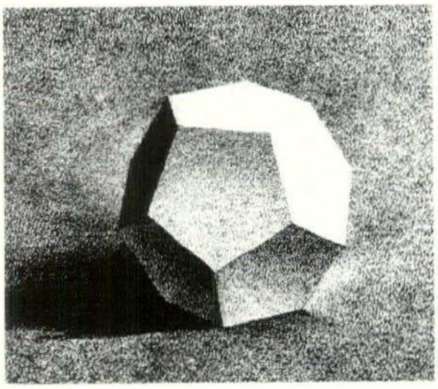
This book is intended to provide a general background for those new to lighting design.

Those who read *The Lighting Primer* will not become overnight experts on lighting design. Nevertheless, they will come away from the book with a valuable background knowledge of lamps, fixtures, lighting requirements for a variety of applications, and sensitivity to the costs of lighting systems and to users' visual comfort.

—Susan Degen

Susan Degen is assistant editor of Architectural Lighting.

Color Model Environments: Color and Light in Three-Dimensional Design, by Harold Linton. New York: Van Nostrand Reinhold Co., 1985. 272 pages, $40, paperback.



Color Model Environments *is profusely illustrated; black and white drawings appear on nearly every page.*

This book by Harold Linton, a design teacher at the Lawrence Institute of Technology in Michigan, begins where the Bauhaus left off. The subject is form, light, and color as determinants of architectural space. *Color Model Environments* is remarkable because it brings together topics that are most often treated separately. Architectural design is a holistic pursuit: the masterful design of interior space depends on the simultaneous manipulation of color, light, and form in addition to hundreds of practical constraints. Linton focuses on the artistic determinants of spatial design as evaluated by drawings and models. There is no mention of the emerging capabilities of computers to simulate light, color, and space, although Linton explores photographic and video techniques.

The book begins logically, with the elements of design and basic composition, and moves to the use of color on the surfaces of materials and in light sources. The theme builds to the study of masses in color and light and the visual nature of spatial enclosure and volume. The last chapter is devoted to examples of architectural applications, drawn from international sources. The final part contains enough well-illustrated professional applications and examples to make the book of interest to practicing architects and interior designers. The number of student projects shown throughout, however, leads one to believe that the book is primarily intended for students and teachers of design.

Profusely illustrated, this is an idea book for designers searching for new possibilities. From fundamental principles to contemporary professional work, there is a wealth of stimulating and highly visual material in *Color Model Environments.* One difficulty with the many color illustrations in this paperback book is that they are clumped unevenly and often far away from the supporting text. For instance, the color illustrations for chapter 6 appear in the middle of chapter 5! This inconvenience is offset by the excellent quality of the color plates and the crisp black and white illustrations that appear on nearly every page, near the supporting texts. The short appendixes and the bibliography provide additional information for students and professionals.

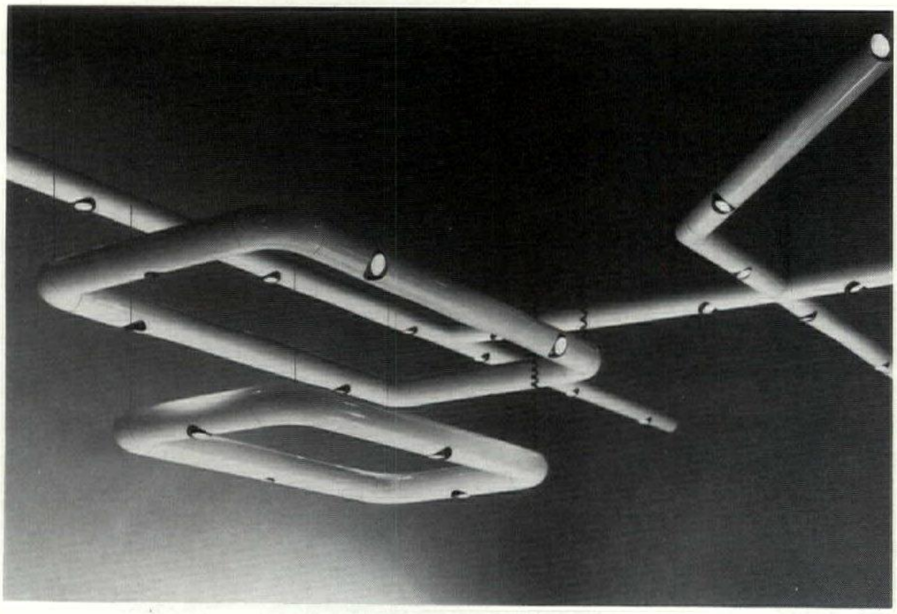
Linton's book brings together topics that are most often treated separately.

After reading this book, I wanted to do some of the experiments suggested in the early chapters. *Color Model Environments* has also made me look at the work of several favorite architects in a new way. This book will be welcomed by designers who want to know more about light, color, and the creation of architectural space.

—David Lord

David Lord is a professor of architecture at California Polytechnic State University, San Luis Obispo, and a member of Architectural Lighting*'s editorial advisory board.*

Product Showcase



Linear lighting

The Inner Spaces low-voltage linear lighting system from U.S. Powerbeam houses MR16 lamp holders in a 3-inch-diameter aluminum tube. The lamp holders adjust 45 degrees within the tubes, and the tubes rotate on axis.

The tubes mount onto 4-inch-long connectors with a split casting that allows the bottom to drop off for access to the wiring box. Tube sections support one to four lamp heads and come in lengths suitable for lamp spacings of 18, 24, or 36 inches on center. According to the designer, the lamps can quickly be popped out and back in.

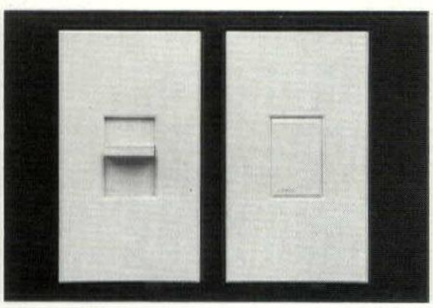
The system has standard finishes in white, black, polished aluminum, brushed aluminum, and polished brass. Custom finishes are also available. U.S. Powerbeam Inc., Little Ferry, NJ.

Circle 60

Halogen pendant lamp

The Puglia pendant lamp was designed by Michel Morelli for Sverige. A frosted glass diffuser surrounds the light source. Light projects upward from a suspended reflector and downward through a glass lens in the pendant's center. The 20-inch-diameter lamp accommodates a 75-watt, 120-volt halogen lamp. Sverige Inc., Ste-Therese, Quebec, Canada.

Circle 61

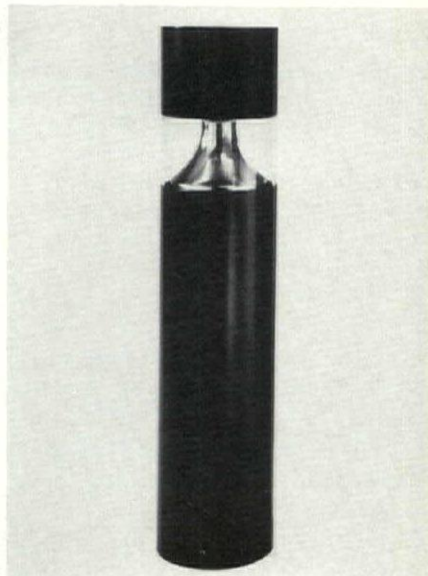


Slide dimmer

The Nova three-way system from Lutron Electronics features a full-range slide dimmer at one location and on-off switching from up to 10 additional locations. A filter provides maximum protection from radio frequency interference and voltage compensation to reduce changes in lighting levels from switching electrical equipment on or off.

The easy-to-install system uses standard three-way wiring and is designed with no visible fins or screws on the front of the units. It matches and gangs with the company's other dimmers, switches, and fan speed controls. The system controls incandescent, halogen, and low-voltage systems from 600 to 2000 watts. The manufacturer recommends it for conference rooms, small lobbies, bedrooms, hallways, stairways, and other spaces where single location dimming and on-off switching from multiple locations is desired. Lutron Electronics Co., Inc., Coopersburg, PA.

Circle 62



Bollards

Square and round bollards in Lithonia's KB series feature a two-piece optical system for high-performance photometrics. The fluted reflector directs light precisely, minimizing rises in arc tube voltage and increasing lamp life. Lamps are easily accessible through the top of the bollard and electrical components from the bottom.

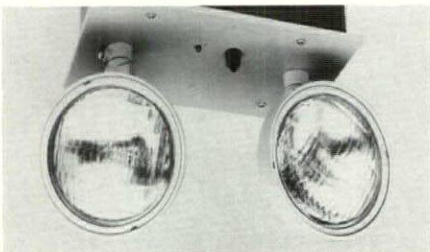
The bollards are available in 6- and 8-inch diameters and accommodate a variety of incandescent, mercury, and high pressure sodium lamps; they come in standard bronze and optional colors. Lithonia Hi-Tek, division of Lithonia Lighting, Conyers, GA.

Circle 63

■ **Wall-mounted security light**

The model 3505 specification grade wall pack and security light from Gim Metal Products features a rugged, die-cast housing with a vandal-resistant injection-molded polycarbonate lens. The unit is UL listed for wet locations and accommodates high intensity discharge and multitube compact fluorescent lamps. Models are available for horizontal, vertical, and overhead mounting. The unit is sold unassembled to OEM lighting manufacturers with all necessary hardware, screws, and gaskets. Ballasts, lamps, and sockets must be purchased separately. Gim Metal Products, Inc., Carle Place, NY.

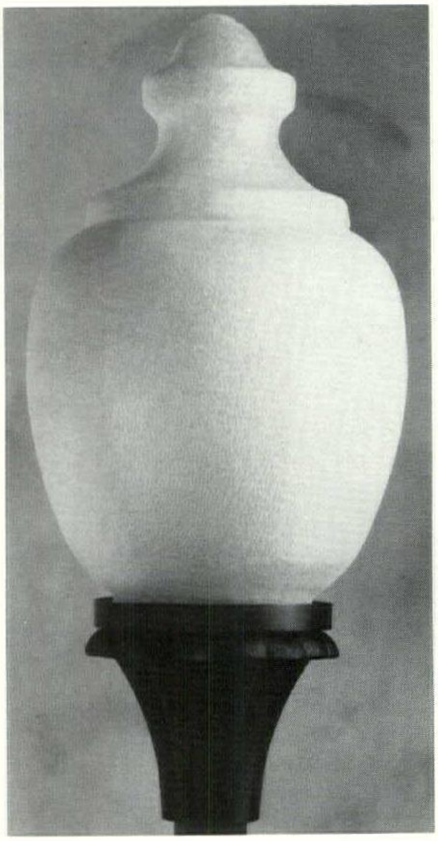
Circle 64



■ **Emergency luminaire**

Siltron Illumination's EM62R emergency luminaire has an all-metal housing. It is recessed for low-profile installation in ceilings or walls and can be flush mounted in suspended ceilings. The UL-listed unit features fully adjustable 8-watt heads for safe egress through hallways during power failures. Features of the compact emergency luminaire include a 9¼-inch by 4¾-inch faceplate, dual 120 and 277 AC voltage, fully automatic 90-minute operation, a 6-volt sealed lead-acid battery, a solid-state charger, a test switch, and an indicator light. Siltron Illumination Inc., Cucamonga, CA.

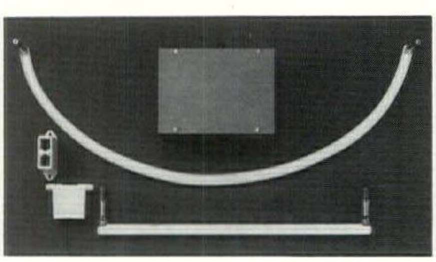
Circle 65



■ **Polycarbonate globes**

The series 6200/6400 traditional acorn style globe lights from TrimbleHouse now accommodate high intensity discharge lamps up to 250 watts. The globes are made of high-impact, vandal-resistant polycarbonate in a choice of clear, frosted, or white finishes. TrimbleHouse Corp., Norcross, GA.

Circle 66



■ **Cold cathode lighting**

Newman Cathode Lighting's TNC lamps combine the advantages of cold cathode and fluorescent in straight and curved lamps with high lumen outputs. The fully dimmable lamps retain the usual long lamp life of cold cathode sources. They come in both white and colored versions; the white lamp is available in a variety of color rendering index values and Kelvin temperatures.

A modular system is available in lengths of 1, 2, 4, and 8 feet, as well as in corner and curved shapes. Safety circuit interlocks are designed in accordance with NEC Article 410, Part R, so the lamps can be used in residential, as well as commercial, applications in most locales. Newman Cathode Lighting, Santa Monica, CA.

Circle 67

■ **Outdoor area lights**

Thin-Lite's 12-volt DC area lights are fully sealed and gasketed for outdoor use. The fixture housing is made of a corrosion-resistant cast aluminum alloy and mounts on a swivel arm that allows vertical adjustments to 180 degrees. It has a tempered glass lens and a specular aluminum reflector.

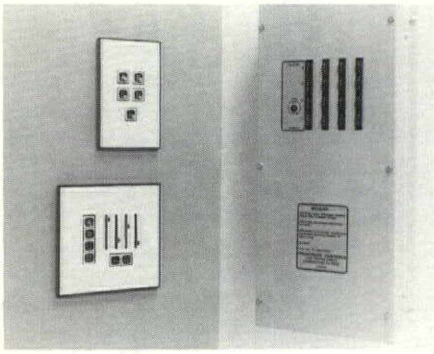
The outdoor area lights are available in models that accommodate double twin-tube compact fluorescent lamps of 10, 13, 18, and 26 watts. Twelve-volt DC operation is standard; other DC voltages can be special ordered. The lights are suitable wherever DC power is available and AC power is undesirable, according to the manufacturer. The manufacturer also notes that the lights can be used in remote areas with alternative energy sources such as photovoltaic cells and wind-powered generators. Thin-Lite Corporation, Camarillo, CA.

Circle 68

■ Metal halide lamps

Venture Lighting International offers a complete line of glare-guard metal halide lamps. A highly reflective opaque aluminum coating on the top of a lamp's outer jacket significantly reduces glare, according to the manufacturer. The lamp also reduces spill light by as much as 70 percent, making it suitable for high-mast pole or high bay applications. The lamps are available in 175, 250, 400, 1000, and 1500 watts with base-up burn positions. Venture Lighting International, Cleveland, OH.

Circle 69

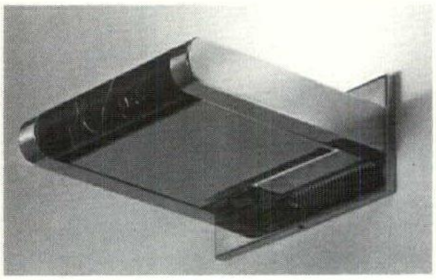


■ Dimmer control panels

Preset control panels from Prescolite Controls are part of the Micro-Pac line of remotely controlled dimmer systems for small to medium rooms. A single-gang panel permits recall of four preset scenes for any number of control channels; a two-gang panel adds four channels of manual control and allows local control without disturbing preset settings.

The UL-listed preset dimmer system contains four dimmers, four scene preset controls, and a fade rate control that can be adjusted from 0 to 60 seconds. The system can control up to four 1200-watt universal loads of incandescent, low-voltage, fluorescent, or neon and cold cathode sources. Prescolite Controls, Carrollton, TX.

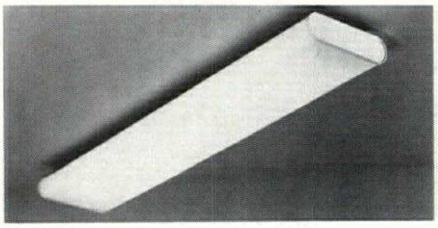
Circle 70



■ Wall bracket

Boyd Lighting offers a wall bracket designed by Richard Brayton that reflects light asymmetrically to illuminate a space's peripheral contours. Its armature and cylinder come in white enamel and polished chrome finishes; the cylinder can also be ordered in black Marquiana Italian marble. The wall bracket has fastener-free mounting. Boyd Lighting Company, San Francisco, CA.

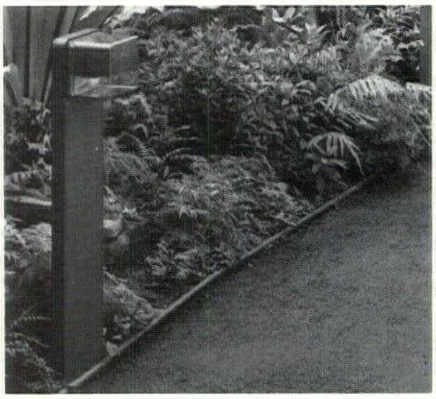
Circle 71



■ Surface fluorescent wrap

The Belmont Wrap from Lightolier is a low-profile, surface-mounted fluorescent luminaire that has a rounded, acrylic diffuser covering a slim, two-lamp chassis. The luminaire has an energy-saving, rapid-start ballast and accommodates two 40-watt T12 lamps. Lightolier, Secaucus, NJ.

Circle 72



■ Bollard pole

Heavy-gauge aluminum bollard poles from Ruud Lighting support the company's line of incandescent, fluorescent, metal halide, and high pressure sodium security fixtures. The vandal-resistant bollard poles have a large wiring chamber with a fully removable front panel to simplify installation. Two ½-inch anchor bolts are provided to ensure rigid mounting in a concrete base.

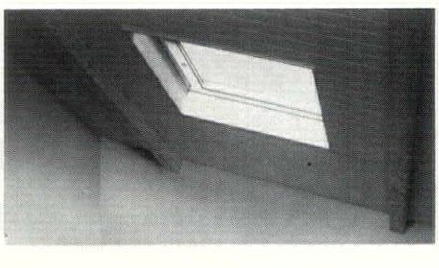
The 36-inch-high, 10-inch-wide, 1½-inch deep bollard has a coat of durable bronze powder thermoset paint. The manufacturer recommends it for outdoor landscaping applications, including patios, walkways, driveways, and other pedestrian areas. Ruud Lighting, Inc., Racine, WI.

Circle 73

■ Screw-in reflector

Westerfield's Reflectocap, a screw-in R40 chrome aluminum reflector, incorporates a 72-watt halogen Capsylite lamp from GTE/Sylvania. The assembly is specially designed to replace 150-watt R40 incandescent floodlights in recessed can fixtures and track lighting systems. The reflector's narrow beam design prevents light scattering and loss of downlight. Compared to an R40 incandescent lamp, the Reflectocap increases energy savings per socket by 52 percent and lamp life by 75 percent, according to the manufacturer. It is suitable for apartment buildings, retail stores, restaurants, hotels, schools, hospitals, and other commercial and residential applications. Westerfield Company, San Diego, CA.

Circle 74

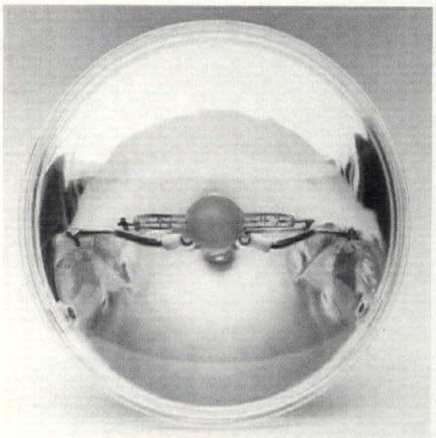


■ Fixed skylight

Velux's model FSF fixed skylight has a ventilation flap that can easily be controlled by a pull-cord or a rod. A removable air filter keeps dust and insects out, while a condensation gasket system around the frame drains moisture through weep holes along the bottom sill.

The skylight has an interior wood frame and a neutral brownish-gray exterior finish; aluminum cladding and step-flashing make it completely weathertight. The standard skylight comes with double-pane insulating tempered glass; high performance, tinted, and laminated glazings are also available. Other options include venetian or roller blinds, which can be operated manually or electrically. Velux-America Inc., Greenwood, SC.

Circle 75



■ Studio, theatrical lamp

GTE/Sylvania's Brite Beam Mark II lamp has a frosted capsule for enhanced color consistency across its beam pattern, according to the manufacturer. The manufacturer also reports predictable output throughout its 1000-hour life because changes in beam distribution due to the lamp's aging have been eliminated. Total light output remains at 100,000 lumens, about four times the output of incandescent or halogen sources.

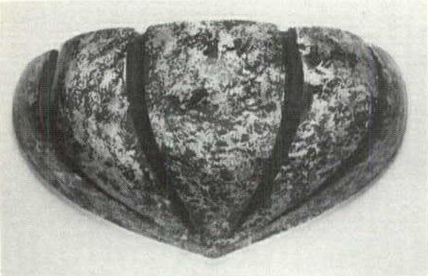
The 1200-watt lamp was originally designed as a daylight-quality fill light for both studio and location shots. The lamp produces less heat than standard halogen or incandescent sources to make working conditions under the lights more comfortable and reduce air conditioning loads. The lamp is available in four lens patterns: very narrow spot, narrow spot, medium flood, and wide flood. GTE/Sylvania, Danvers, MA.

Circle 76

■ Low-profile luminaire

The Deco-Cell is part of a series of fixtures from Kenall for 13-watt double twin-tube fluorescent lamps. The low-profile, cutoff luminaire has a 3-inch-deep polycarbonate housing in bronze or white. It is suitable for unattended public areas such as corridors, stairwells, foyers, overhangs, and closets. An optional capacitor is available for power factor conversion. Kenall Manufacturing Company, Chicago, IL.

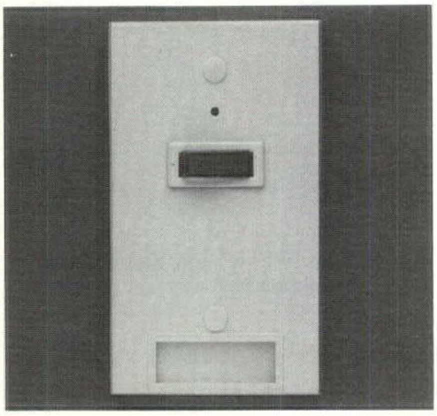
Circle 77



■ **Wall sconce**

The Apollo wall sconce from Derek Marshall has a burgundy background with a faux d'or finish. It measures 20 inches wide and 11 inches high, and extends 9 inches from the wall. The sconce is part of a new collection of wall sconces available in a wide variety of finishes, including metal leaf, ceramic glaze, and colored lacquers. A variety of faux finishes are also available. The UL-approved sconces accommodate an incandescent lamp of up to 200 watts. Derek Marshall Lamps & Accessories, Center Sandwich, NH.

Circle 78

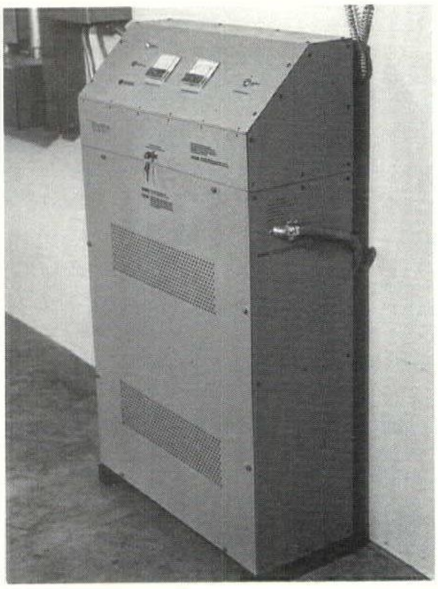


■ **Automatic light switch**

The Switch-O-Matic from Unenco is an automatic, infrared occupancy sensor wall switch; it turns lights on when it senses someone entering the room and turns them off after the last occupant leaves. The device monitors a space of 200 square feet at a 155-degree angle and controls up to 1200 watts of incandescent or fluorescent lighting.

The automatic switch has a solid metal fire safety shield, a manual on-off switch with a lighted indicator, and specification-grade electrical components that do not generate heat. The ivory-colored wall switch can be installed in place of a regular wall switch in six minutes, according to the manufacturer. It comes with a three-year factory warranty. Unenco, Inc., San Leandro, CA.

Circle 79

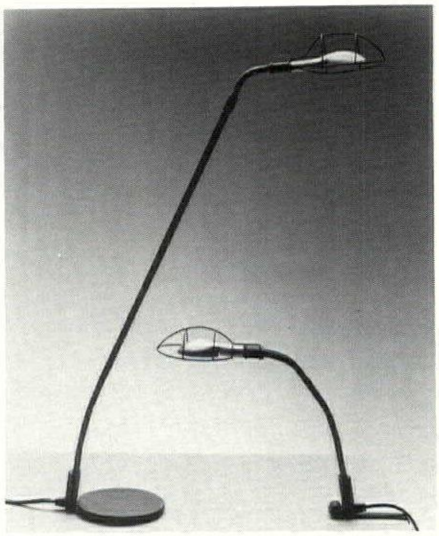


■ **HID emergency lighting**

Bodine's HID 1600 emergency lighting system operates high intensity discharge lamps during a power failure without affecting their normal operation or life. The system illuminates lamps at 50 percent of normal output in the emergency mode to provide light from familiar sources and eliminate the need for quartz restrike and auxiliary emergency lighting, according to the manufacturer.

The system's two major components are a DC power supply and remote inverter ballasts for each emergency fixture. The power supply automatically sends current to the lamps when AC power fails or drops. Individual remote ballasts provide continuous power so that even if one fixture fails, others will function. Other features include orderly shutdown, noise and strobe reduction, and high lumen output. The Bodine Company, Collierville, TN.

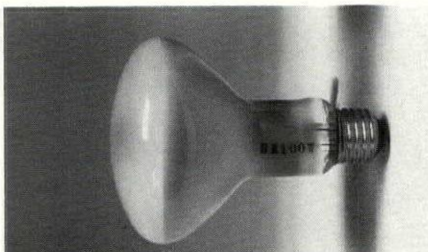
Circle 80



■ **Task light**

The components of Zelco's Micro halogen luminaire can be assembled in a variety of configurations. With each lamp head, the manufacturer supplies two interchangeable arms, a weighted tabletop base, and a clip-on base. The luminaire's AC adapter converts line voltage to 12-volt power. Zelco Industries, Inc., Mt. Vernon, NY.

Circle 81



■ **Landscape lighting**

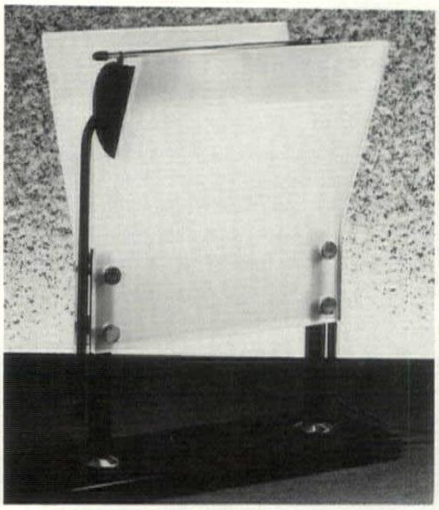
C.E.W. Lighting offers Iwakasi Electric's new R30 mercury vapor reflector lamps in 100- and 50-watt sizes, which expand the range of lamps available for landscape lighting. These lamps have a beam pattern, light output, and color rendition similar to the R40 lamps, but their smaller size makes it possible to downsize outdoor lighting fixtures. C.E.W. Lighting, Inc., Dallas, TX.

Circle 82

■ Wood-framed fixture

Light Concepts offers Old English wood-framed fluorescent fixtures, including model 11269 with a hand-oiled solid oak frame accented by a nontarnishing brass inlay. The luminaire is available with a flat diffuser and integral oak grid or with a dropped diffuser and no grid. Both styles come in three sizes: a 1½-foot by 4-foot unit for four 40-watt lamps, a 1-foot by 4-foot unit for two 40-watt lamps, and a 2-foot-square unit for two 40-watt U-shaped lamps. Light Concepts, division of Lithonia Lighting, Conyers, GA.

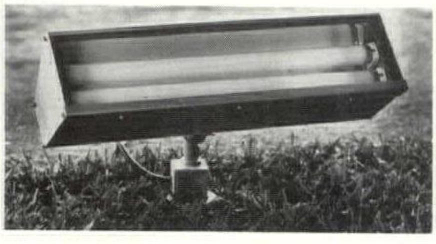
Circle 83



■ Table lamp

Multiworld offers the Alfiere table lamp designed by Giovanni Grignani. The lamp's lacquered and coppered metal body stands on a black marble base and holds a sand-blasted crystal diffuser. The table lamp accommodates one 150-watt halogen lamp and has a full range dimmer and adjustable light direction. Multiworld Inc., Falls Church, VA.

Circle 84



■ Fluorescent floodlights

The FFL series fluorescent floodlights from Standard Electric Fixture Co. have housings of heavy-duty extruded aluminum on a swivel knuckle mounting. The housing has a natural, noncorrosive aluminum finish and a gasketed clear acrylic diffuser. UL-listed for damp locations, the floodlights are available with preheat or rapid start 120-volt ballasts.

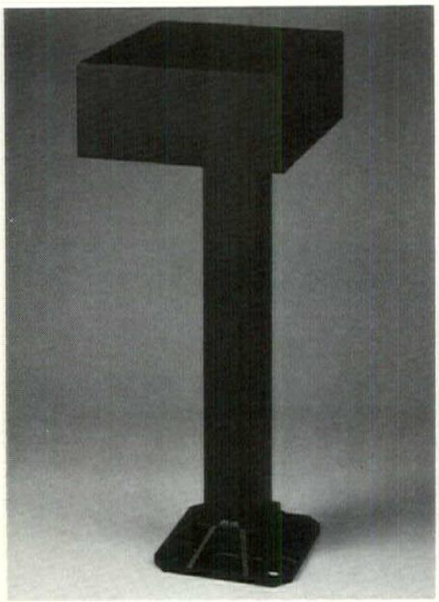
The fixtures come in several sizes for different lamp lengths and wattages. A 12-inch model accommodates a single 18-watt or one or two 7-, 9-, or 13-watt compact twin-tube fluorescent lamps. Larger sizes accommodate one or two T8 fluorescent lamps from 15 to 40 watts. Standard Electric Fixture Co., Inc., Miami, FL.

Circle 85

■ Exit signs

Perfeclite offers a complete line of exit signs for incandescent or fluorescent lamps. The signs accommodate universal symbols and are available in several mounting configurations, including back-to-wall, end, surface, and ceiling. All fixtures are UL listed and comply with OSHA requirements. Perfeclite Company, Cleveland, OH.

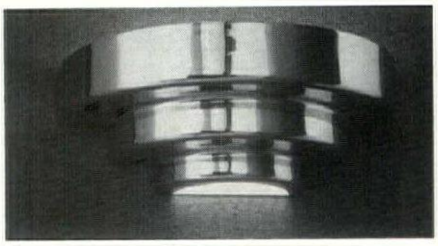
Circle 86



■ Outdoor downlight

A linear downlight with a precisely controlled beam spread is part of Guth's new Castellan outdoor lighting series. The downlight's heavy-gauge aluminum lamp housing is hinged for easy access. Its low-profile, 4-inch-square mounting post is available in heights from 36 to 42 inches. The unit accommodates mercury vapor, metal halide, and high pressure sodium lamps in wattages from 70 to 175. The downlight is suitable for sidewalks, planter areas, building entrances, and other applications that have high traffic and severe weather conditions. Guth Lighting, St. Louis, MO.

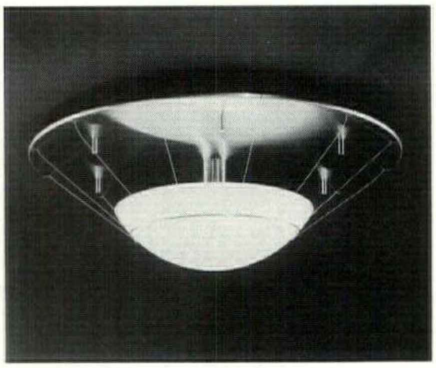
Circle 87



■ Wall sconce

The tiered model CB931 wall sconce is one of 16 fixtures included in Visa Lighting's new Quick Ship program. The one-piece handspun wall sconce shown here measures 18 inches wide, 6½ inches high, and 9 inches deep. It accommodates two 100-watt A19 lamps and has a solid polished brass finish. All sconces in the program are shipped within three working days of ordering. Visa Lighting Corporation, Milwaukee, WI.

Circle 88



■ Ceiling luminaire

VeArt's Spider luminaire, designed by J. Cerutti, measures 32 inches in diameter and hangs 12 inches from the ceiling. It accommodates an Osram Halo Star 250-watt E27 halogen lamp. VeArt International Inc., Montreal, Quebec, Canada.

Circle 89

■ Lamp series

George Kovacs is the licensed U.S. producer of the Petals line of floor, table, wall, and ceiling lamps designed by J.T. Kalmar, an Austrian lighting manufacturer. The lamps feature a 23-inch-diameter shade of beveled opal glass and a finish of solid polished brass or nickel plate. The 24-inch-high table lamp accommodates two 100-watt A lamps and has an on-line on-off switch. The 72-inch-high floor lamp accommodates three 100-watt A lamps and has a full range dimmer. George Kovacs Lighting, Inc., New York, NY.

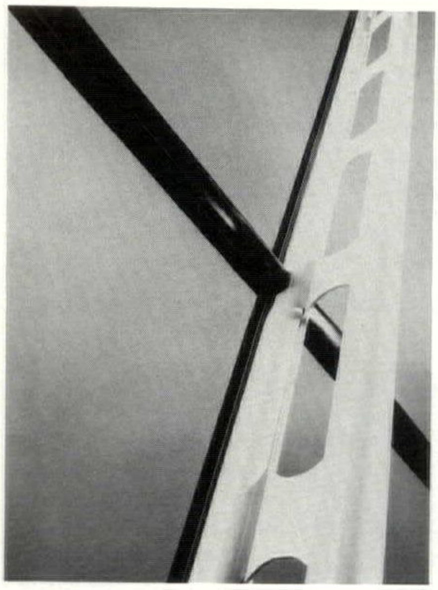
Circle 90

■ High-intensity lamp holder

The new Series MLH high-intensity lamp holders from Leecraft Manufacturing are engineered to accommodate double-ended RSC metal halide and high pressure sodium lamps. Features include high-temperature ceramic housings, 5-kilovolt pulse, and 12-inch leads of 18-gauge 250-degree Celsius Teflon wire.

The lamp holders are available as complete double-ended assemblies with mounting brackets for 70-watt and 150-watt lamps or as individual units for use with custom mounting brackets. The manufacturer recommends them for use with HQI and NAV units in applications that require a high color rendering index, such as displays, showrooms, offices, and industrial facilities. Leecraft Manufacturing Co., Inc., Long Island City, NY.

Circle 91

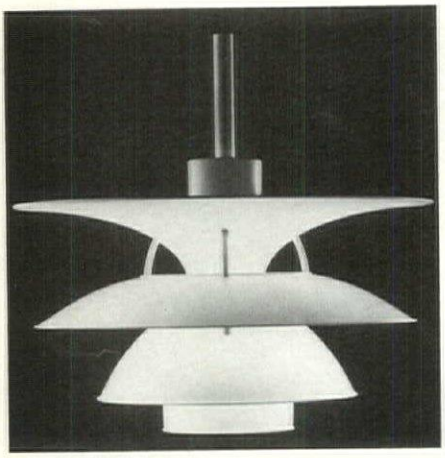


■ Framing system

Designed for high-span, vertical atrium applications, the 2800 Trusswall framing system from Kawneer features two rounded vertical chords connected with 15/16-inch-thick aluminum webs. The webs are spaced up to 2 feet on center and are machine welded between the two extruded aluminum chords.

A standard system, which meets a design load of 20 pounds per square foot, is based on a typical unit with vertical mullions spaced 6 feet on center and installed in a clear vertical span of 30 feet. Modifications are possible without additional custom order charges. Options include four web profiles, 10 color choices, two exterior cover shapes, and a silicon glazing instead of exterior covers for an uninterrupted line. Kawneer Company, Inc., Norcross, GA.

Circle 92

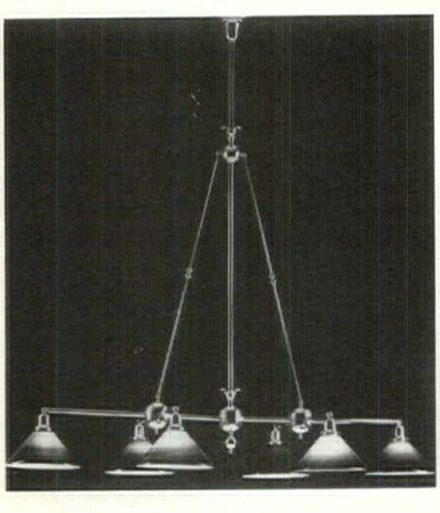


■ Pendant lamp

Poul Henningsen designed Poulsen Lighting's PH 6½-6 pendant lamp, which provides uniform, symmetrical, glare-free light distribution. A series of rounded struts supports the lamp's architecturally scaled system of graduated reflector shades and concealing cones.

The pendant measures 25.6 inches in diameter and 15.7 inches high; it comes with a 12-foot-long electrical cord covered in white plastic. Its inner and outer shades have a matte white baked enamel finish. The UL-listed luminaire accommodates a 500-watt, PS 35 clear lamp. Poulsen Lighting Inc., Miami, FL.

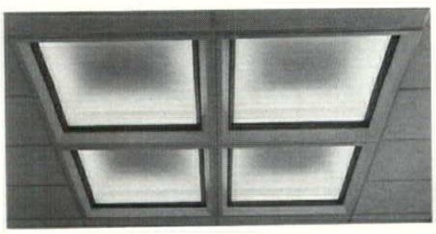
Circle 93



■ Gaming table luminaire

Nowell's offers a custom-made luminaire for use over a casino gaming table. The luminaire measures 6 feet long, 6 feet high, and 2 feet wide. Special steel interior body rings and steel arms encased in solid brass add support for the luminaire's extra length, and custom swivels secure the bracing supports. The luminaire accommodates six 100-watt incandescent lamps. Green-cased glass shades are standard, and other colors can be special ordered. Models can be manufactured to customers' size specifications. Nowell's Inc., Sausalito, CA.

Circle 94



■ Indirect recessed luminaires

Columbia Lighting's MIR series modular indirect recessed luminaires provide the appearance of sculptural coffers in a standard suspended ceiling. The 9-inch-deep fixtures come in 3-, 4-, and 5-foot modules that conceal four T8 or T12 fluorescent lamps within their perimeter skirts. All light is reflected off a textured white interior surface.

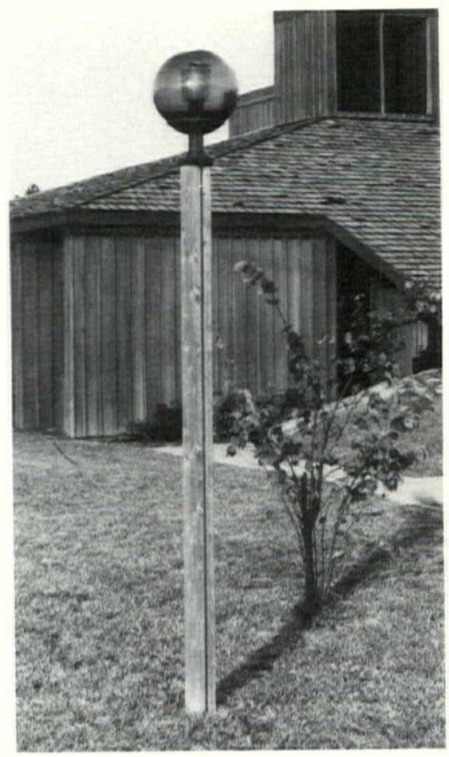
The MIR series offers a selection of decorative skirt designs. The modules may be mounted individually or in aligned, staggered, or clustered arrangements. Columbia Lighting, Spokane, WA.

Circle 95

■ Compact fluorescent floodlight

Lumatech's new compact fluorescent floodlight, the Reflect-A-Star 9 Quad, contains a replaceable 9-watt double twin-tube fluorescent lamp and an Alzak reflector. The floodlight's narrow 2-inch neck and 6.1-inch length allow it to fit into tight downlight and track fixtures. The floodlight can replace a 75-watt incandescent lamp, according to the manufacturer. Optional features include 4½ and 5¼-inch-diameter reflectors, colored lenses, and a brightness control louver. Lumatech Corporation, Oakland, CA.

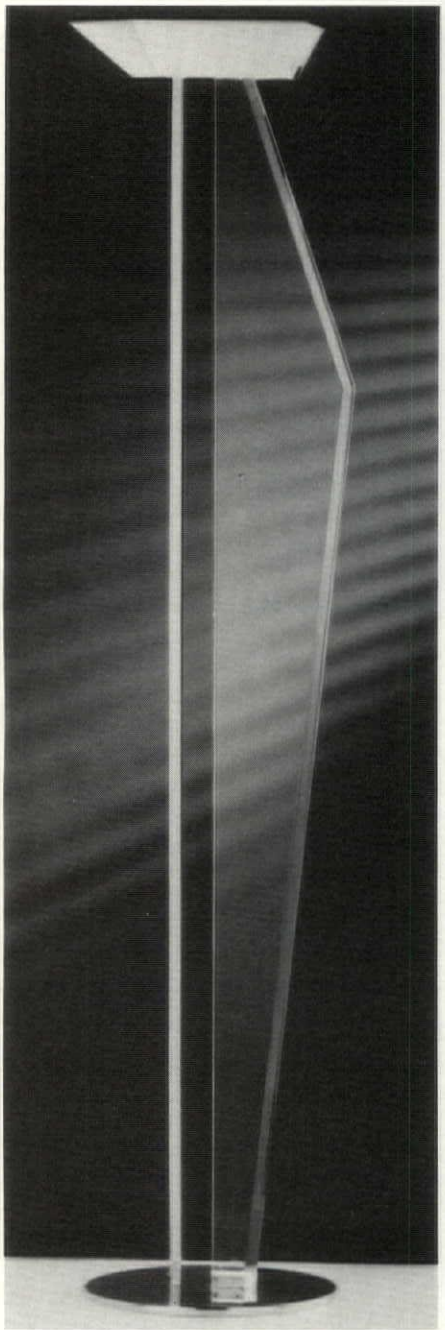
Circle 96



■ Wooden light standards

J.H. Baxter offers the Timber Wood line of light standards, which are pressure treated for protection from wood-destroying organisms. The standards are laminated of western Douglas fir and have a 1-inch by 1¼-inch internal raceway for wiring. Straight standards are available with crossarms of various lengths and can be ordered with plain or revealed surfaces. Curved models are also available. Fixtures can be top-mounted with a factory-prepared slip fitter. The company's three-ring binder is available upon request. J.H. Baxter & Co., Eugene, OR.

Circle 97



■ Halogen floor fixtures

The Riva series of floor lamps from Fredrick Ramond includes the model 330FF, which features a boat hull form suspended atop a sail-shaped prism of acrylic. Polished chrome and black enamel finishes are available for the lamp, which accommodates a 500-watt halogen lamp with a 600-watt dimmer. Fredrick Ramond Inc., Cerritos, CA. ■

Circle 98

SHARE YOUR ILLUMINATING EXPERIENCES

Architectural Lighting is looking for practical, problem-solving articles that will help lighting professionals meet commercial, industrial, and institutional lighting challenges. Call or write for Guidelines for Authors or Project Submission Guidelines.

Charles Linn, AIA, Editor
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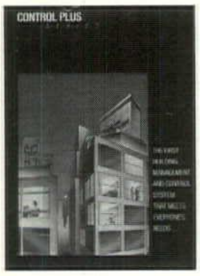
ARCHITECTURAL LIGHTING

Product Literature

Emergency lighting

The Designer series ceiling unit is a recessed, self-powered emergency fixture designed to fit most suspended grid or lay-in ceilings. A data sheet lists standard features. Yorklite Electronics Inc., Austin, TX.

Circle 120



Lighting controller

The Control Plus system allows building owners to use a touch telephone in any central location to control lighting circuits individually or in groups. A brochure describes features and accessories. Schlage Electronics, Santa Clara, CA.

Circle 121

Linear lighting

A 6-inch round linear tube system includes 192 direct and/or indirect lighting arrangements. A brochure contains sketches of combinations and illustrations of typical systems. Peerless Lighting Corporation, Berkeley, CA.

Circle 122

Compact fluorescent fixtures

A brochure includes photos, descriptions, and specifications for continuous strips, modules, and other fixtures for compact twin-tube fluorescent lamps. Norbert Belfer Lighting, Ocean, NJ.

Circle 123

Minifloodlights

A brochure from Kim Lighting profiles the 4300 series of low-wattage floodlights for fluorescent, incandescent, and high pressure sodium sources. Kim Lighting, Industry, CA.

Circle 124

Track lighting

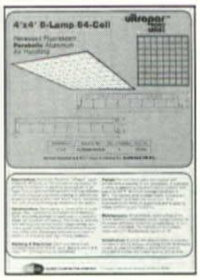
A color brochure illustrates components of Inlite's 3000 series light track, including eight different fixtures, accessories, and matching canopy styles for ceiling or wall mounting. Inlite Corporation, Berkeley, CA.

Circle 125

Illuminated fountains

Hydrel's water effect equipment is featured in a brochure that contains color photos of applications and descriptions and illustrations of fountain kits and system components. Hydrel, Sylmar, CA.

Circle 126



Recessed fluorescent

The Ultrapar 9040 series of recessed fluorescent fixtures with parabolic aluminum louvers includes a 64-cell, 4-foot-square unit that accommodates eight F40 lamps. Globe Illumination Company, Gardena, CA.

Circle 127

Exterior fixtures

Dinico offers its complete line of exterior lighting products in a 57-page color catalog that includes descriptions and photos of all fixtures and components. Dinico Products Inc., Hackensack, NJ.

Circle 128

Retrofit guide

American Louver offers a four-page guide with installation specifications for retrofitting parabolic louvers in a variety of fluorescent ceiling lighting systems. American Louver Company, Skokie, IL.

Circle 129

■ Street lighting

A brochure from Holophane describes the features and advantages of the traditional acorn-style Granville luminaire and discusses the optical system and suggested applications. Holophane, Newark, OH.

Circle 130

■ Outdoor fixture

Ryther-Purdy developed the Adams fixture to be compatible with its lighting standards. A data sheet describes features and shows cutaway sketches of the fixture. Ryther-Purdy Lumber Company, Inc., Old Saybrook, CT.

Circle 131

■ Post-top luminaires

A brochure featuring the CL collection of architectural lighting systems includes photos of 21 luminaires along with a general description of the product line. Custom Lighting Inc., Colton, CA.

Circle 132

■ Interior lighting

A brochure illustrates the Odyssey Illuminations line of chandeliers and wall sconces for commercial applications. Several custom fixtures are also included. RWL Corporation, New Haven, CT.

Circle 133

■ Redwood fixtures

Chandeliers and other hanging fixtures made of natural redwood are presented in a brochure that includes photos, detailed sketches, and specifications. Sylvan Designs, Inc., Northridge, CA.

Circle 134

■ Optical reflectors

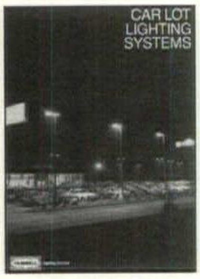
A data sheet discusses optical reflectors that are designed to improve fluorescent fixture efficiency and allow removal of a portion of the lamps and ballasts. Maximum Technology, Inc., Brisbane, CA.

Circle 135

■ Building controller

The Pro Series digital automation and control system allows complete building automation and control. A color brochure describes the system's features and optional components. Jensen Electric Company, Reno, NV.

Circle 136



■ Commercial lot lighting

A 12-page color Hubbell lighting guide can help car dealers improve product display and expand sales hours. Hubbell Incorporated, Lighting Division, Christiansburg, VA.

Circle 137

■ Outdoor luminaire

The Bridgeport is one of a collection of outdoor luminaires for commercial applications available from Hanover Lantern. A data sheet includes photometrics, a cutaway drawing, and a list of features. Hanover Lantern, Hanover, PA.

Circle 138

■ Lighting collection

Hadco's new Quik-Ship brochure contains a selection of bollards, posts, and fixtures for traditional and contemporary residential lighting, performance lighting, and low-level lighting. Hadco, Littlestown, PA.

Circle 139

■ Museum lighting

LSI offers a new color brochure on museum lighting systems. It includes explanations of fixture applications, color photos of actual installations, and schematic drawings of various fixtures. Lighting Services Inc., New York, NY.

Circle 140

■ Lighting collection

Illuminating Experiences presents its complete line of lighting products in a 100-page catalog that includes color photos, dimensions, and descriptions. Illuminating Experiences, Inc., Highland Park, NJ.

Circle 141

■ Fluorescent adapter

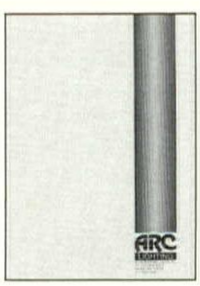
A brochure features Silver Star adapters and fixtures for twin-tube compact fluorescent lamps. It contains photos, descriptions, and specifications for each component. American Energy Controls Mfg., Elk River, MN.

Circle 142

■ Solar lighting

The Himawari solar lighting system collects solar rays, modifies their spectral composition, and then transmits the light via optical fibers. A color brochure describes the system and suggests applications. Sumitomo Corporation of America, Seattle, WA.

Circle 143



■ HID luminaires

A catalog from Arc Lighting highlights four high intensity discharge architectural lighting fixtures. Schematic drawings, descriptions, features, specifications, and photometrics are included in the catalog. Arc Lighting, Salem, MA. ■

Circle 144

Calendar

October 13, 1987 — **Driving your marketing machine home, getting there is half the fun!** DLF seminar, San Francisco. Contact: Paula Goodell, Northern California Designers Lighting Forum, P.O. Box 1429, San Francisco, CA 94101, (415) 550-0333.

October 13–15, 1987 — **Contract interior designers lighting conference,** General Electric Lighting Institute, Cleveland. The conference is for both staff and supervisory interior designers engaged in commercial, institutional, and industrial projects. Contact: Registrar, GE Lighting Institute, Nela Park, Cleveland, OH 44112, (216) 266-2614.

October 14, 1987 — **Tour of the Sylvania Lighting Center,** Danvers, MA, sponsored by the Boston DLF. Contact: Paul Chabot or Tracy MacEachen, Boston Designers Lighting Forum, P.O. Box 6406, Boston, MA 02102, (617) 367-0910.

October 15, 1987 — **Entry deadline** for the NLB's eighth annual National Lighting Awards Program, for projects completed on or after January 1, 1985. Contact: National Lighting Awards Program, c/o National Lighting Bureau, 2101 L Street NW, Suite 300, Washington, DC 20037, (202) 457-8437.

October 19–21, 1987 — **Outdoor lighting design workshop,** General Electric Lighting Institute, Cleveland. Contact: Registrar, GE Lighting Institute, Nela Park, Cleveland, OH 44112, (216) 266-2614.

October 21–23, 1987 — **Seminar on modern store lighting,** General Electric Lighting Institute, Cleveland. Contact: Registrar, GE Lighting Institute, Nela Park, Cleveland, OH 44112, (216) 266-2614.

October 26–30, 1987 — **Fundamentals I,** short course, General Electric Lighting Institute, Cleveland. Repeats November 30–December 4. Early registration is recommended. Contact: Registrar, GE Lighting Institute, Nela Park, Cleveland, OH 44112, (216) 266-2614.

October 29–30, 1987 — **Lighting for corporate and institutional facilities,** seminar, New York University, Midtown facility, New York City. Contact: Anne Ballantine, New York University, Real Estate Institute, 11 West 42nd Street, New York, NY 10036, (212) 790-1345.

October 29–30, 1987 — **Working with the new AIA contract forms,** AIA seminar, Washington, DC. Professor Justin Sweet is course director for the two-day seminar. Repeats November 5–6 in Chicago and November 19–20 in San Diego. Contact: Miss J.K. Van Wycks, Federal Publications Inc., 1120 20th Street NW, Washington, DC 20036, (202) 337-7000.

November 1–3, 1987 — **Lighting Energy Solutions:** a national conference on energy-efficient lighting, Boston Park Plaza Hotel, Boston. Presented by the Northeast Solar Energy Association for architects, lighting designers, engineers, facility managers, utility representatives, and lighting equipment suppliers; the conference includes a products exhibition. Contact: Larry Sherwood, NESEA, P.O. Box 541, Brattleboro, VT 05301, (802) 254-2386.

November 6–8, 1987 — **Interior and architecture photography workshop,** Tallahassee, FL. Includes a day of taking photos with instructor Peter Goodman and a voluntary critique. Contact: Jane Grosslight, Center for Professional Development and Public Service, Florida State Conference Center, Florida State University, Tallahassee, FL 32306, (904) 644-3801.

November 9–11, 1987 — **Annual lighting conference for architects,** General Electric Lighting Institute, Cleveland. Contact: Mrs. Nancy Christensen, GE Lighting Institute, Nela Park, Cleveland, OH 44112, (216) 266-2138.

November 10, 1987 — **HQI fixtures and lamps: how to specify,** DLF panel discussion, San Francisco. Contact: Paula Goodell, Northern California Designers Lighting Forum, P.O. Box 1429, San Francisco, CA 94101, (415) 550-0333. ■

Manufacturer Credits

Industrial struts decorate Main Street rotunda (AT&T Town Pavilion, Kansas City, Missouri). 175-watt mercury vapor downlights: **McPhilben.** Strut and power cable system: **Wiremold.** Marquee lighting: **Neo-Ray.** Neon: **Federal Sign Corp.** 250-watt metal halide wall and ceiling washers: **Elliptipar.** Glass: **PPG Industries.**

Users gradually adapt to indirect lighting (WEPCO Public Service Building Annex, Milwaukee, Wisconsin). Custom indirect fluorescent luminaires: **Lightolier.** T8 lamps: **Sylvania.** Programmable load controller: **General Electric.**

Chief Justice helps designers light court library (Missouri Supreme Court Library, Jefferson City). Indirect dual-source luminaire combining 250-watt high pressure sodium and 400-watt metal halide lamps: **Guth.** Modified fluorescent luminaire: **Lightolier.** Custom brass task lights: **Winona Lighting.**

Outdoor lighting philosophy considers plants, technology, people (Austin Systems Center, Austin, Texas). Exterior mercury vapor uplights, downlights, and burial fixtures: **Hubbell Lighting Division.** Conference room fixture: **Achille Castiglioni.**

Designers' secrets of success for neon, cold cathode. (Tower Records headquarters.) Standard T8, 120-milliampere cold cathode lamps and sockets: **Newman Cathode.** Transformers: **Jefferson.** Recessed adjustable incandescent fixtures: **Capri.** MR16 and PAR 36 lamps: **General Electric.** Louvers: **Nova Honeycomb.** Recessed compact fluorescent downlights: **Staff.** 13-watt compact fluorescent lamps: **North American Philips.** Dimmers for all systems: **Lutron.** ("Ripple" installation by pool.) Neon fabrication: **Neon Williams.** Transformers: **Jefferson.** Dimmer: **Ohmite.** Custom hardware: **Christopher Sproat.** ("Lightfall.") Cold cathode fabrication: **Bill Concannon, Aargon Neon.** Transformers: **France.** Custom acrylic junction boxes: **Christopher Sproat.** (The Diner.) Neon fabrication: **City Lights Neon.** Recessed downlights: **Halo.** Transparent fabric roofing over courtyard: **Dow Corning.** Fabric: **ODC Inc.** Glass block: **Pittsburgh Corning.** Custom stainless steel transformer boxes and detailing: **Feldkamp Enterprise.** (Conference room.) Custom fabricated neon and halogen luminaires: **Archigraphics.** Diffusers: **Ray Products.** Dimmer switches: **Lutron.** Pulley system for descending globe: **David Quick.**

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