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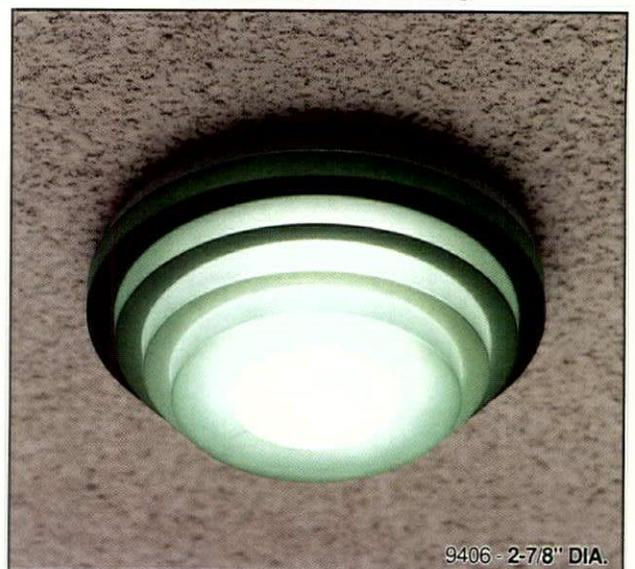
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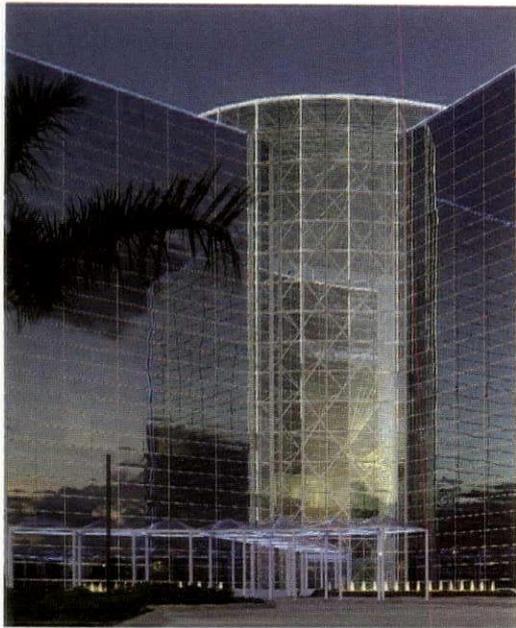
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# ARCHITECTURAL LIGHTING

OCTOBER 1990  
VOLUME 4, NUMBER 10



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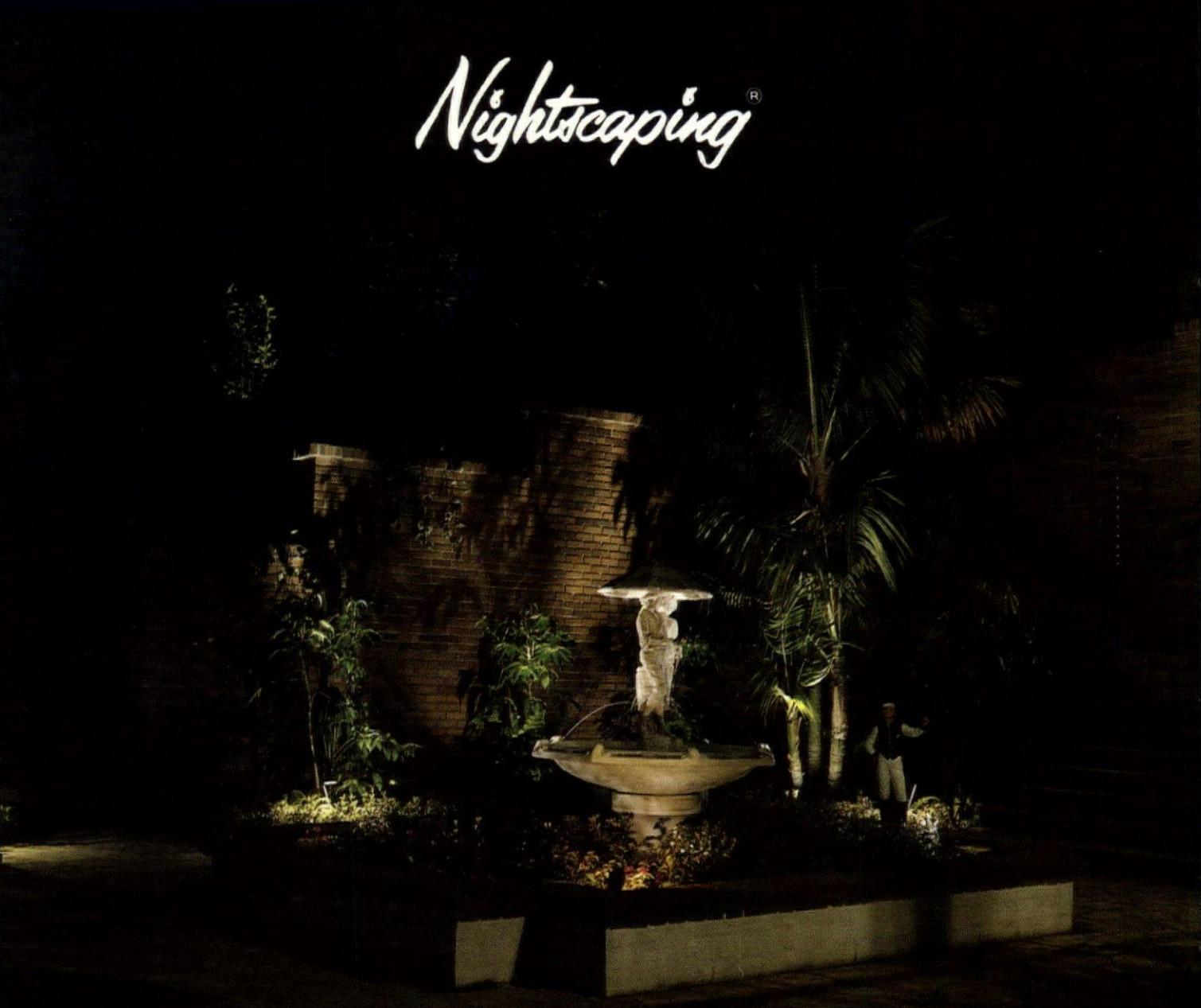
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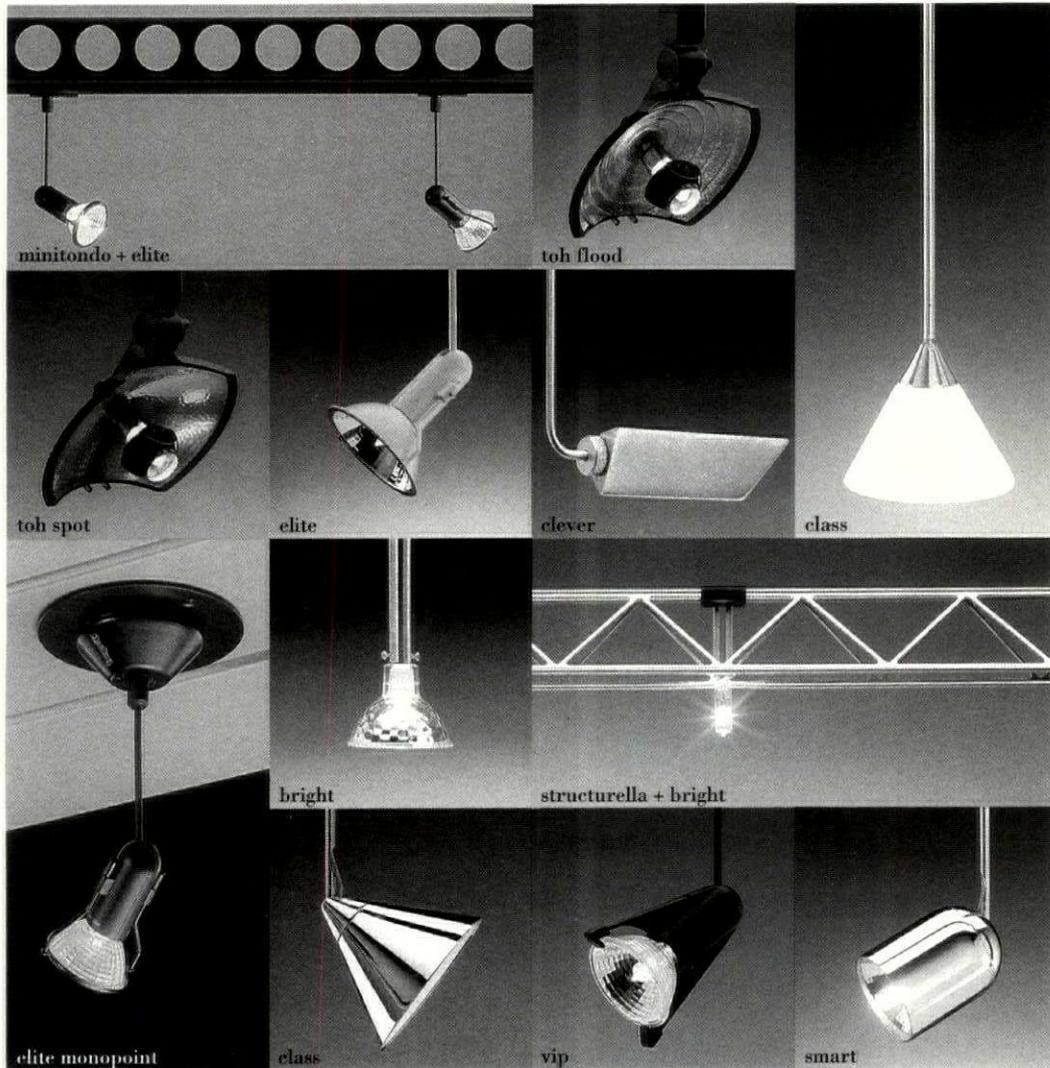
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## Cornell Study Results On Visual Health Problems

Glare on video display terminals (VDTs) is creating more than complaints from computer users. It's also resulting in visual health problems and significant losses in worker productivity, according to a new study from Cornell University.

Cornell's Department of Design and Environmental Analysis set out to determine the most effective lighting for VDT environments, since a leading complaint of computer users is poor office lighting. Researchers studied the effects of two types of lighting systems on managerial and professional computer users in a nearly windowless building.

The study found that lensed indirect lighting dramatically reduced visual health complaints and accompanying losses in productive worktime by those managerial and professional users. Nearly one-fourth of the computer users said they lost 15 minutes or more every day because they had trouble focusing their eyes in areas with conventional office downlighting designed for computer areas. In contrast, only 1 percent of the computer users working under the indirect lighting system lost more than 15 minutes a day because of focusing problems.

Among the computer users working under conventional computer-area lighting, more than 10 percent said they lost at least 15 minutes a day because of watery and itchy eyes, compared with only 4 percent in the indirect lighting section. Between the two groups, loss of productive work time caused by tiredness or lethargy was four times as great in the group with conventional computer-area downlighting.

Led by Dr. Alan Hedge the Cornell study was started in 1988 at a major facility of Xerox Corporation in Upstate New York. Researchers developed a benchmark survey to evaluate overall worker satisfaction in the building and then Xerox renovated the building and standardized decor and lighting. Half the offices were equipped with state-of-the-art overhead fluorescent lighting (parabolic lighting), usually seen in new or renovated buildings. The other half were equipped with lensed indirect fluorescent lights, which direct light toward the ceiling (uplighting).

Dr. Hedge and his team surveyed the workers several months after the renovation and found that the indirect uplighting had a positive effect on worker performance, satisfaction, and visual health. Indirect lighting ranked much higher on several subjective scales: better overall, more comfortable, and less glaring.

Cornell researchers then returned to Xerox 12 months later to conduct a follow-up survey to make sure their findings were accurate and to be certain the results of the first "after" study were not due to simply a change made in their environment, commonly known as The Hawthorne Effect.

The most recent findings were startling, according to Hedge. In addition to visual health problems and lost productivity, researchers discovered that employees had modified nearly half of the conventional parabolic lights to try to improve their visual environment. These employees said they lost productivity because of direct glare and bright, unpleasant or uncomfortable light.

Very few complaints emerged from the employees work-

"LIGHT ETHEREAL,  
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ing under indirect lighting. Only 1 percent said the lighting was unpleasant, and few employees said that uplighting led to any loss in productivity.

Employees strongly preferred the lensed indirect lighting: 71 percent of those working with the indirect system preferred it, and 74 percent of those working under the parabolic system preferred uplighting.

"This is an overwhelming preference," said Dr. Hedge. "We didn't expect to see results this one-sided, especially given that the parabolic lighting was designed for computer areas."

Dr. Hedge said that a leading objective of the Department of Design and Environmental Analysis is to help business create workplaces that are pleasant, healthy, and effective. The Xerox Corporation study was conducted by Cornell University under a grant from Peerless Lighting Corporation, Berkeley, CA.

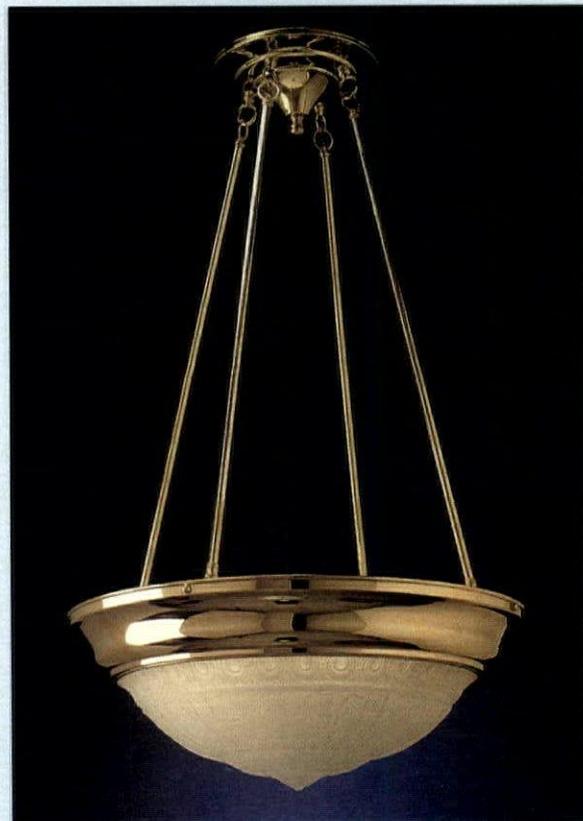
## Advisory Board Predicts Light Source Expansion

"The compact fluorescent lamp will have as much impact on the lighting industry in the 1990s as the linear fluorescent lamp did in the '40s," declared Russell Churchill, manager of G. E. Lighting Institute at the inaugural meeting of the Edison Price Lighting New Products Advisory Board, held June 25 and 26 in New York.

The advisory board, which will meet annually, brought together Edison Price senior management and an international group of lighting experts. EPL president Emma Price explained, "The assembled experts analyzed upcoming trends in the lighting industry—now our company will implement what we learned to make sure that our future products meet our customers' needs."

The advisory board members made the following additional predictions about the lighting industry:

- Lighting will become increasingly internationalized; specifiers and manufacturers must learn to operate in the global economy.
- Lamp companies will increase the rate of introduction of new sources, especially in the high intensity discharge area. Incandescent lamps will get a new lease on life with the introduction of energy-saving halogen versions.
- Both customers and regulators will put increasing emphasis on two often contradictory concerns. The first is energy conservation, which favors the use of fluorescent and high intensity discharge sources. The second is an environmental issue: these energy-saving lamps can create disposal problems.
- Lighting will become just one component in the future's high-tech super-building, where it will be integrated with computerized dimming, motion detectors, sophisticated air exchange systems and even old-fashioned sunlight to pro-



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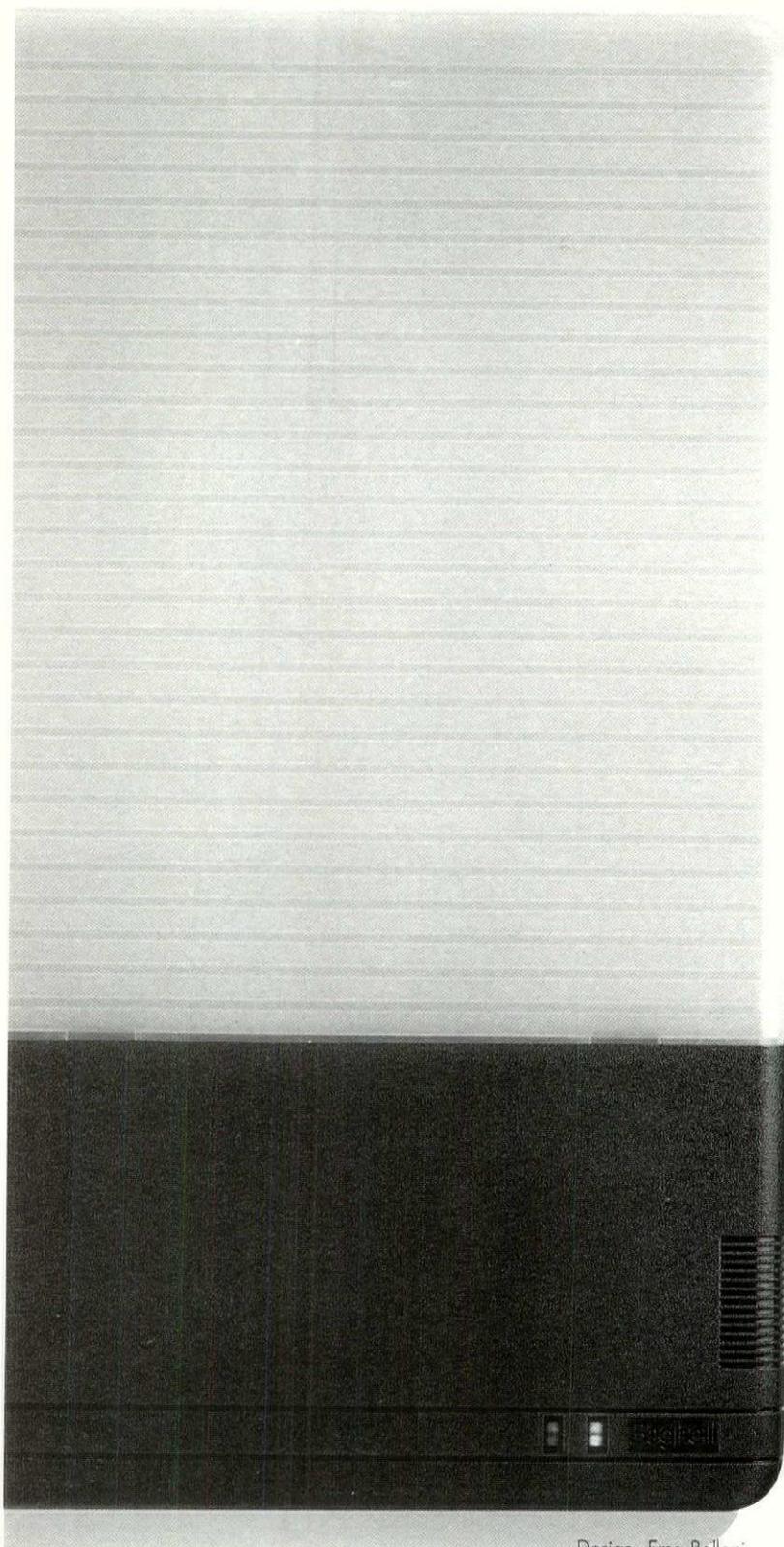
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INTO THE PRESENT

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# EMERGENCY · LIGHT

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Design: Eros Bollani

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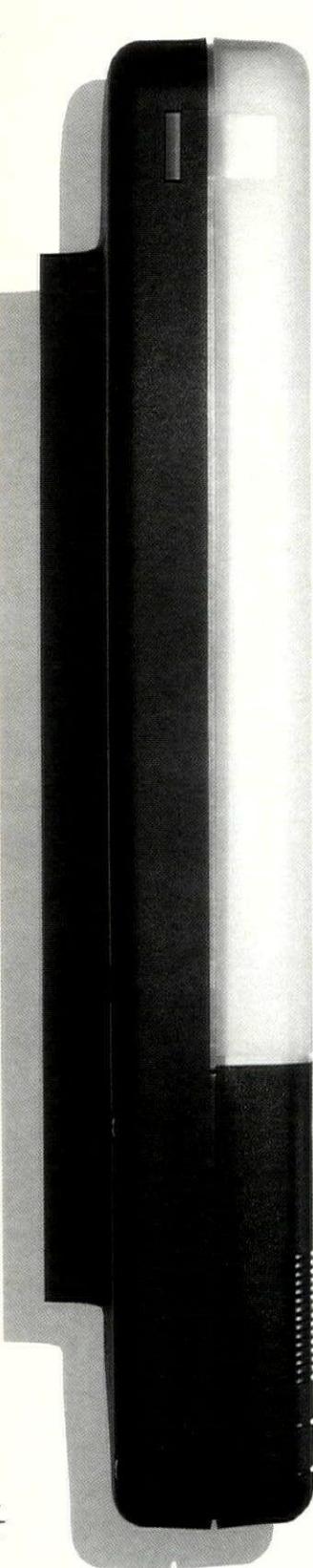
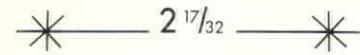
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## EDITORIAL

# The Business Bust— Up Close And Personal

**Y**ou name it, we've tried it," says one anonymous but real-life lighting designer in New Jersey, whose two-person firm has fallen on hard times like a lead balloon mainly because of economic downswings in the building and construction industry. "The building market in New Jersey is flat," she says.

Though she handles all kinds of projects, in the past high-end residential jobs could always be counted on as the firm's bread and butter. There was always a top echelon of clients who were so wealthy they'd go virtually unaffected by the economic turmoil that would topple those less fortunate.

But now, those that have it are scared to spend it. "In my 17 years experience, high-end was never affected, but this time around, they're not spending money," the designer says. "Many of my clients are builders, who also constructed custom homes for themselves. But now they're not building, and they're not doing their own homes, either.

"In the past, when interest rates were high, if clients didn't buy new homes, they would renovate the ones they had. Now renovations have become out of the question because of the diminished resale value," she says.

She saw the signs of a downturn coming in 1989. Last fall, she conducted a marketing campaign for the firm, sending out letters with resumes and project listings to architects and interior designers in the area. Two weeks after the materials were sent, everyone on the list was called in an attempt to make appointments to introduce the firm.

"Out of a list of 150 firms, I was able to make about six appointments, when we did the follow-up phone calls," the designer says. "And when we went to visit the architects and designers, the standard responses were: they were going out of business themselves; they didn't want to start sharing fees with a lighting designer because income was hard to come by as it was; and, there is no work, period."

From that marketing project, the firm did manage to get one job—that paid a fee of \$500.

Though she hasn't raised her fee in five years, that isn't an advantage in today's market.

"Many firms are undercutting their fees just to get jobs in to maintain a cash flow. This is damaging, because the firms still can't pay all the bills, and you need to put the same amount of work into the project to complete it. The client isn't settling for less," she says.

Some large design and architecture firms are managing to subsist on projects in progress abroad. But for the small business design professional, the slogan, "Have Work, Will Travel," seems to be gaining in popularity.

This past spring, an interior designer that the lighting designer frequently worked with relocated from New Jersey to Florida.

"Although building is down about 30% there, it's still more active than in the Northeast," the designer says. Now she may follow her colleague's lead. She did the rounds, visiting prospective clients with the designer in Florida, in the hopes of picking up some clients. She also has compiled a list of designers and architects in Florida, and plans a return trip to call on them.

Steps like these are being taken by more and more professionals because this economic slump is not a passing trend. Projections have it lasting anywhere between 18-36 months.

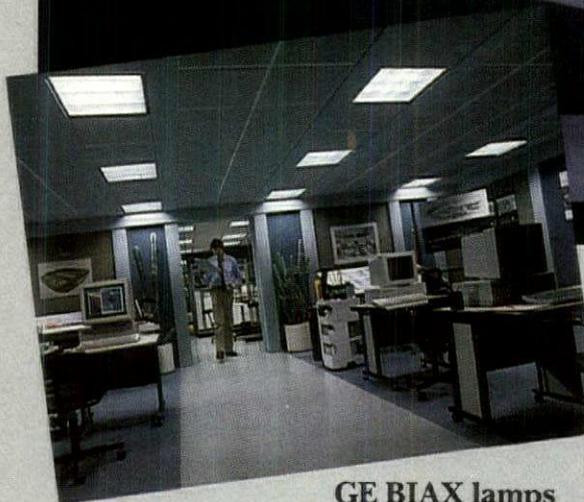
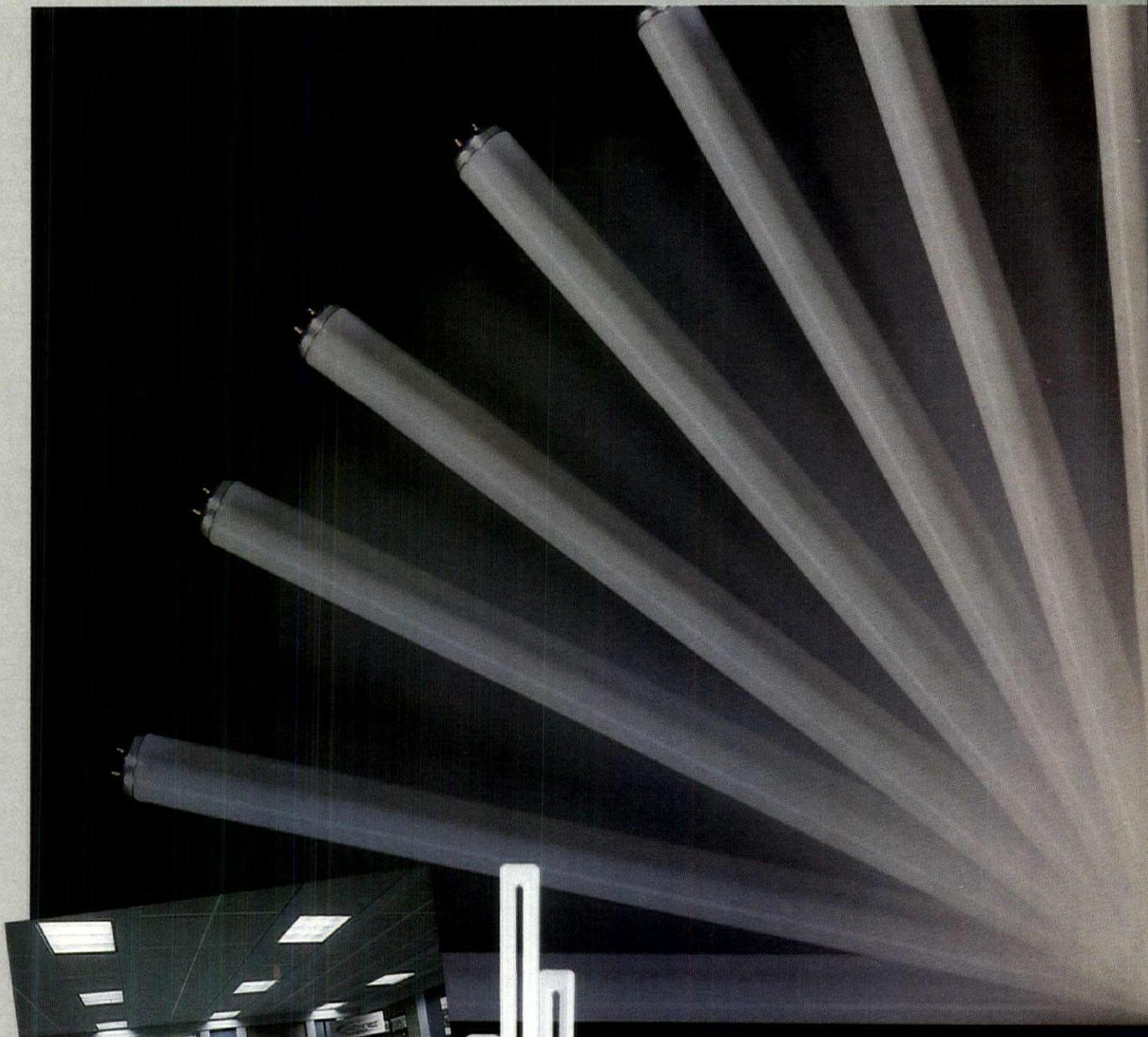
I have no answers. My anonymous informant has no answers ("If I can figure out how to survive, I'll let you know!" she says).

I know there must be many of you out there who are taking steps to belt-tighten, and I ask you to phone or write in with your experiences.

I don't doubt that everyone believes there is a light at the end of the tunnel. The problem is, many are afraid they won't make it through the tunnel.

**WANDA JANKOWSKI**  
EDITOR-IN-CHIEF

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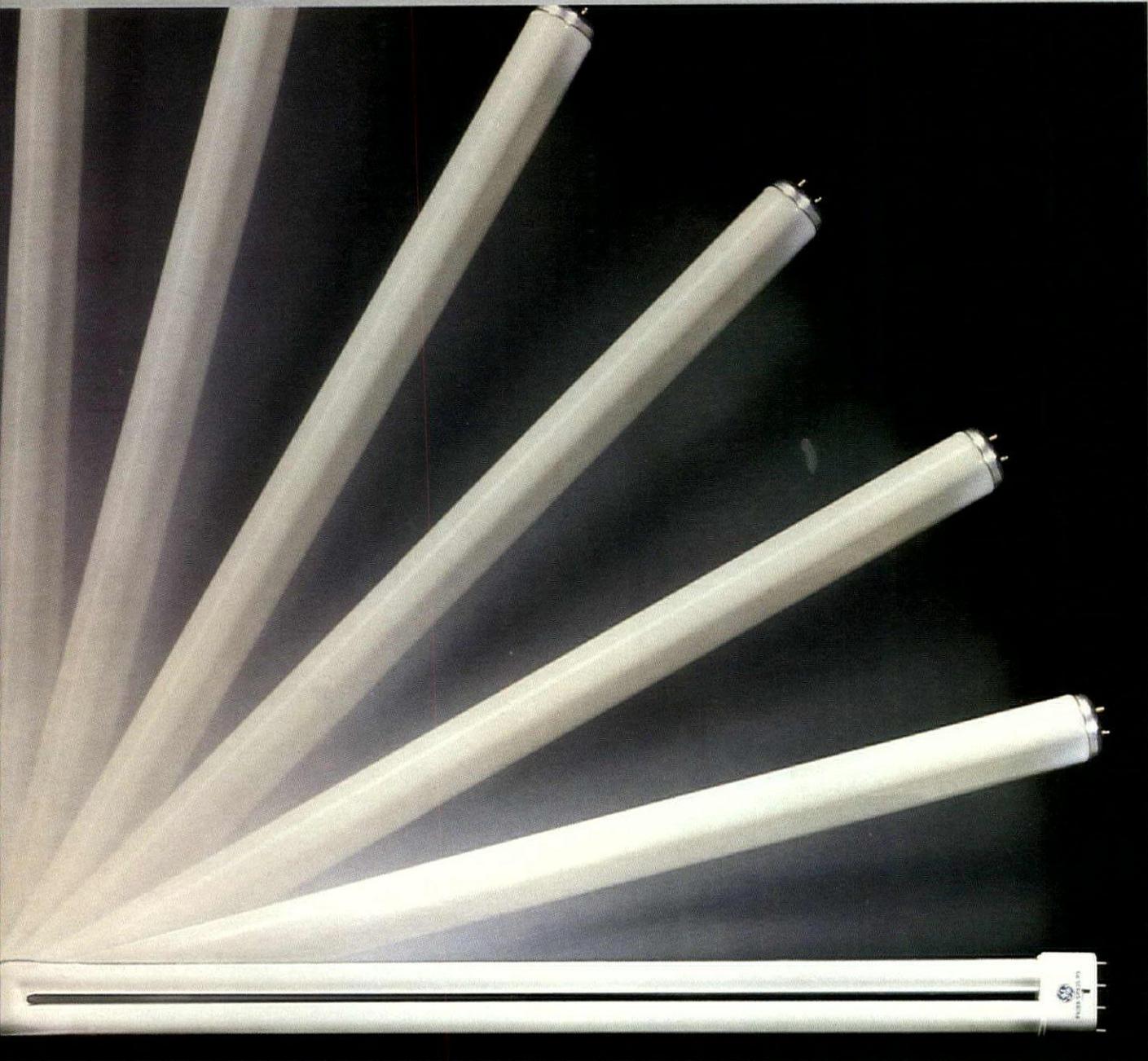


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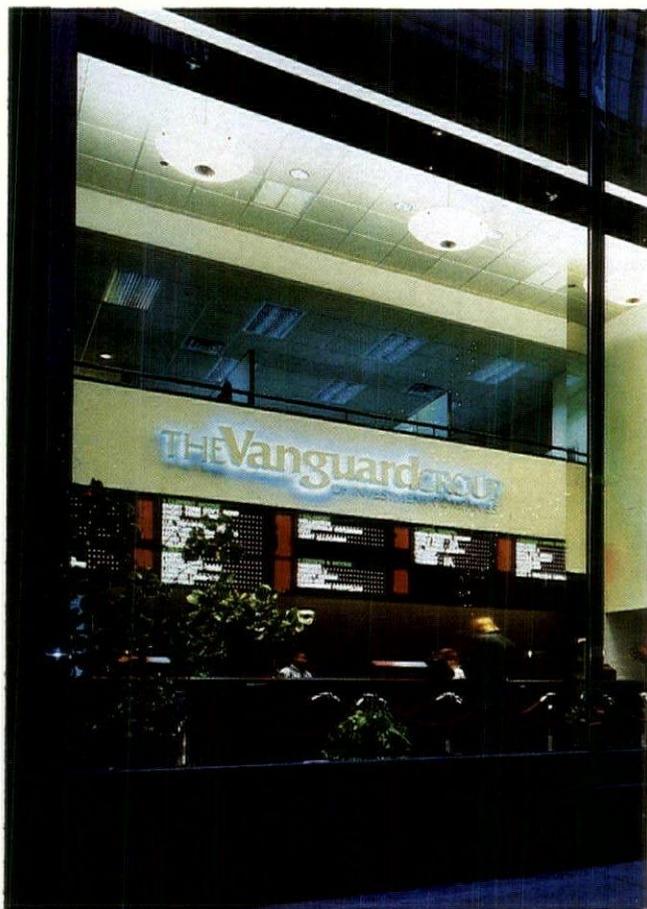
**GE Lighting**

## Custom Signage Puts Vanguard Group In The Vanguard

BY WANDA JANKOWSKI  
EDITOR



**QUICK READ:** Vanguard's changeable electronic rate board and backlit logo had to be visible to passersby on the sidewalk.



**CHALLENGE** When the Vanguard Group of Investment Companies opened its new office at 1700 Market Street in Philadelphia, it required both a rate board to display changing prices and yields of nearly 60 mutual funds, and a logo to announce the firm's presence on Market Street.

**DESIGN/TECHNICAL CONSIDERATIONS** The rates and yields of the funds rise and fall throughout each day. It was critical that the information displayed be accurate at all times, as many shareholders pass by or step into the office just to check the status of their accounts. In addition, Vanguard requested a minimum character height of two inches, so that the display would be legible from the sidewalk and from the street traffic beyond. The project also needed to be completed with a strict budget.

**METHOD** It was clear a manual sign would not be adequate. A full light-emitting diode display was considered, but found to be too expensive, with no provision for expansion. Other options considered and eliminated included: standard backlit characters raised and lowered electronically, television monitor displays, projection methods, ticker-tape displays, and plasma screens. After thorough study, Research Planning Associates developed a one-of-a-kind, computer-controlled rate board. This economical solution combined two forms of lighting: the unchanging portions of the rate board that lists the categories of stocks and bonds is backlit with fluorescent lamps; the portion of the board that lists changing rates and yields uses computer-controlled LED inserts. Baffles have been placed between the fluorescent and LED portions to prevent light leakage. Cummings Signs developed the sign in coordination with Hi-Tech Electronics Sign Co. Research Planning Associates worked closely with both firms for almost a full year on the project. The complementary corporate logo, installed above the stock rate signage, is composed of large, hollow aluminum letters that are backlit with cold cathode to make them appear to float off the wall.

**CONCLUSION** In the Fall of 1989, the sign was installed. Total 1989 costs: Rate Display—\$39,100; Logo—\$10,500.

### DETAILS

**PROJECT:** SIGNAGE FOR THE VANGUARD GROUP RETAIL OFFICE

**LOCATION:** PHILADELPHIA

**OWNER:** VANGUARD GROUP OF INVESTMENT COMPANIES

**ARCHITECT, AND INTERIOR AND LIGHTING DESIGNER:** RESEARCH PLANNING ASSOCIATES, INC.; LINDSAY VOLKENING, AIA, and SUSAN KLINKER, team leaders

**PHOTOGRAPHER:** OWEN MCGOLDRICK

**MANUFACTURERS:** CUMMINGS SIGNS, NASHVILLE; and HI-TECH ELECTRONICS SIGN CO., CLEARWATER, FL

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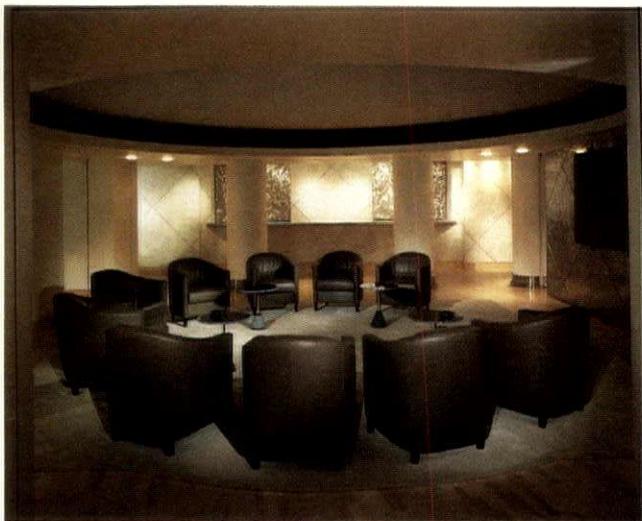
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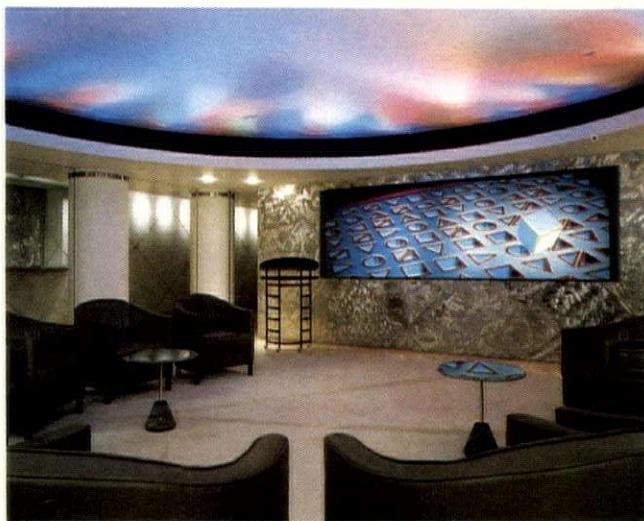
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## Avant-Garde Approach To Showroom Lighting



**ILLUMINATING THE OCULUS** in Steelcase Inc.'s presentation room sets the scene for a colorful and "moving" program.



**BY CHRISTINA LAMB**  
ASSISTANT EDITOR

**CHALLENGE** Located in the historic Beardmore Building in Toronto is Steelcase Inc.'s flagship Canadian showroom. The existing French provincial structure was remodeled to contain the 22,000-square-foot display facility that consists of rooms furnished with the company's office furniture. The presentation room, where lectures are given and programs run, was designed with the concept of creating a focal point by outfitting an avant-garde centerpiece artwork—a "painting" of light. The canvas for this creation is a 17-foot diameter oculus—a large circular opening in the ceiling with another surface 10 inches above the lip, or shelf, of the opening. Like an artist blending a palette of paints, "the lights create amorphous globs of color on the ceiling," says Brian Hire, lighting designer for the project.

**DESIGN/TECHNICAL CONSIDERATIONS** "A complex control situation was involved," says Hire. A flexible lighting system that could be controlled to meet certain requirements, provide various functions, and produce options was key to the development. Different illumination levels had to be achieved for the continuous running of the oculus throughout the day, and the many phases of a presentation.

**METHOD** Theatrical lighting and controllers were used in creating the system. Tiger cube fixtures, originally invented for the Barnum & Bailey Circus tiger pedestals, are housed in the 10-inch shelf between the opening of the oculus and the ceiling. These fixtures are small black boxes with an aperture through which the light shines. Colored glass covers the opening producing red, green, blue, and amber light. Evenly spaced around the circumference of the oculus are 80 of these

fixtures housing 75-watt MR 16 lamps divided into eight separate circuits. One automated fixture is placed at each of the eight cardinal compass points of the circle. These fixtures also use 75-watt MR 16 lamps—alternating colors in each hemisphere—and are remotely controlled on all axes. "The automated instruments are in continuous motion, creating various beam sizes and lengths to produce movement; this creates a never-ending kind of look," says Hire. Located in the corners of the room are 50-watt PAR 20 lamps in recessed fixtures. These provide extra illumination for these spaces that combine with the ambient light provided by the oculus for general illumination.

**CONCLUSION** "The illuminated oculus is not traditional where everything is nice and even," Hire says. "It's splotchy, streaked, and smeared, satisfying the design concept. Everything is on dimmers with four separate settings for the oculus: full operation; a presentation setting where the automatic lights park themselves and a spotlight is thrown on the presenter; and a low, subdued setting when the programs are on; and off."

### DETAILS

**PROJECT:** PRESENTATION ROOM, STEELCASE TORONTO SHOWROOM

**LOCATION:** TORONTO, CANADA

**CLIENT:** STEELCASE CANADA LTD.

**ARCHITECT:** QUADRANGLE, RIC PULLEY, STEELCASE design manager

**LIGHTING DESIGNER:** BRIAN HIRE, STEELCASE LIGHTING DESIGN

**INTERIOR DESIGNER:** STEELCASE FACILITIES MANAGEMENT PROJECT TEAM, CARL LEISMER, project manager

**ELECTRICIAN:** PLAN ELECTRIC

**PHOTOGRAPHER:** ANDRE BENETEAU, ROBERT BURLEY DESIGN ARCHIVE

**MANUFACTURERS:** L&E: tiger cube MR 16 lampholders; ABSTRACT ELECTRONICS AB: Calibre automated MR 16 lampholders; ETC/LMI: Expression controller with custom control interface; ELECTRONIC THEATRE CONTROLS; TEATRONICS: modular dimming

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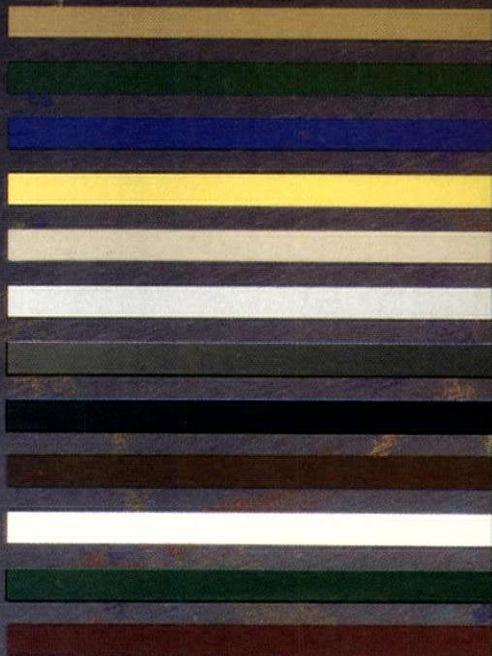


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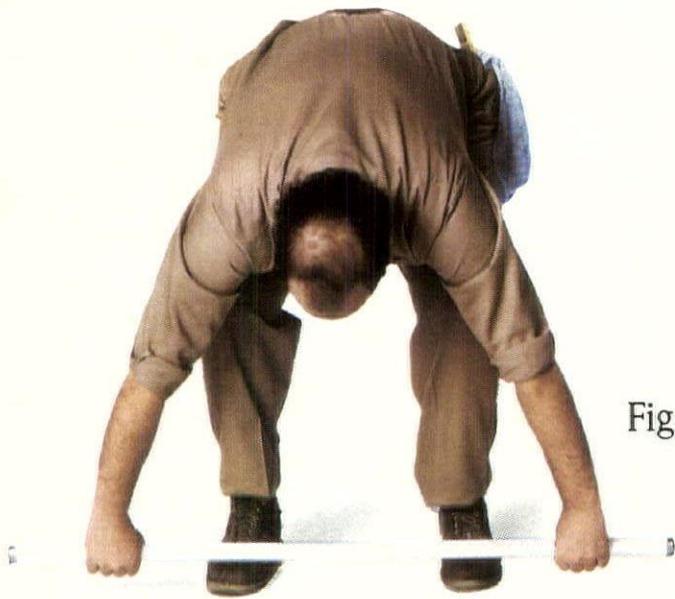


Fig. 1

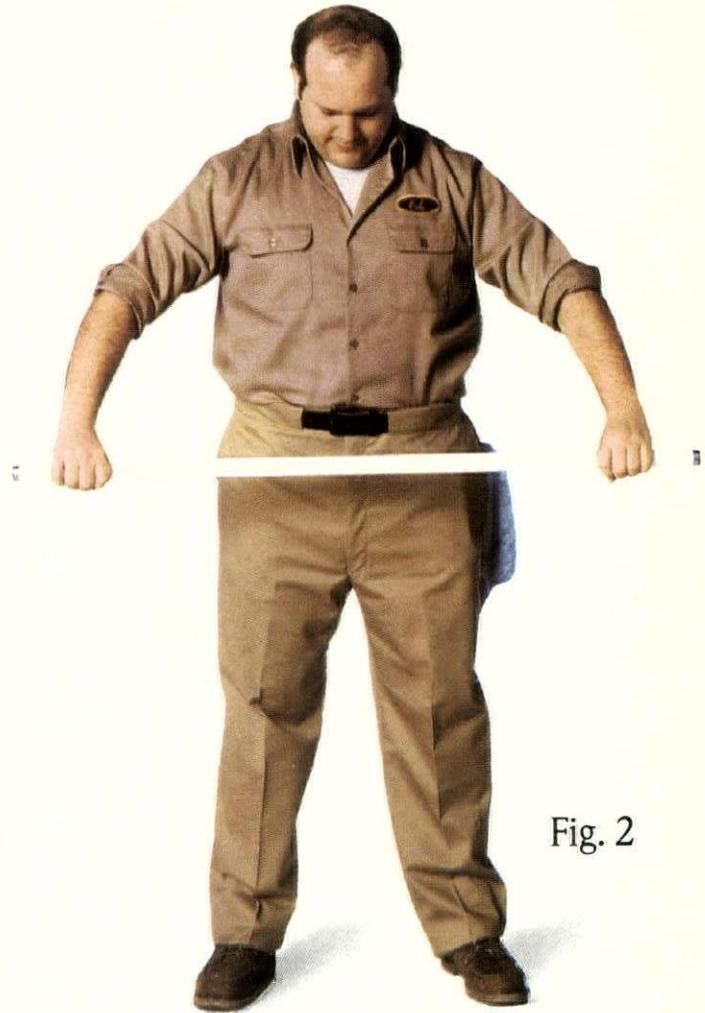


Fig. 2

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Fig. 3



Fig. 4

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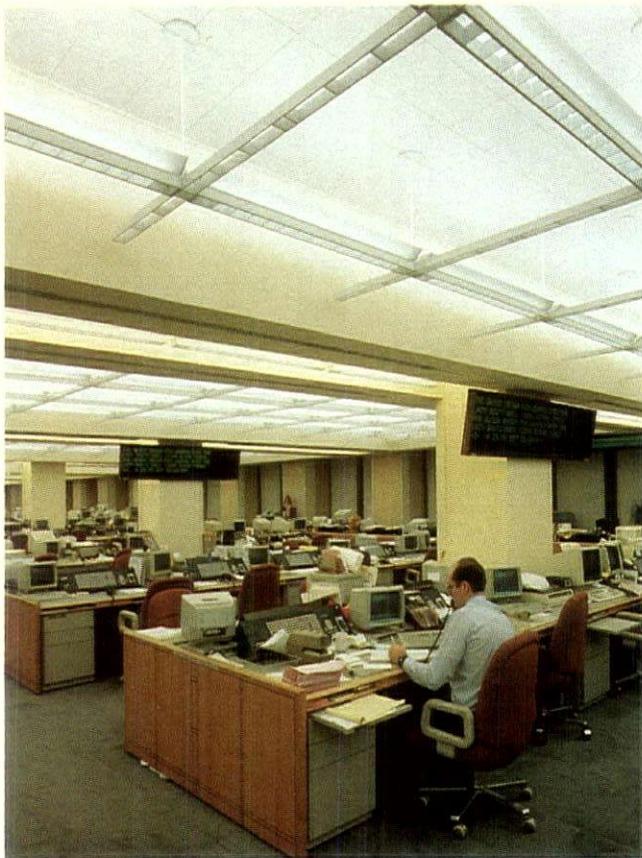
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# Trading Direct Glare For An Indirect System

BY CHRISTINA LAMB  
ASSISTANT EDITOR



**MULTIFUNCTIONAL LIGHTING:** An indirect, fluorescent system provides illumination for cross-floor communication, and minimizes glare on computer screens.



**CHALLENGE** The Bear, Stearns' trading floor required a versatile lighting system that would be suitable for the various functions and tasks performed in such a space. Traders must be able to read, write, and visually communicate with each other across the floor, and electronic information on computer screens must be easily viewed without any reflections or glare.

**DESIGN/TECHNICAL CONSIDERATIONS** Desk and computer locations can be shifted on the trading floor and video display terminals (VDTs) can be turned to face any direction. Therefore, it was important to develop a system that would not produce reflections regardless of VDT placement. Fixed direct lighting systems can cause glare on the computer screens, so an indirect system—one that would still allow workers to accomplish tasks comfortably—was crucial to the lighting design.

**METHOD** A large area of uniform indirect light was created by using 2-foot long pendant fixtures, with both a luminous bottom and sides, that use 32-watt T8 fluorescent lamps. By installing this system, they avoided the darkness between the fixture and the ceiling, which in most indirect systems is usually responsible for reflected shadows in the VDTs. The foot-candle level of each of the components is adjusted to match the foot-candle level of the ceiling above. The key to achieving the desired lighting effect was combining the luminance of the fixture and ceiling surfaces rather than having the direct component be a source of light.

**CONCLUSION** Since uniform indirect lighting is flat by nature, effort was placed on designing the fixture to be as interesting as possible. The system's end profile and its cross members are strong architectural elements, with the grid design adding scale to the space.

## DETAILS

**PROJECT:** BEAR, STEARNS' TRADING FLOOR

**LOCATION:** NEW YORK

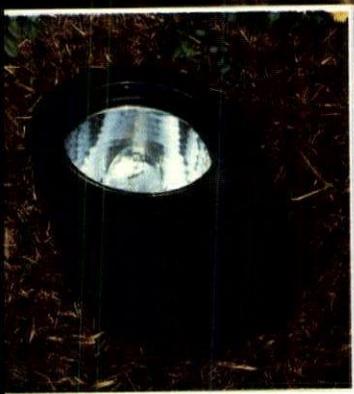
**CLIENT:** MEL KASS, VICE PRESIDENT, BEAR, STEARNS

**ARCHITECT:** KOHN PEDERSON FOX CONWAY

**LIGHTING DESIGNER:** JERRY KUGLER

**PHOTOGRAPHER:** PETER GOODMAN

**LIGHTING MANUFACTURER:** ZUMTOBEL: ID-VM system



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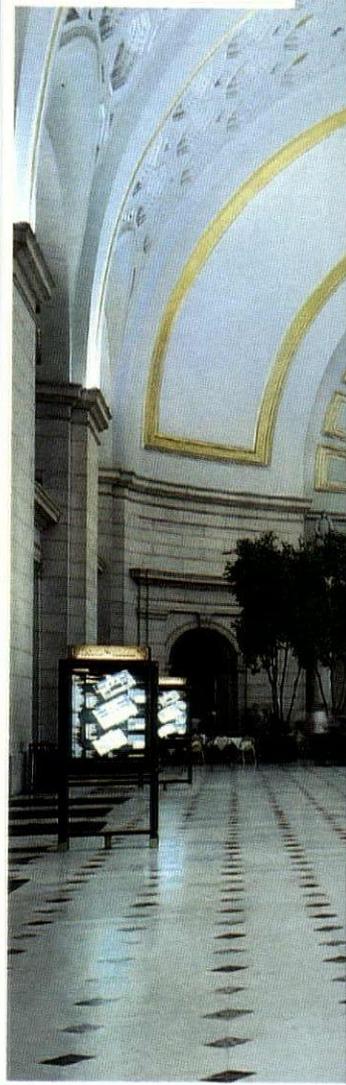
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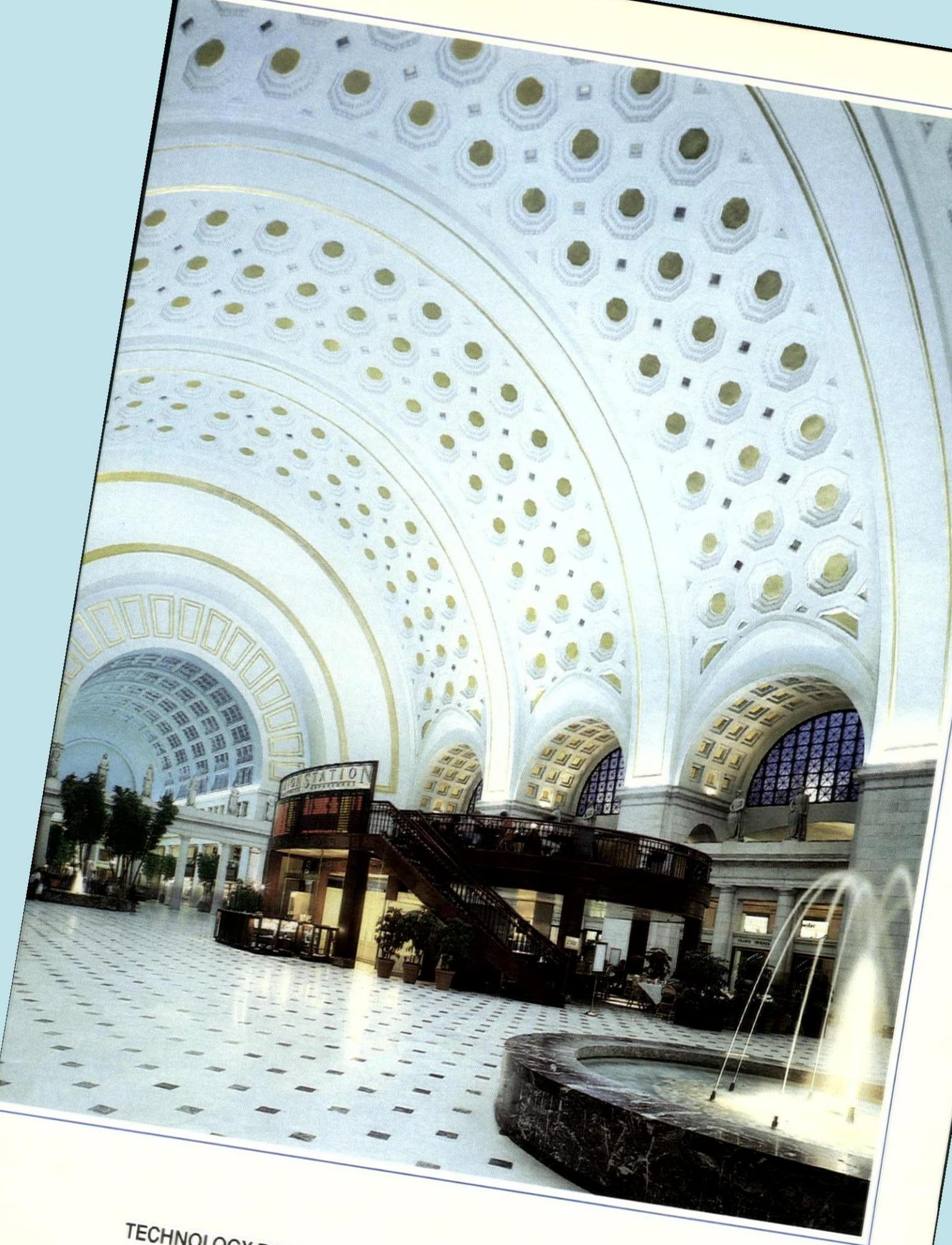
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**OCTOBER 28-31** IFMA '90: "A Decade of Leadership." Baltimore Convention Center, Baltimore; (713)623-4362.

**NOVEMBER 4-6** National Contract Glazing Conference. Chicago O'Hare Marriott Hotel, Chicago; (703)442-4890.

**DECEMBER 1-4** NADI 97th Market. Passenger Ship Terminal, Piers 90 & 92, New York; (212)213-2662.

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**OCTOBER 24** IESNA Lighting School: Application and Design. Bingham Office Center, Southfield, MI; (313)591-9441.

**OCTOBER 27** IESNA Lighting School: Design Overview. Bingham Office Center, Southfield, MI;

(313)591-9441.

**NOVEMBER 1** IESNA Lighting School: Exterior Lighting. Bingham Office Center, Southfield, MI; (313)591-9441.

**NOVEMBER 5-7** Lighting for Office & Public Buildings. GE Lighting Institute, Cleveland; (800)255-1200.

**NOVEMBER 7-9** Lighting Conference on Hotel/Motel & Conferencing Facilities. The Lighting Center, Philips Lighting Co., Somerset, NJ; (201)563-3600.

**NOVEMBER 13** IESNA Lighting School: Lighting Economics. Bingham Office

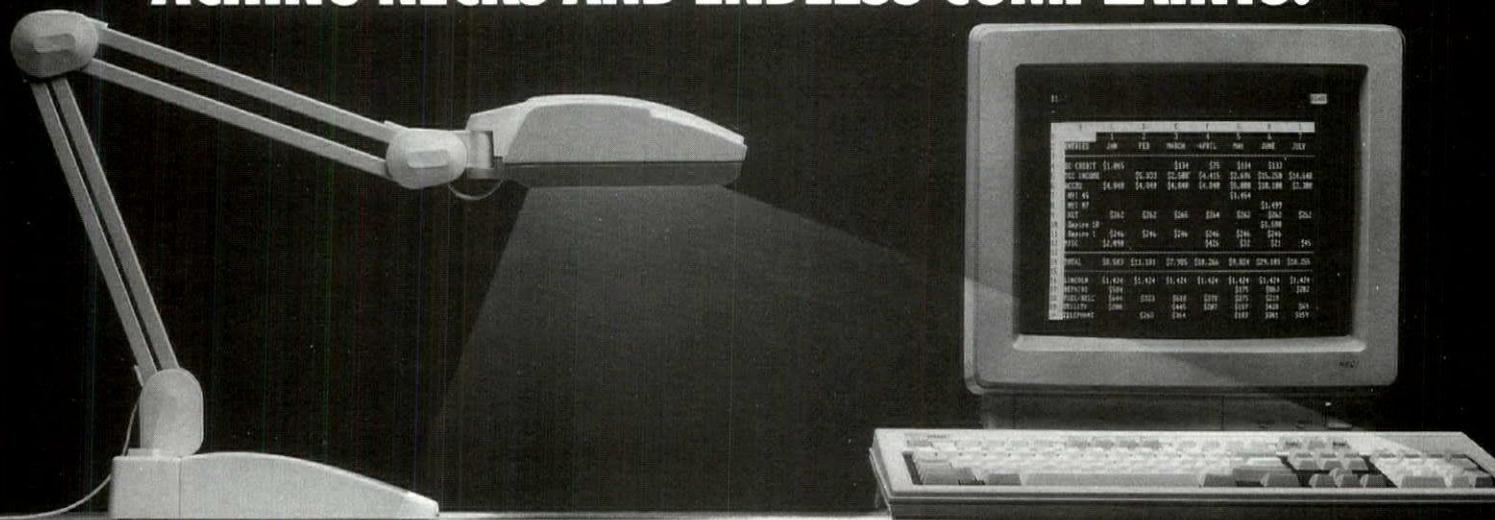
Center, Southfield, MI; (313)591-9441.

## CORRECTIONS August 1990 issue

"Directory 1990-91," page 40—  
GE Lighting, Nela Park, Cleveland, OH 44112  
(216) 266-3900  
(800) 523-5520  
FAX: 216-266-8346

"Will This Fixture Last?," page 20—  
The top left photo, although provided by Kim Lighting, is not a Kim Lighting fixture. The photo is used simply as an illustration of how environmental conditions can affect lighting equipment in general.

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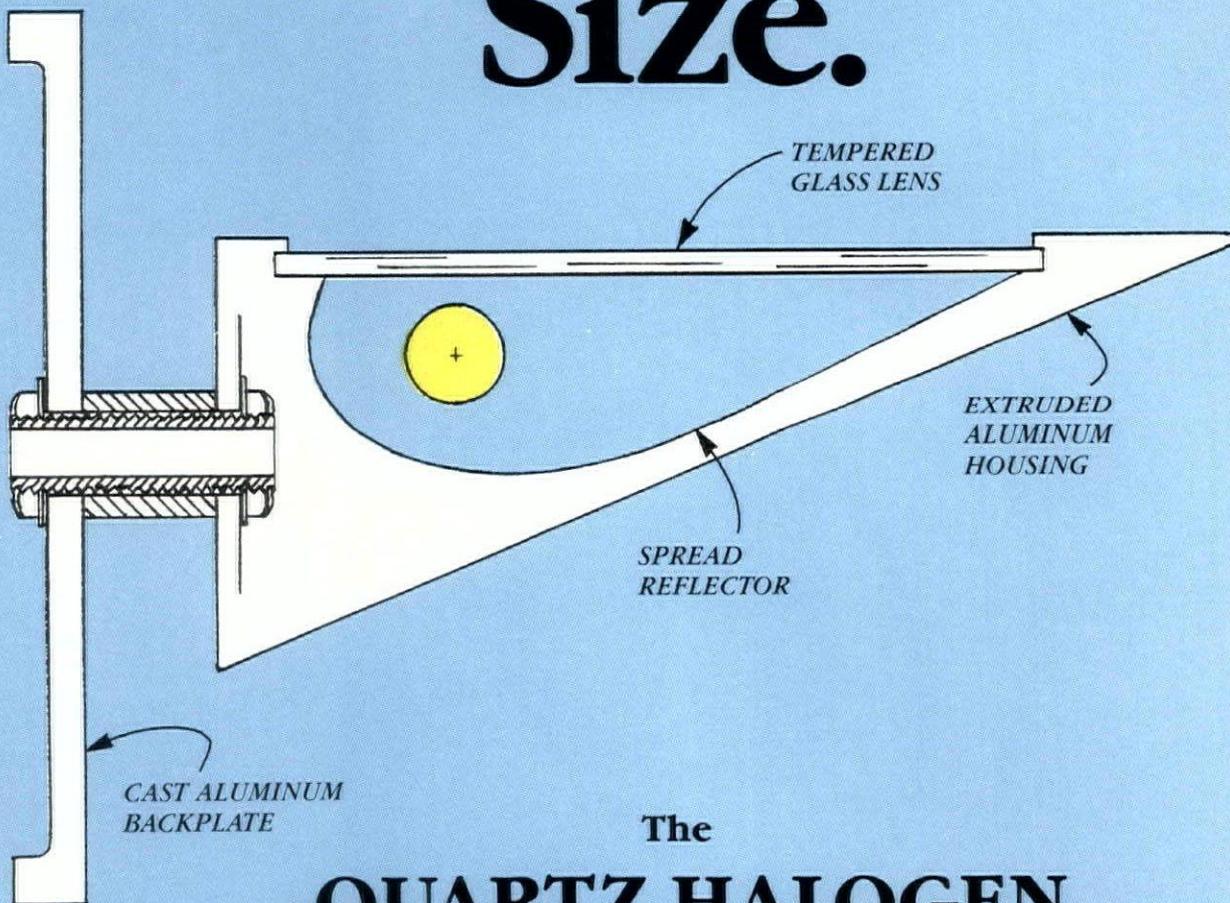
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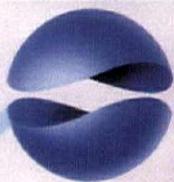
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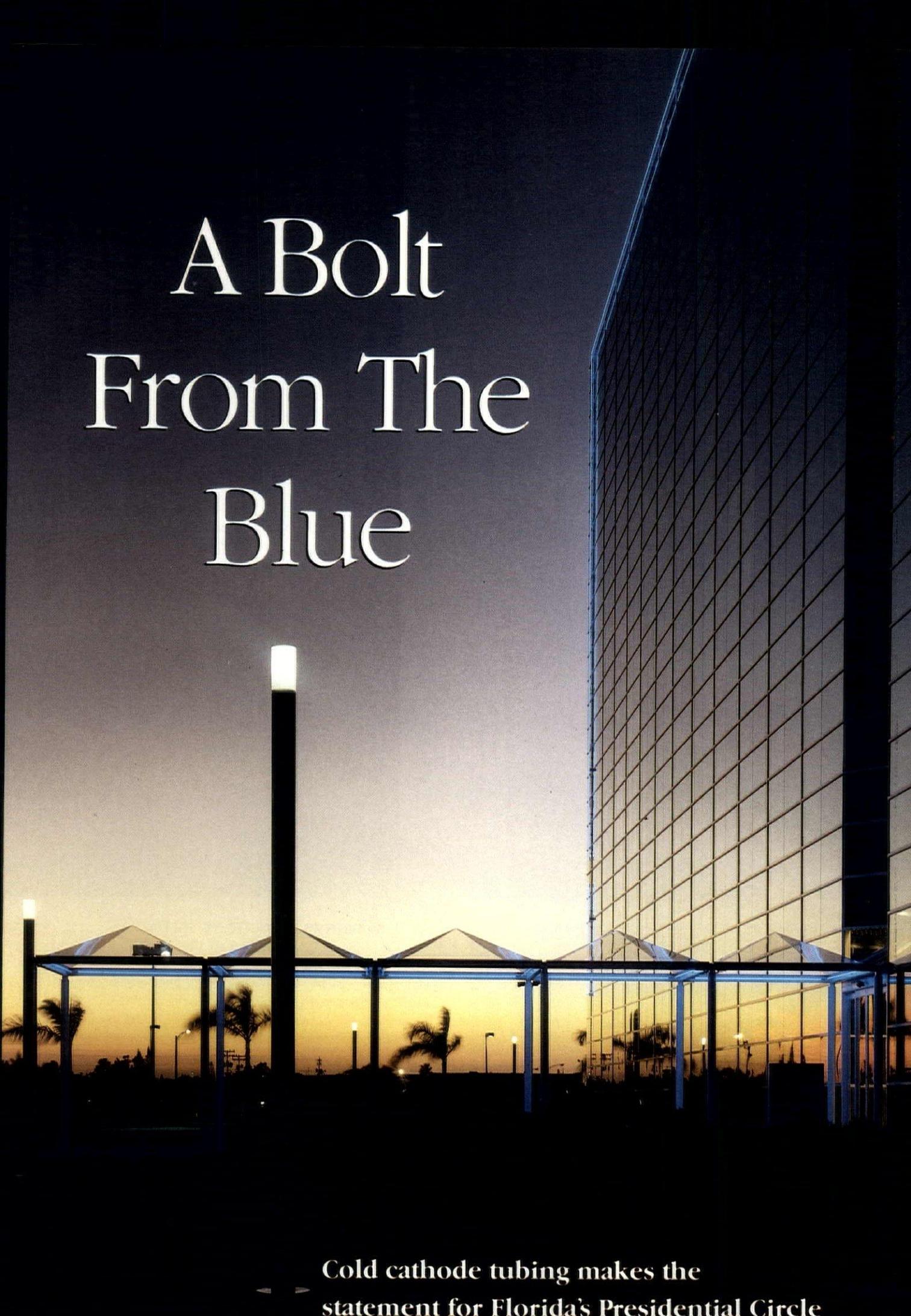
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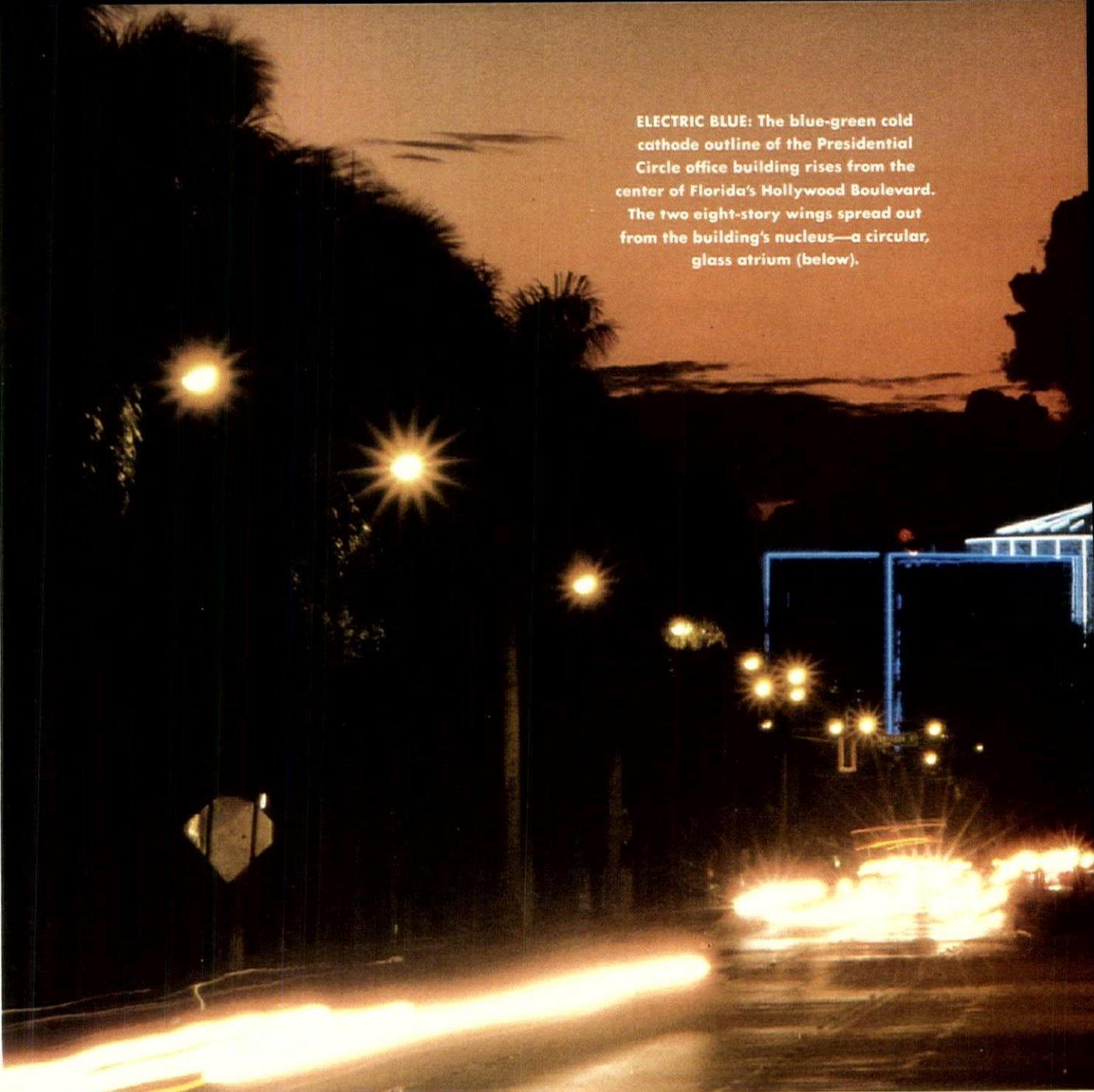
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A photograph of a modern building at dusk. The building has a glass facade that reflects the sky. In the foreground, there is a walkway with several tall, thin, illuminated columns. The sky is a mix of blue and orange, suggesting sunset or sunrise. The overall mood is serene and modern.

# A Bolt From The Blue

Cold cathode tubing makes the  
statement for Florida's Presidential Circle



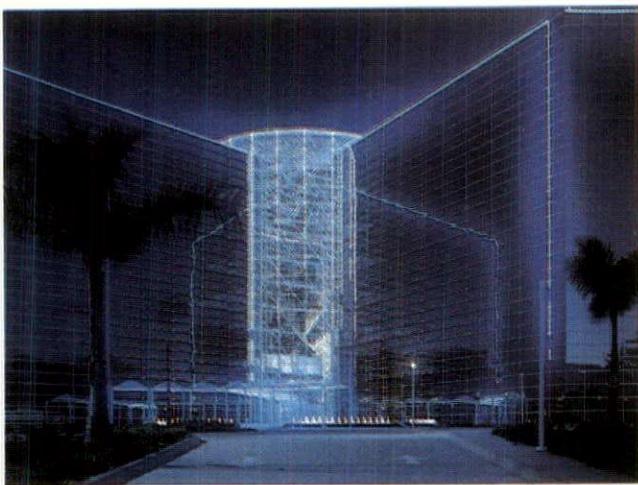
**ELECTRIC BLUE:** The blue-green cold cathode outline of the Presidential Circle office building rises from the center of Florida's Hollywood Boulevard. The two eight-story wings spread out from the building's nucleus—a circular, glass atrium (below).

**BY CATHERINE SCHEITING SALFINO**  
MANAGING EDITOR

**D**riving down the steamy, palm-lined street of Florida's Hollywood Boulevard, the outline of a huge building looms into view. The spectacular construction appears to be a fortress with which everyone must reckon before being granted passage.

That is just the show-stopping effect architect Jeffrey Silberstein, of Barretta & Associates, Boca Raton, FL, and lighting designer Alena Appia and principal Ray Grenald, of Grenald Associates Ltd., Los Angeles, were looking to achieve with Presidential Circle, an office complex that is fast becoming a landmark of Hollywood, FL.

"The client wanted us to create something monumental, something that would take advantage of the site," says Silberstein, the firm's director of design. "It's a circular site that's very classical in the sense that it's



PHOTOS BY DAN FORER



axial—north, south, east, and west. The site is set in the middle of a four-corner crossing, so anyone approaching the building has to drive around a circle to pass by it.”

One of the client's requirements was to include with the 300,000-square-foot building an atrium, an architectural feature that draws many tenants, Silberstein says. However, zoning requirements mandated that the building could be no higher than eight stories. So Silberstein came up with a design that splits the office space into two wings that are separated in the middle by the atrium.

Another client requirement was that the building look like a landmark by night as well as by day. But since its facade is of glass construction, it cannot be illuminated with exterior floodlighting because of the glare that would result.

The decision then was to go with outlining the building with light, says Appia, a design associate with

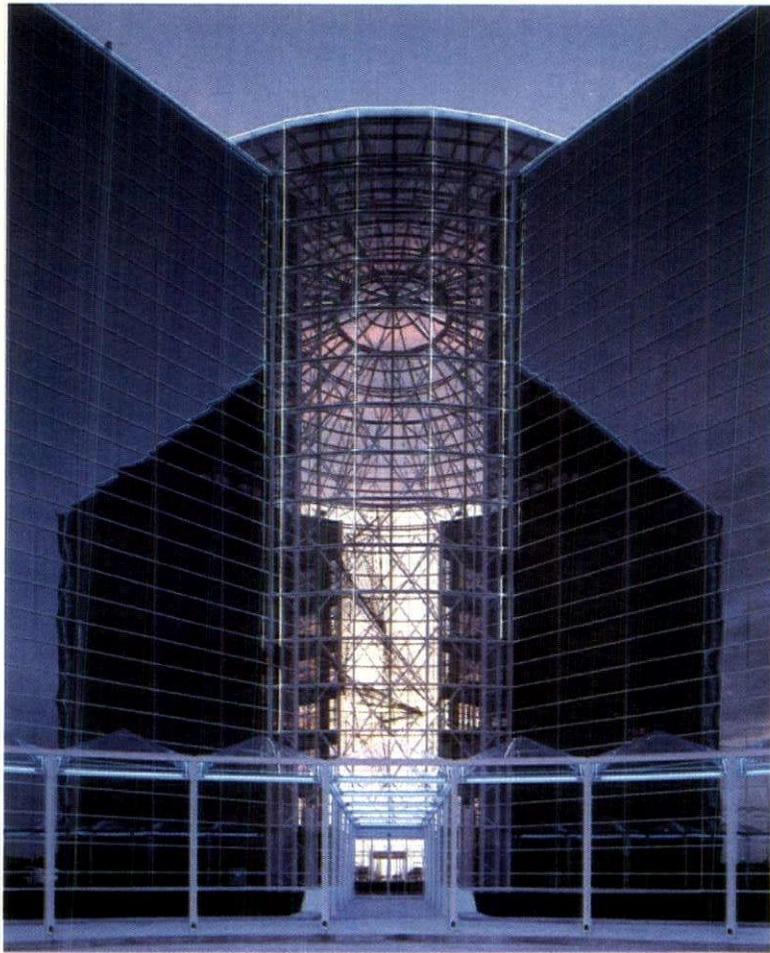
## AND THE WINNER IS...

**SIDE** LIGHTS

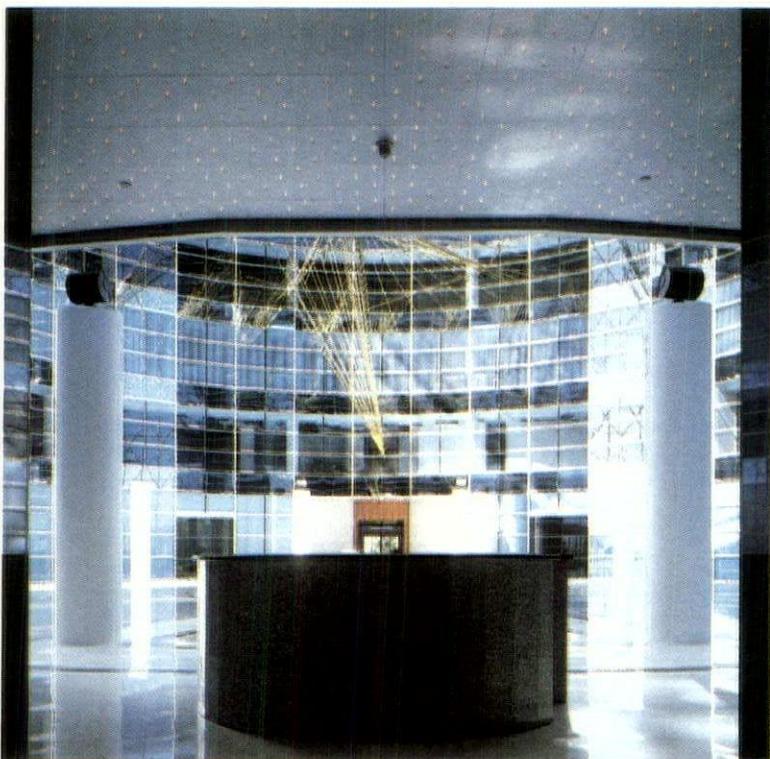
The best of the best. That's what the Presidential Circle office complex in Hollywood, FL, is considered after garnering the best of show award in the "Six Stories & Above" category in the state's Night Beautiful 1990 contest.

Since 1987, the Night Beautiful contest has recognized projects that exhibit ingenuity, creativity, energy efficiency, and originality in exterior lighting design in Florida.

Since the lighting design team, Grenald Associates Ltd., is located in Los Angeles, the project was eligible for California's Illuminating Engineering Society award for office design. It captured the title in March 1990.



**STRIKING COMBINATION:** At night, blue-green tubing outlines the wings, warm white highlights the atrium, and blue cold cathode carries the canopy. The entryway's aluminum ceiling is generously treated with 1-watt accent lights (below).



Grenald Associates Ltd.

"It was a simple attitude where the design really couldn't be any other way," she says. "But there were two sources we could use to light it—fiber optics and cold cathode. We decided against fiber optics, though, because of the source's fading rate due to the ultra violet rays that would beat down on it. Also, fiber optics has advanced since the time we commenced the project (which began in late 1986 and was completed July 1989). It was a more complicated system then."

Additionally, a fiber optics system is more expensive than cold cathode, and since the total project was budgeted at \$20 million, the team decided to specify cold cathode. However, the team had to determine how to cost-effectively install the source, Silberstein says, because it too is expensive, running about \$25 per linear foot. Presidential Circle required 12,000 linear feet of the tubing, totalling \$300,000 worth of cold cathode, he says.

The team created a system that uses the cold cathode sparingly.

"Instead of lighting the entire periphery of the building, we outlined only parts of it, achieving the same result," Appia says.

"So this not only saved money, it made the building seem almost kinetic," adds Silberstein. "You almost want to see those lines touching each other but they're not."

### CHOOSING COLORS

It took about a month, Silberstein says, to look at color samples before making the final choices on the cold cathode tints. A blue-green is used to outline the two wings of the building. Warm white tubing follows the contours of the central atrium, and blue tubes outline the skylight canopies that lead to the atrium.

"Blue is very visible at night," Appia says.

Also, Silberstein says, he wanted to retain the Floridian look and scheme.

"The blues and white reminded me of the Caribbean, with its turquoise blue waters and white sand," he says.

The single exposed tubes are surface-mounted to the building's mullions, Appia says. The cold cathode in this project is a series system, she says.

"The power makes a loop from its source to the lamp socket and then to the lamp," Appia says. "It then goes to another socket, and then to another lamp, and back to where it started."

The tubing that outlines the building begins about 8 feet above the ground. The power is carried from the ground-level power source through an insulated cable to the tubing.

Appia says the lighting team also specified mid-point wiring, a practice that calls for the transformer to be split in half, feeding the power from the center of a long stretch of tubing.

"This extends the number of feet of cold cathode tubing that can be fed with one transformer," she says. "The transformers were brought into the building and the mullions were used as grounding. By doing this, the project called for less transformers."

Between their sockets, each length of cold cathode tubing is secured in the middle by a glass support—a rigid element to which the lamp is affixed.

The atrium roof is illuminated in a starburst design with cold cathode tubes that run along the framing members toward the dome's pinnacle from its periphery.

### STRAW BIRD IN ATRIUM CAGE

Within the atrium, a mobile that looks like an enormous straw bird is suspended from the dome's glass roof. At night the piece is illuminated with 150-watt column-mounted metal halide uplights.

The exterior of the atrium is further promoted as the building's focal point with a reflecting pool and fountains. The jet streams of the fountain are illuminated with 300-watt, 120-volt metal halide luminaires that are placed in ring formation under the spray. The result is a water wall of light.

Further exterior illumination consists of 35-foot tall decorative lamp posts that surround the building on its entry level. The tube-like lamps are lit with 75-watt metal halide lamps.

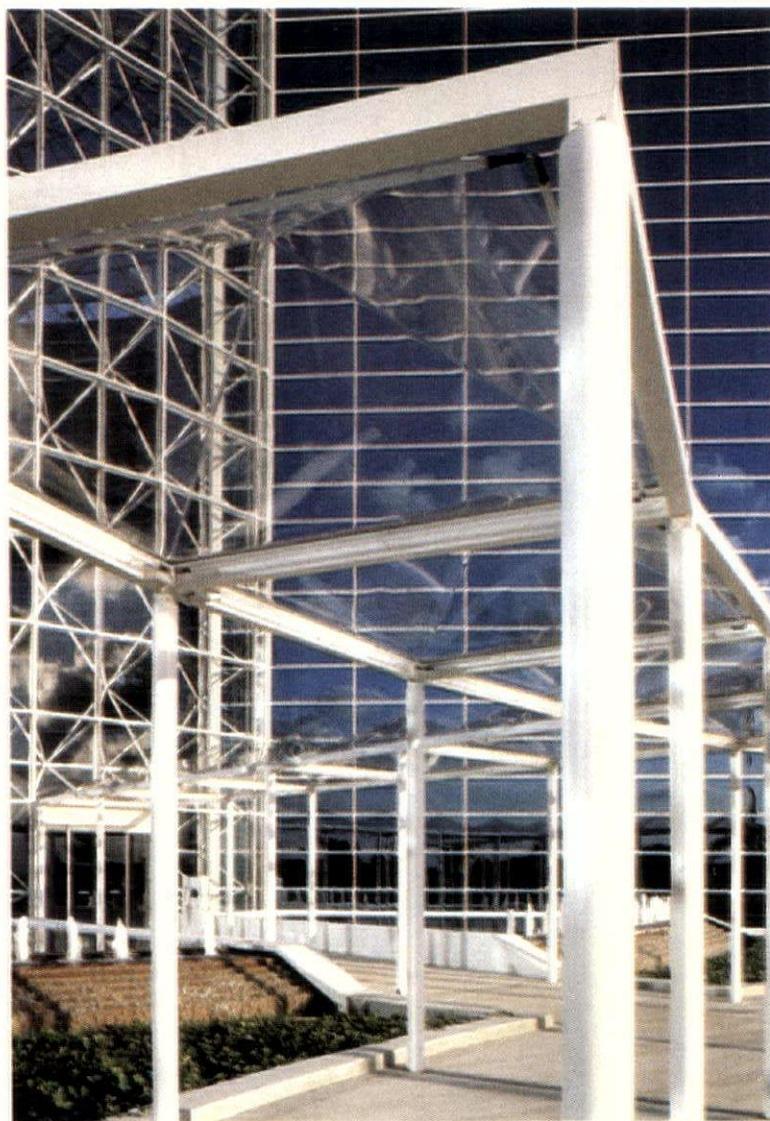
"Because of the sufficient emission of light, we didn't have to use many fixtures," Appia says. "And they offer a very even distribution of light."

Besides its unique look, the project itself was different for Silberstein because, he says, the lighting and building design were planned at the same time.

"Here was an opportunity to work on a project that was conceived differently," he says. "The lighting was an important aspect of the design concept, resulting in an extremely successful project." ■



**LIGHT SUSPENSION:** The artistic mobile (above) suspended from the dome roof is illuminated with metal halide lamps that sit atop the columns, like that in the photo's forefront. Below, the canopy's cold cathode is visible around the perimeter of the walkway framework.



### DETAILS

**PROJECT:** PRESIDENTIAL CIRCLE

**LOCATION:** HOLLYWOOD, FL

**CLIENT:** THE GAMPEL ORGANIZATION

**LIGHTING DESIGNER:** JEFFREY SILBERSTEIN, BARRETTA & ASSOCIATES; RAY GRENAUD & ALENA APPIA, GRENAUD ASSOCIATES LTD.

**ARCHITECT:** BARRETTA & ASSOCIATES

**INTERIOR DESIGNER:** BARRETTA & ASSOCIATES

**LANDSCAPE ARCHITECT:** THE SWA GROUP

**ELECTRICIAN:** J.P. ELECTRICAL CONTRACTORS CORP.

**LIGHTING MANUFACTURERS:** MELWEB/FEDERAL SIGNS;

25mm cold cathode tubing, custom brackets; KIM LIGHTING;

150-, 175-watt metal halide luminaires; TIVOLI INDS. INC.; 1-

watt Tivoline ceiling panel lamps; J.P. ELECTRIC; custom lamp

posts; AMERICAN PRODUCTS INC.; AmerLite, 300-watt, 120-volt

metal halide luminaires

**PHOTOGRAPHER:** DAN FORER, DAN FORER PHOTOGRAPHY



# Dramatizing Tradition

3M Corporation's D.C. office gets a lift with creative lighting



**LINEAR PERSPECTIVE:** Daylight is brought into the core of 3M Corporation's Federal Government Affairs Office with a glazed wall system. To avoid glare and add a touch of drama, a light cove was installed throughout the lobby (above, right) and the general office areas (above left, and left). The lobby receives further attention with MR 16 spots and narrow floods placed sporadically throughout the space.



**BY CATHERINE SCHETTING SALFINO**  
MANAGING EDITOR

**T**he reserved atmosphere of a standard office space is not a tradition with which breaking comes easy. Especially in a city like Washington, D.C., where tradition runs deep and even refined drama could be perceived as going overboard. Add to that building constraints such as ceiling height and energy-efficiency limits, and a seemingly mundane lighting project becomes an exercise in creativity, coordination, and drawing-board specificity.

In lighting the 3M Corporation's Federal Government Affairs Office in the nation's capital, Ellerbe Becket, Inc.'s design group aimed for an innovative way to illuminate the space, while integrating the lighting with the facility's sophisticated interiors.

"The office is relatively traditional in its design," says Mark P. Duckett, vice president, Ellerbe Becket, and project manager. "But when we sat down to design the space, we decided the lighting would be a very inte-

gral part of the plan. "One of the challenges was to bring the natural light into the facility and blend it well with our light sources.

That's when we came up with the glazed walls, which are a departure from a standard office space, and a nice amenity for all the occupants. The glazing gives the impression of an open space."

However, the walls created a glare control concern. The glazed portion of the design is constructed like a curtain wall, with two-thirds of it being glass and the bottom third being casework. The glass, Duckett says, is meant to be seen as an open plane with elements floating through it.

"The chair rail and the doors are elements in the plane," Duckett says. "The light cove seemingly floats in the plane, too."

The light cove runs throughout both floors of the project, from the lobby to the general office area.

PHOTOS BY KEN WYNER

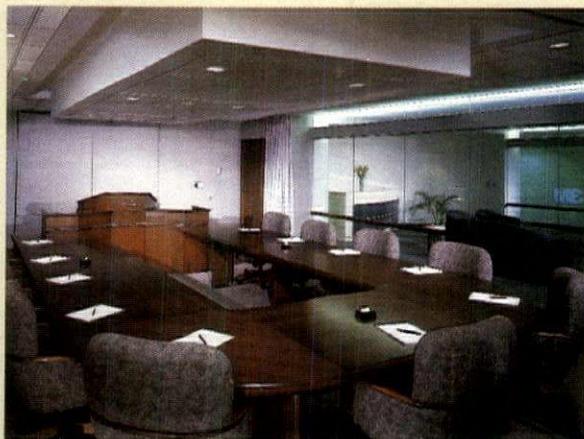
"We wanted the lighting to be discreet but dramatic, but not overpoweringly so," says the project's lighting designer Lisa Marie Brooks. "We didn't want a solid wall above the cove because we wanted the space to breathe. So we designed a special reflector system for the cove."

The system's baffle is placed toward the rear of the shallow cove by the clerestory, Brooks says. At this angle, the light of the 30-watt T8 lamps, which are placed in every 8-foot section of the cove, does not cause glare or excessive ceiling brightness that would interfere with the effect of the glazed wall. Additionally, because of Washington's building height limit, the light cove had to be installed closer to the ceiling than it normally would have been.

"This part of the lighting design was just so

complex, everything had to be specified exactly—there was no room for on-site experimentation," Brooke says. "And between the interior designer, the cove manufacturer, and our electrical group, this became a big challenge. If the cove lighting got botched up once, we knew it would be botched up throughout. But it did work. And now the light just seems to whisper out of there."

The cove lighting needed to harmonize with other illumination sources in the lobby so that the light would integrate with the space's various textures, like granite, travertine marble, cherrywood, and carpeting. The taupe tones of the fabric wall coverings and upholstery added another dimension that Brooks wanted enhanced by the lighting.



## CONFERENCE ROOM CONSIDERATIONS

### SIDE LIGHTS

SINCE THE 3M CONFERENCE ROOM needs to function in a variety of ways for multimedia presentations, a creative lighting plan had to be put into place.

"Accommodations had to be made for videos, an overhead projector, and marker boards, and we wanted the table to be flexible enough that it could seat up to 30 people," says Ellerbe Beckett's Mark P. Duckett, project manager. "So what we needed was a lighting system that would be very flexible."

This meant working on a soffit that would permanently suspend a projector, and would house a light fixture that would illuminate the conference table sufficiently. The Ellerbe Beckett design team coordinated the size of the soffit with the cutout of the custom-designed cherrywood table, which is the main focus of the room.

"Because of the rich color of the table, we went with 100-watt A 19 downlights to create a warm

mood in the room," says the project's lighting designer Lisa Marie Brooks. "Also, the table is highly polished, so it was important to install the fixtures in a way that would eliminate potential reflected glare."

The lamps were installed so that they would be just beyond the shoulders of those seated, throwing the light in front of them and avoiding shadows. During the video or slide presentations, illumination from the perimeter cove light in the lobby shines through the drawn curtain, washing it with light.

"Also," Brooks says, "we had to be sensitive to any glare that would shine on the marker board. We installed a light strip housing 5-watt incandescent lamps above the board to eliminate any lamp image reflections on the shiny surface."

The lighting is on a four-scene preset dimming system that integrates the ceiling projector into the remote control, which can be used from any point in the room.

"We didn't want lamps focused everywhere, but we wanted the lighting to be dramatic because it is the entrance area," Brooks says. "We specified wall-washers sporadically because we wanted a scalloped lighting effect that would create a brightness contrast and bring out the textures of the wall coverings."

The statues in the lobby are illuminated with 20-watt MR 16s. The center table is brought to life with a 75-watt MR 16, and the chairs are lit with a combination of 75- and 50-watt MR 16s.

"We overlapped the beam patterns to soften the harshness of the halogen lamps," Brooks says. "The 50-watt MR 16 floods with narrow distribution were used for that reason."

However, Brooks says, they had to pull in the reins somewhat on the usage of the recessed lamps because of the glossy travertine surfaces. To avoid glare, downlights were installed in such a way as to cut light reflection on the counter. Task lights and a decorative luminaire soften the downlight units aimed at the work surfaces.

All of the lobby lighting is on dimmers, Duckett says.

"We wanted to allow 3M to set a variety of lighting levels," he says. "The preset scenes can create a brighter mood for daytime work, or they can be dimmed down for an evening reception."

Avoiding glare was also a concern in the general office areas, where the team had to deal with the glass walls and computer screens. The team considered the city's energy code and aimed to retain 2-3 watts per square foot in the office spaces. Brooks says she specified 2-foot x 2-foot troffers that each house three 40-watt double biax lamps. To avoid glare on the glazed walls and computer screens, the troffers are matched with 1.5-inch x 1.5-inch x .75-inch aluminum parabolic louvers.

"The main effort for the general office area

was energy efficiency in the lamp sources," Brooks says. "The biax lamp meets this criteria plus it offers improved operating economy, long life, and excellent color rendition."

While glare and color rendition concerns came into play in the conference room, the space had additional requirements that led the designers to come up with a unique design plan that called for recessed incandescent A lamps, cove lighting, and low-wattage strip lamps. Duckett says the success of the lighting in the room depended heavily on the layout of the custom table and the overhead soffit. (See "Sidelights.")

"This project was really a collaborative effort on the part of many people," he says. "In all aspects, it was a very closely coordinated venture. I think a lot of it has to do with the size of the team, which was made up of 13 people. It was small enough that it was controllable, but large enough to have a lot of ideas that led to a really creative office design." ■

#### DETAILS

**PROJECT:** 3M FEDERAL GOVERNMENT AFFAIRS OFFICE

**LOCATION:** WASHINGTON, D.C.

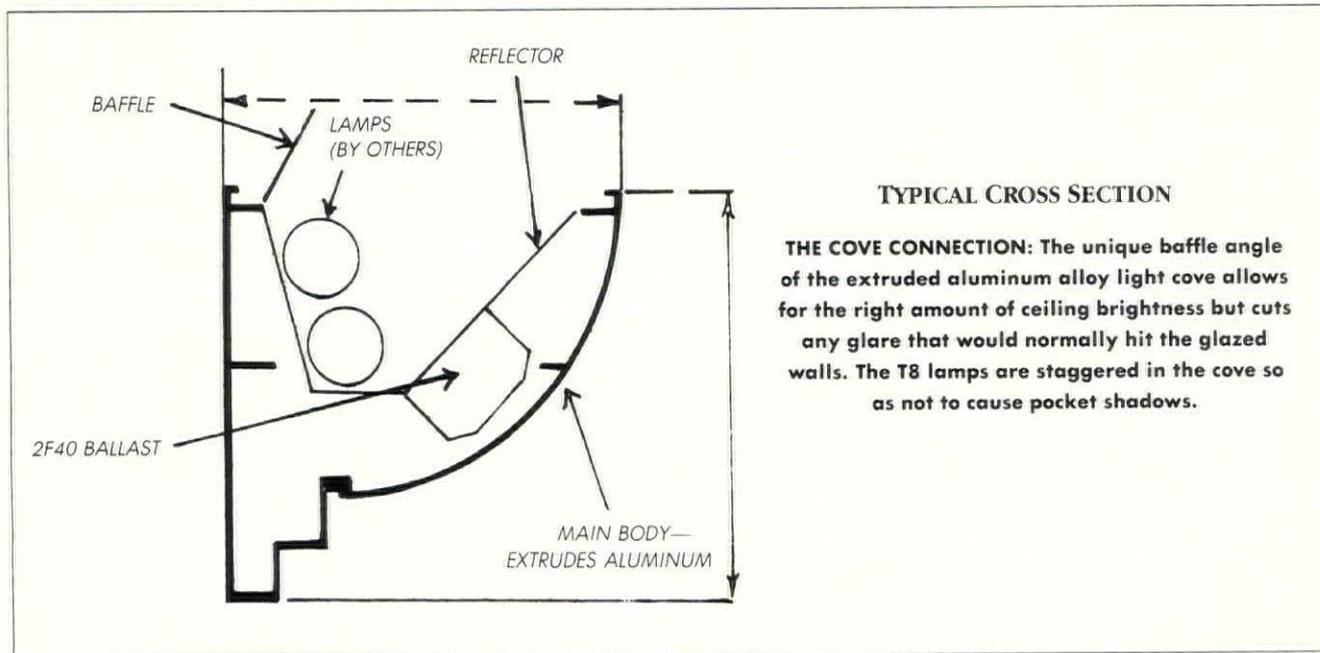
**CLIENT:** 3M CORPORATION

**LIGHTING DESIGNER:** LISA MARIE BROOKS, ELLERBE BECKETT, INC.

**ARCHITECTURAL/DESIGN TEAM:** MARK DUCKETT, project manager; RANDY BEATTY, PAUL BOHN, LISA MARIE BROOKS, TOM GROGAN, DARWIN LARSON, CATHY McCORMICK, VIRGINIA REED, PETER SCHMIDT, STEVE TARBUCK, AL WESSEL, SHARON WONG, RANDY WOOD

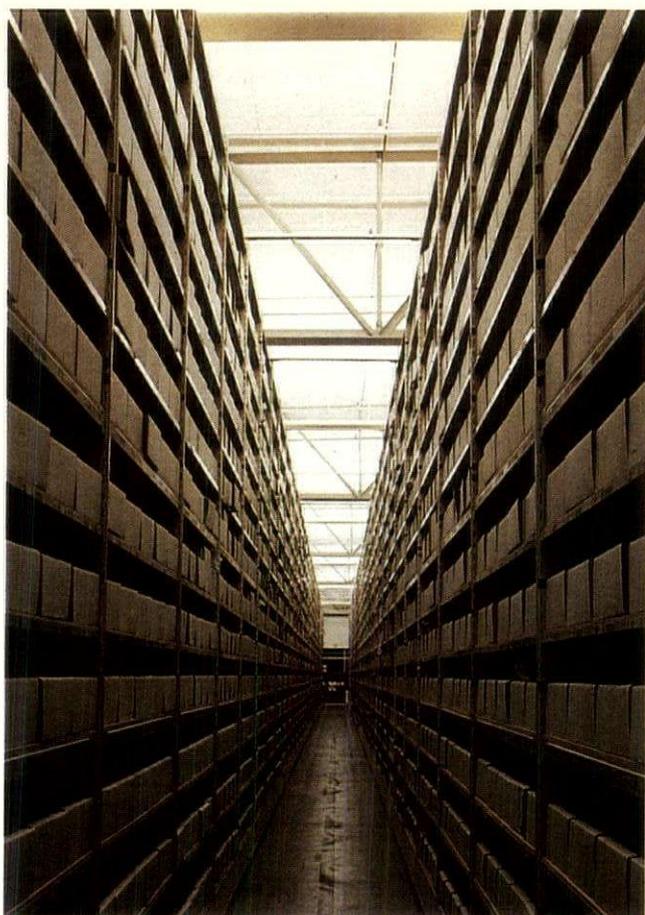
**PHOTOGRAPHER:** KEN WYNER, KENNETH M. WYNER PHOTOGRAPHY

**LIGHTING MANUFACTURERS:** SYLVANIA: 100-watt A 19s, 30-watt T8s 20-, 50-, 75-watt MR 16s, 40-watt double biax T8s 5-watt light strip lamps; PRESCOLITE: 5-inch downlight fixture, adjustable downlight fixture; LUCIFER: 92-inch light strip; ALUMITRON: custom cove light fixture; DURAY: 13-watt T5 under cabinet light in reception area; DAYBRITE: aluminum parabolic louver; LIGHTOLIER: 9-watt personal task light in reception area; Scenist Master dimming system with infrared remote for conference room, Crescendo dimming system for lobby



#### TYPICAL CROSS SECTION

**THE COVE CONNECTION:** The unique baffle angle of the extruded aluminum alloy light cove allows for the right amount of ceiling brightness but cuts any glare that would normally hit the glazed walls. The T8 lamps are staggered in the cove so as not to cause pocket shadows.

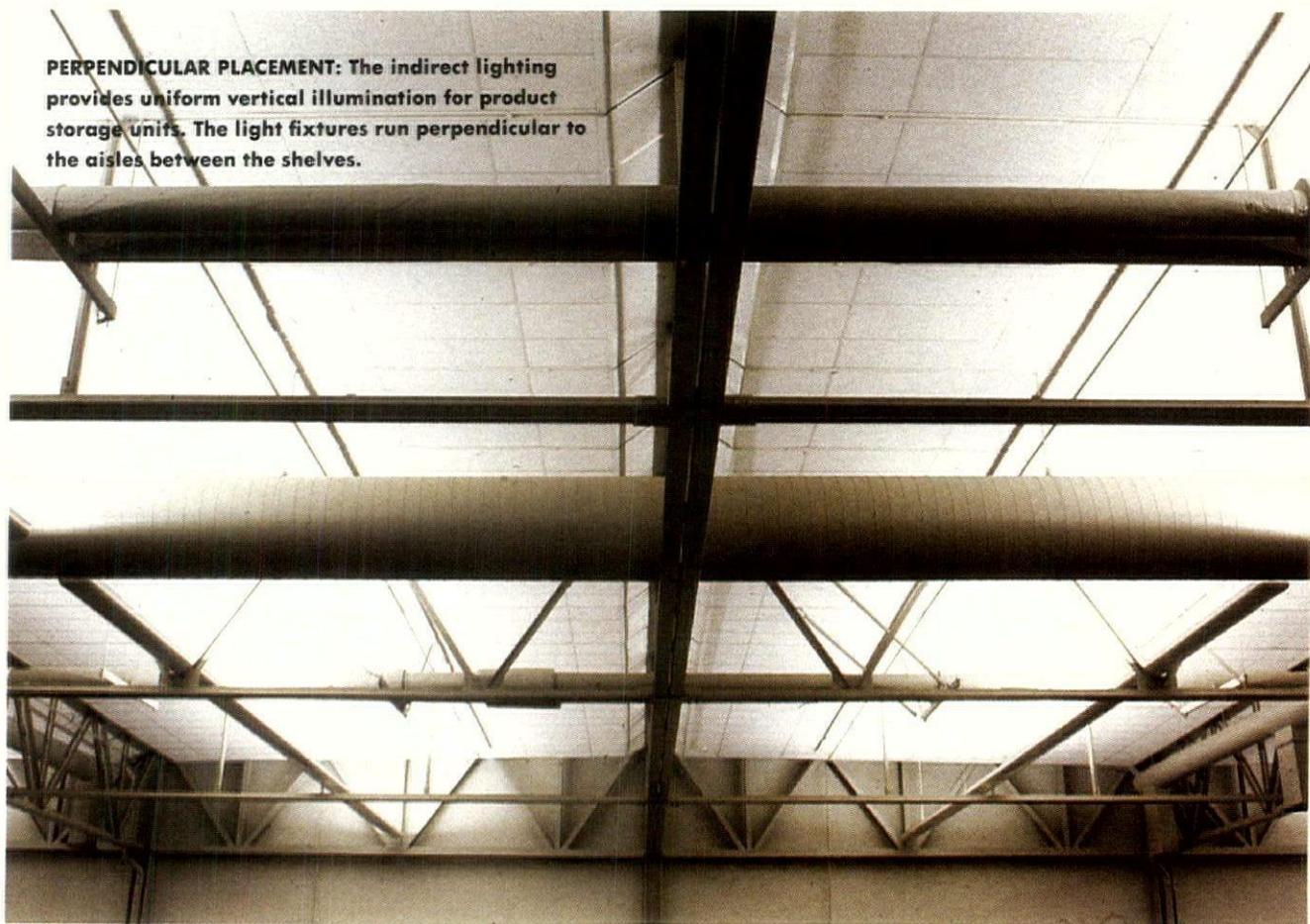


■

# One System Suits All

**High-bay indirect fluorescent  
lighting debuts in multi-use  
manufacturing facility**

**PERPENDICULAR PLACEMENT:** The indirect lighting provides uniform vertical illumination for product storage units. The light fixtures run perpendicular to the aisles between the shelves.



**BY CHARLES LINN, AIA**  
EXECUTIVE EDITOR

**H**ewlett Packard's rapidly changing needs prompted HED Architects to design a new prototype facility with a high degree of adaptability. The new 250,000-square-foot facility in Roseville, CA, is broken down into generic modules as small as 20,000 square feet, all of which are serviced by daylight corridors and utility spines.

The modules have an almost unlimited number of uses. Within each module, zones of open office space can be converted to product storage and then back to offices again. Or, if conditions demand, either type of space can be converted to production. The lighting throughout the facility had to meet the needs of all three types of spaces, without requiring any alterations that would impede the rapid conversion of the space to a new use.

The difficulty of providing a lighting system that meets a one-lighting-level-fits-all criterion was compounded by other factors. The need for glare-free lighting for VDT screens in both the office and manufacturing areas, as well as the need to evenly illuminate the fronts of tall warehouse shelving units from top to bottom, made it risky to specify a single lighting system for all three types of space. Added to these challenges was a 22-foot ceiling height, plus California's Title 24 Energy Code, which mandates a lighting power density of 1.5 watts per square foot or less. Then, there was Hewlett Packard's requirement that the lighting maintain an average of 70 footcandles at the work plane.

Architect John Duvivier runs down a list of solutions that were rejected.

"We looked at installations of indirect metal halide fixtures—'hockey pucks'. Those might have worked except that they produced hot spots on the ceiling. And the inconsistency of the color of the lamps from fixture to fixture created a rainbow effect on the ceiling," he says. "The light is too cold and too inconsistent. You never know what kind of color you're going to get."

Duvivier also wanted to avoid the effect that is created when fluorescent downlights are suspended from a high ceiling on long pendants to get them close to the work plane.

"You get rows of bright panels below, and a dark void above. This effectively creates a false ceiling plane, and a gloomy space."

This method of installation would also have imposed restrictions on future alterations of the space.

The daylight corridors that divide each manufacturing module provided a clue to the solution.

"What we *didn't* want to do," continues Duvivier, "was create a contrast between the enclosed volume of



**MULTI-PURPOSE SYSTEM:** The photos at right show typical office and production facilities as they are currently configured at Hewlett Packard's new facility. Both are lit with an indirect fluorescent lighting system.

PHOTOS BY RICHARD SEXTON

the space and the daylit perimeter. What we *did* want to do was light the entire volume of each space, so that it would appear to be open and airy."

#### AN INDIRECT SOLUTION

After thoroughly investigating these other options, project engineer David Komonosky set out to solve the problem using an indirect fluorescent fixture.

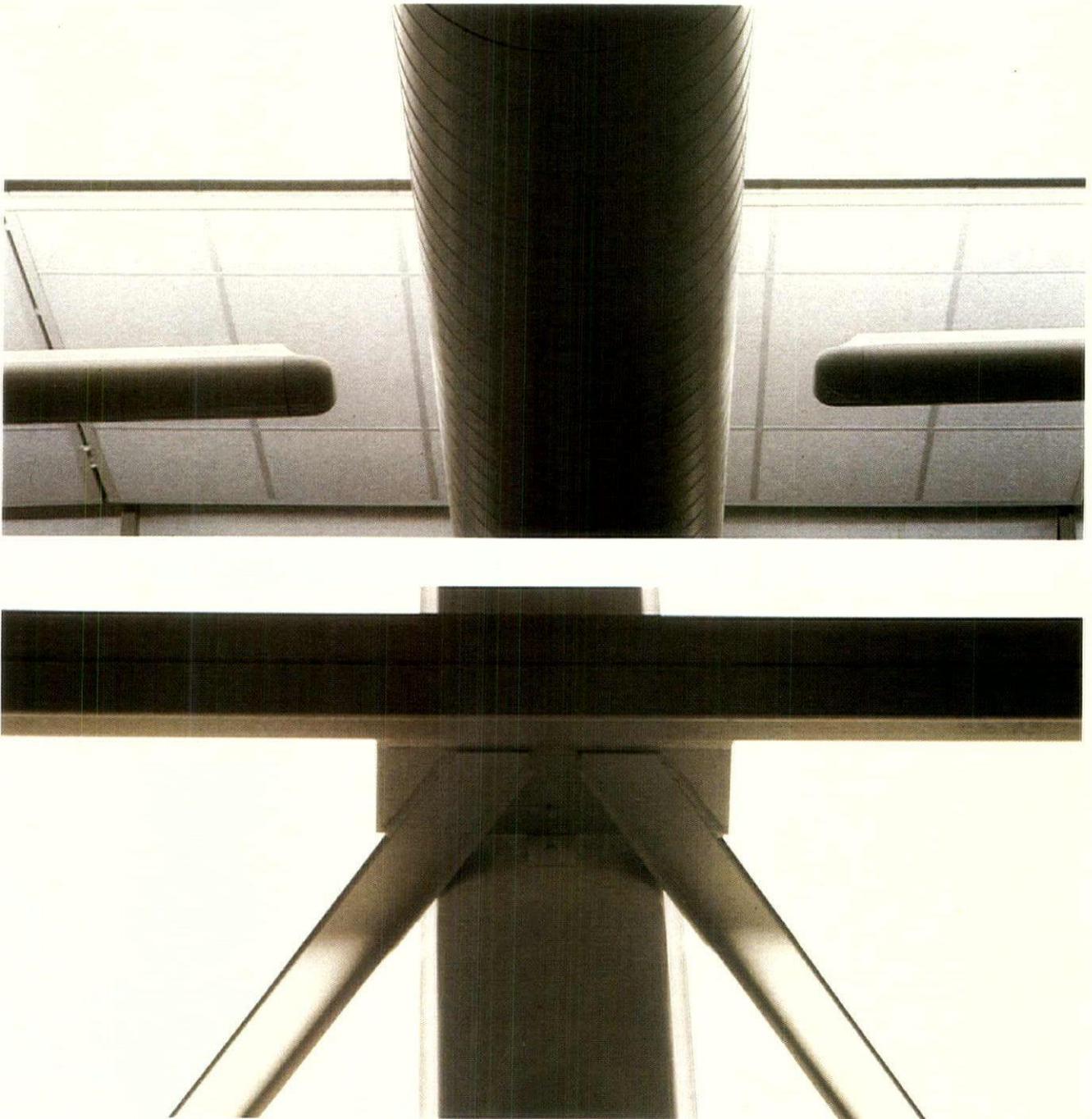
"The first thing I had to do was to convince Hewlett Packard that an average of 40 footcandles at the work surface would be adequate," Komonosky says. "Seventy footcandles of indirect light would have been too bright for this

application, especially if the lighting system had been designed to give a 5:1 ceiling luminance ratio, which was one of my criteria."

Meeting the uniformity requirements meant installing the fixtures 5 feet below the ceiling. The structural system in the space also imposed some limitations on where the fixtures could be mounted, forcing them to be 32 feet apart.

Komonosky's next problem was finding an indirect fluorescent fixture that put out enough light to meet the footcandle, uniformity, and mounting requirements. Since most indirect fluorescent fixtures typically have been designed for office applications, where they are mounted both closer to the ceiling and closer together, this job

**HI-TECH INDIRECT:**  
The indirect fixtures fit well into the Hewlett Packard facility's high-tech environment.



required a custom fixture.

Komonosky approached a manufacturer and asked about the possibility of using a pair of fluorescent biaxial lamps in an extra-wide indirect fixture body. To understand the advantages of using this lamp, one need only look at the numbers: a 40-watt biaxial fluorescent lamp is 22.5 inches long, yet it packs a whopping 3,150-lumen initial output. That is the same output as a 40-watt T12 fluorescent lamp that is 48 inches long. By using four biaxial lamps in the same amount of space that holds just two T12 lamps, the light output had been doubled, and there was still enough room to add an additional T8 lamp.

"Our initial calculations indicated that we'd have no problem getting 40 footcandles at the work plane with just the biaxial lamps in this fixture," Komonosky says. "But as we got further into the design process, we began looking at all of the stuff beneath the ceiling that we really hadn't accounted for: cable trays, piping, ductwork, and trusses. There were just tons of stuff up there that had to be lit. We considered adding another row of biaxial lamps down the center of the fixture, but that would have exceeded our Title 24 restrictions. The power density could have been increased to accommodate our need if we had employed certain control strategies. But adding more controls would have exceeded the amount of money we had in the lighting budget. We elected to add a row of T8s between the two rows of biaxial lamps, and that worked perfectly."

At this point the light fixture was no more than lamps, wiring, and optics in a box.

"We worked extensively with HED Architects on the shape of the fixture, faxing sketches back and forth between our offices," Komonosky says. "The manufacturer ended up modifying the extrusion to meet its own requirements, and the final shape was approved by the whole design team."

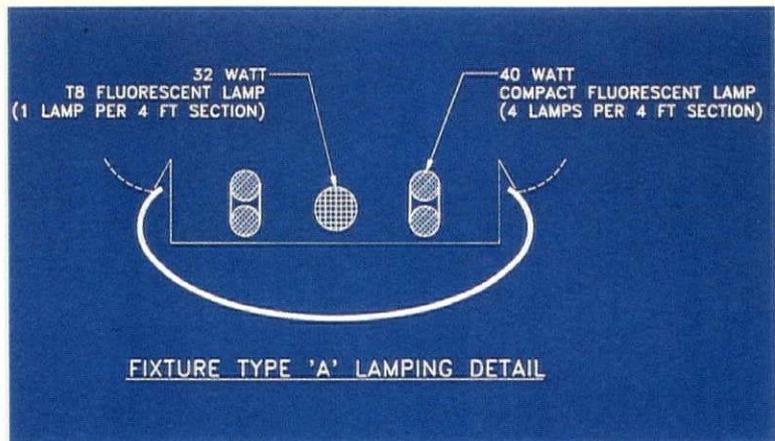
#### POST-DESIGN VALUE ENGINEERING

"Because this lighting system was so unorthodox," Komonosky says, "it was assumed that it would be more costly than some other systems. So, the contractor took a shot at engineering a few different systems to replace it, using similar illumination and power density criteria. What he found was that he couldn't beat the installed price of the indirect fluorescent, which was \$2.50 per square foot, including the branch wiring back to the power panels."

#### SIMPLE INSTALLATION LOWERS LABOR COST

What the contractor found was that the indirect fluorescent system's ease of installation was a major money saver.

"That," continues Komonosky, "is because long



fixture runs are prewired. You only have to provide one power point for many thousands of lumens."

In this case, just 42 power feed locations were required for one 20,000-square-foot module, including emergency lighting. It would have taken 112 feed locations to have done the job in 250-watt indirect metal halide fixtures, assuming identical ceiling luminance ratios and illuminance levels.

Additionally, installation of the fixtures was less time consuming than the installation of other fixtures because long lengths of the indirect sources are hung at one time. In addition, Title 24 requires that lamps within a row of fixtures be switched individually, so that half the lamps can be turned off when not required. This wiring is done by the manufacturer at the factory, rather than in the field, again saving on labor costs.

#### THE FINISHED PROJECT

Post-occupancy luminance measurements showed that Komonosky's 5:1 ceiling luminance ratio criterion was actually exceeded by the final result—it was closer to 4:1.

"Color rendering was a real concern here as well," adds Komonosky, "and the 3500K biaxial and T8 lamps matched really well."

"We loved the indirect system because it was both elegant looking and affordable," says Duvivier. "And now everybody at Hewlett Packard wants to work in this building." ■

#### DETAILS

**PROJECT:** DISTRIBUTION CENTER OF THE SUPPORT MATERIAL ORGANIZATION

**LOCATION:** ROSEVILLE, CA

**OWNER:** HEWLETT PACKARD CORPORATION

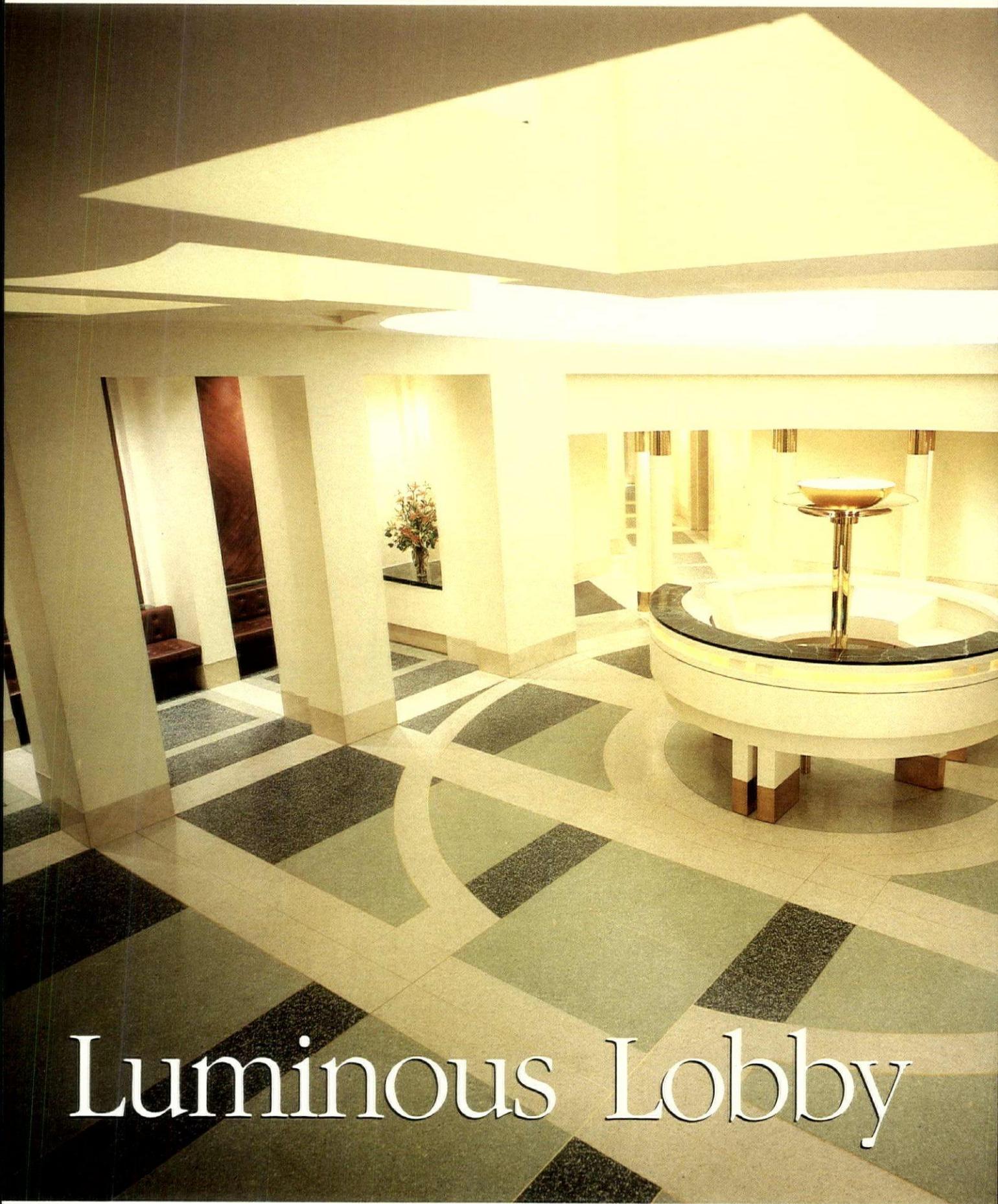
**ARCHITECTS:** HED ARCHITECTS: JOHN DUVIVIER, Principal; JOHN CHEKENE, Project Manager

**ELECTRICAL ENGINEERS:** SYSKA & HENNESSY, INC., ENGINEERS; OCTAVIAN DRAGOS, Project Manager; DAVID KOMONOSKY, Project Engineer

**MANUFACTURERS:** PEERLESS LIGHTING CORPORATION: indirect fluorescent fixtures; GENERAL ELECTRIC CO.: biaxial and T-8 fluorescent lamps

**PHOTOGRAPHER:** RICHARD SEXTON, Courtesy of Peerless Lighting Corporation

**LAMP POSITIONS: A section through the indirect light fixtures shows the relative positions of the biaxial and T8 fluorescent lamps.**



# Luminous Lobby

**LINNEBACH LIVES:** A custom-made uplight in the center of the reception desk (closeup, right) functions as a Linnebach projector. The 1984 Reference Volume of the *IES Lighting Handbook* defines a Linnebach as "a lensless scenic projector, using a concentrated source in a black box and a slide or cutout between the source and the projection surface."



## Lighting helps create a well-ordered lobby in a difficult space

BY CHARLES LINN, AIA  
EXECUTIVE EDITOR

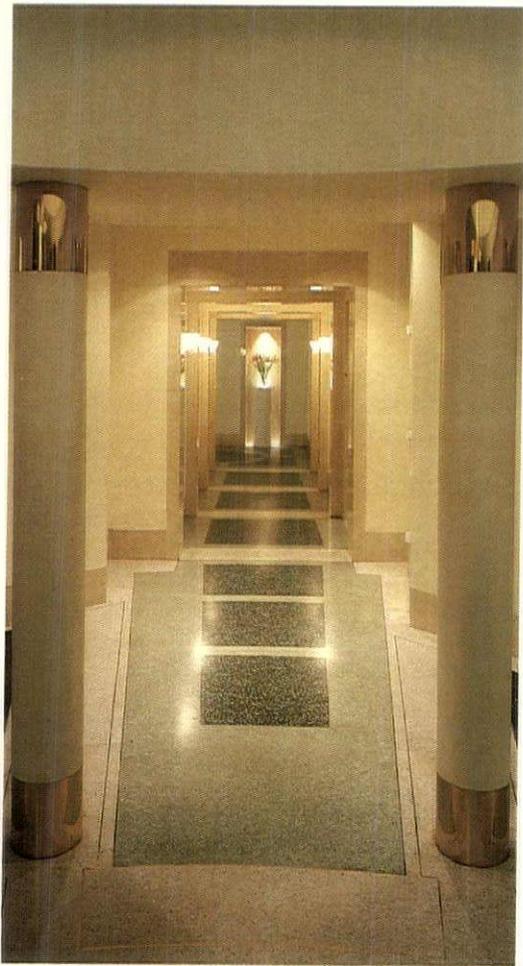
**A**rchitect Randy Croxton was faced with the leftovers when designing the lobby of the Bromley, a condominium building on Manhattan's upper west side. That is, Croxton got the space that was left over after the developers had divided up the first floor among several other tenants. Yet, the developers still wanted him to design a lobby in that space that would be elegant and memorable to maintain a competitive edge against a number of other condominium projects on the market in Manhattan at that time.

"The revolving door that led from the outside was off-center to the space, so there was an asymmetrical relationship between the entryway and the amount of space available in the lobby. We also had four large columns that came down through the space, and a long circuitous route to the elevators," says Croxton. "We had enough volume to do a high space, but at the same time, we didn't want the lobby to feel boxy, without any sort of articulation or feeling of scale.

"Our part was the circular window motif that had been developed on the exterior facade," Croxton continues. "We introduced another array of columns into the space, and centered a very large dome over them. A slot cut into the dome is aligned with a key oculus window centered over the revolving door entry. The center of this very rigorous geometry is a reception desk—and in the center of the desk stands a large, brass sculpture, which lights the dome overhead."

Lighting designer Carroll Cline designed a simple, yet effective method of lighting the dome. "Basically, it was a Linnebach projector," Cline says. "It's an old-fashioned notion that I think dates back to the early days of theater lighting. The idea was that you take a bare filament and put it inside a black box—and the shape of the pattern of the light is the same shape as

PHOTOS BY OTTO BAITZ



**WHITE ON WHITE SCALLOPS:** Decorative sconces are used in corridors emanating from the central lobby (left). A-lamp downlights create scallops on each side of the columns (below, left). Concealed uplights over the revolving door in the background (below, right) illuminate the architectural slot that connects the entry to the central portion of the lobby. The reception desk is lit by a hidden low-voltage strip.

any opening you put in the box. Here, the edge of the dish is aligned with the edges of the dome and projects a perfect circle of light up into it. Rather than an incandescent filament, we used a 400-watt clear—not coated—metal halide lamp.”

Cline also took an unusual approach to lighting a group of columns arranged in a semi-circle around the reception desk by placing a recessed A-lamp downlight between each pair. The light tends to scallop the columns in a way that makes them look round. They were lost otherwise,” he says.

“They wanted some sort of neutral lighting down the corridor to the elevator lobby,” Cline says, “so we put some very neutral sconces down there along with an MR 16 over the flowers at the end of the hall.”

The architectural slot leading from the oculus is illuminated by uplights concealed in the structure over the revolving door, and PAR 38 wall-washers complete the lighting throughout the rest of the space. ■

#### DETAILS

**PROJECT:** LOBBY DESIGN, THE BROMLEY

**LOCATION:** NEW YORK CITY

**ARCHITECT:** THE CROXTON COLLABORATIVE, RANDY CROXTON, AIA, principal-in-charge; JOHN BIZBEE, project architect

**LIGHTING DESIGNER:** CLINE BETTRIDGE BERNSTEIN LIGHTING DESIGN; CARROLL CLINE, FIALD

**PHOTOGRAPHER:** OTTO BAITZ, INC.

**LIGHTING MANUFACTURERS:** NORBERT BELFER: low-voltage strip lighting; EDISON PRICE: downlights and wall-washers; RAMBUSCH: custom-made brass uplight; SPI: wall sconces





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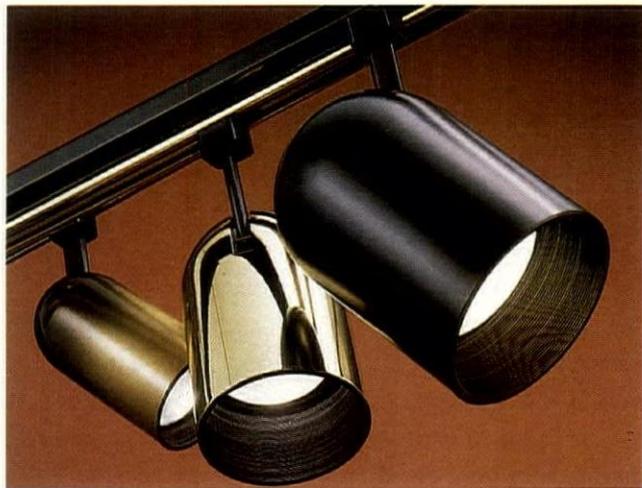
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# PRODUCT ADVERTISEMENTS REVIEW



TARGETTI STRUCTURELLA



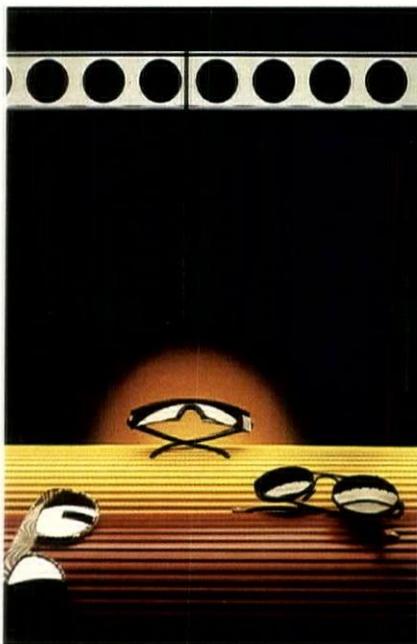
LITHONIA GOTHAM TRACK

**THE STRUCTURELLA SYSTEM** consists of miniature extruded aluminum, three-dimensional frames that function as insulated electrical conductors as well as supports for miniature halogen and dichroic spotlights. The maximum run from each electrical feed of the miniature space frame is approximately 20 feet in each direction. The system can be suspension or wall mounted. Targetti Inc., New York. **Circle No. 50**

**GOTHAM TRACK**, a family of surface track lighting, features a housing design that incorporates 1-circuit and 2-circuit wiring in the same low-profile housing, providing compact size, added capacity, and switching flexibility. The system offers a variety of cylinders, squares, spheres, bellspots, and wall-washers in a choice of size, wattage, and finish. Most are designed to use medium-base R and PAR lamps and many are available in versions for MR 16 and PAR 36 low-voltage lamps. The track sections are suitable for surface or pendant mounting. Lithonia Downlighting, a division of Lithonia Lighting, Conyers, GA. **Circle No. 51**



LITHONIA SIGNATURE SERIES



TARGETTI MINITONDO

**THE SIGNATURE SERIES** Electroluminescent exit signs use an electroluminescent lamp—a .025-inch thick panel—that fits behind the faceplate of the sign and provides uniform illumination. The lamp generates little heat, so the lamp and nickel cadmium battery have life expectancies of up to eight years. A mounting canopy is provided for top and end mounting; back mounting does not require a canopy. Finishes are available in black, white, bronze, chrome, brass, and brushed aluminum. Lithonia Emergency Systems, a division of Lithonia Lighting, Conyers, GA. **Circle No. 52**

**MINITONDO**, a low-voltage miniature track system can be horizontally or vertically surface mounted or suspended. The system uses miniature 50-watt spotlights that feature a wide variety of design options. An adapter allows quick changes of the fixtures as well as the interchangeability of fixtures with all Targetti low-voltage systems. Targetti Inc., New York.

**Circle No. 53**

# Basic Fiber Optics: Systems and Applications

BY CHARLES LINN, AIA  
EXECUTIVE EDITOR

**A** number of manufacturers have introduced fiber optics products to the architectural lighting market within the last several years. These products offer many exciting possibilities, but to make the best use of them, designers need understand how they work, and exactly what they will and won't do.

## HOW OPTICAL FIBERS WORK

Optical fibers won't replace lamps. In fact, they require them for operation. What they will do is conduct light coming from a source very much the same way that a wire conducts electricity. An optical fiber can bend light in any

direction that the fiber itself is capable of bending. This allows the light source to be isolated in a convenient, remote location.

Fiber optics operate on the principle of *total internal reflection*. The idea is that if light is focused onto the end of a tube whose internal surface is a near-perfect reflector, almost all of the light that goes in one end of the tube will come out the other end, even if the tube is bent.

The light source for optical fibers used architecturally is usually either a halogen or metal halide lamp, focused on the ends of the optical fibers. It is also possible to use xenon

CONTINUED ON PAGE 48



PHOTO COURTESY OF LUMENYTE INTERNATIONAL CORPORATION

## APPLICATION IDEAS

### EXTERIORS—WET & OTHERWISE

**P**OOLS, PATHS, & PERIMETERS: Because the light source and wiring can be placed remotely, fiber optics is well suited to interior and exterior applications involving water—like pools and the pathways that surround them (left). The stepped, rounded architectural details of the Lake Eola Bandshell are accentuated at night by outlining them with fiber optics (below).

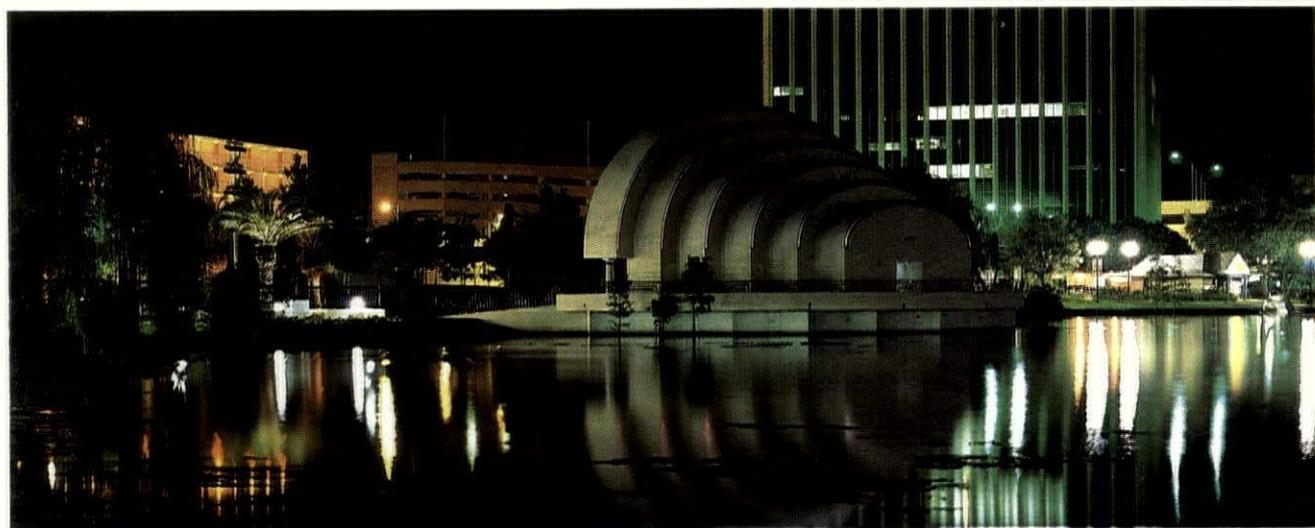


PHOTO COURTESY OF FIBERSTARS, INC.



PHOTO COURTESY OF LAZARUS LIGHTING DESIGN. FIBER OPTICS SUPPLIED BY LUMENYTE INTERNATIONAL CORPORATION.

## APPLICATION IDEAS

### DECORATIVE & ARTISTIC EFFECTS

**BIG WAVE & COOL JAZZ:** In 1989, artist Tony Delap designed and engineered "The Big Wave" architectural sculpture (above) in Santa Monica, CA. In 1990, Lazarus Lighting Design was commissioned to replace the original illumination. They used four ½-inch pieces of optics that span 150 feet, and are illuminated by eight 180-watt lamps in four custom collumators placed at the base of each side of the arch. A wall display in yellow and green graces the Jazz Bar (right) at Terminal One, Los Angeles International Airport.



PHOTO COURTESY OF FIBERSTARS, INC.

CONTINUED FROM PAGE 47

and laser sources, but these are generally considered to be cost prohibitive for architectural applications. The lamps and ancillary equipment—a transformer or ballast, a cooling fan, fuse or other thermal protection device, and sometimes a color wheel or other special effects equipment—are assembled into a single unit called an illuminator.

### OPTICAL FIBER MATERIALS

Optical fiber is available in a number of different types. Basically, all fibers are made up of a core material and a core coating, or "jacket." Fibers that are used for side-lighting are intended to permit some leakage. That is, their manufacturers use a jacket that permits light to be emitted along the entire length of the fiber, creating an effect that is similar to, though not as intense as, neon or cold cathode.

Other types of fiber are intended to emit light out of their ends only, producing a point of light at the end of the optical fiber. The core of these fibers is jacketed with a substance that

prevents light from leaking out of the sides of the fiber. The internal reflection of this type of fiber is more efficient, and most of the light put into the fiber escapes out its end.

The optical fibers used in architectural lighting applications are manufactured of plastic, usually acrylic or polystyrene. These materials are less expensive and easier to work with than the silica-based fiber used in telecommunications.

The two different types of optical fiber commonly utilized for side-lighting purposes vary in size and the way they are packaged. One manufacturer bundles a number of tiny fibers together inside a clear, flexible Lexan tube.

Other manufacturers use larger diameter fibers. Their standard sizes range from 3/16-inch to 1/2-inch diameters, although fibers as small as 1/16-inch and as large as 3/4-inch are also available.

CONTINUED ON PAGE 50

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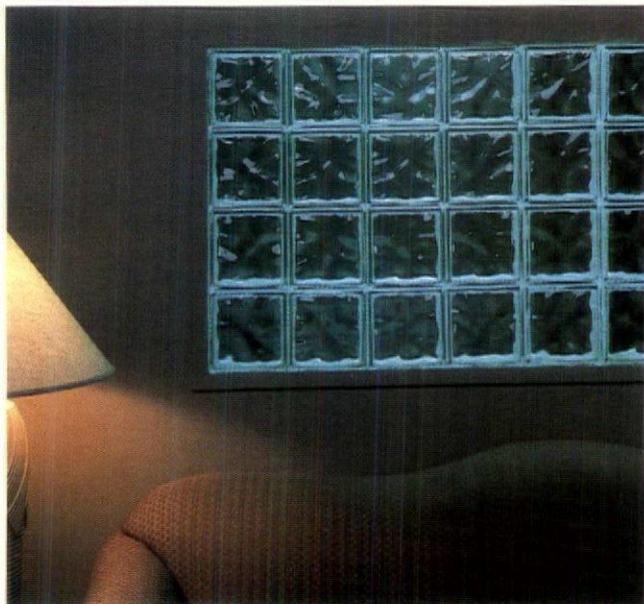
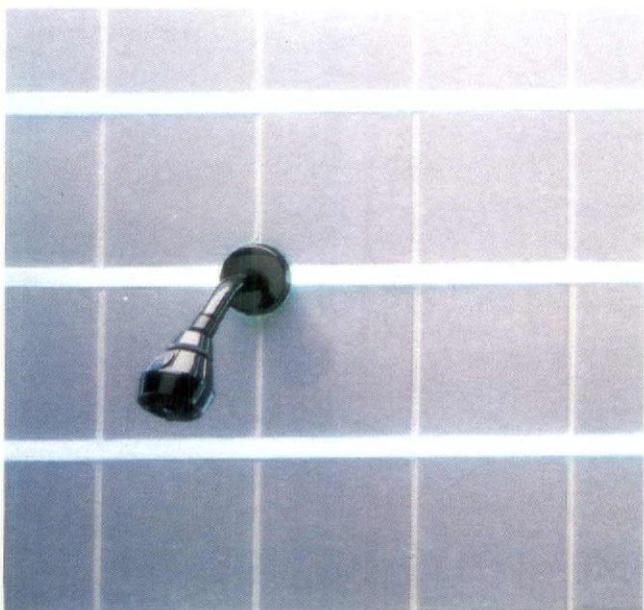


PHOTO COURTESY OF FIBER OPTICS DESIGN INC.

## APPLICATION IDEAS

### HOME & HOSPITALITY INTERIORS

**BARS, BLOCKS & BATHS:** Points of light peek through a bar top (above, right). The edges of glass block can be accentuated with colored light (top, left). Sleek, linear cove treatments can be used in a variety of living areas (center). Strips of fiber optics can be used safely in showers (below) and around whirlpools for fun or function.



CONTINUED FROM PAGE 48

### FIBER OPTICS ADVANTAGES

The advantages of using optical fiber as a means of transmitting light are several-fold.

*Optical fiber is safe*, carrying light, but no current. The fiber can be submerged in water without exposing users to the danger of electrical shock. The dangers of breakage possible with other linear light sources, such as neon or cold cathode, are eliminated.

*Optical fiber can be easily installed* in locations where it would be difficult or impossible to install an electric light source. It can also be safely installed in areas where vandalism might be a problem. The compact size of the product makes it suitable for location in small coves where a metal raceway fitted with lamps would not fit.

*When optical fiber is used as a point source*, as it is in many signage applications, one lamp can be used to supply light to many, many points. This eliminates a great deal of wiring, and the expense of servicing many lamps.

*Changing the color of light coming from the optical fiber* is as easy as changing the color of the light source itself. A blue gel placed between the light source and the end of the optical fiber will make the light emitted by the fiber blue as well. Often motorized, multi-colored filter wheels are placed between the lamp and fiber ends to produce a display that constantly changes colors. Strobing and dimming of the fiber is also as easy as strobing or dimming the light source.

*Fiber optic displays can easily be animated* by exposing the fiber ends to the light sequentially. Some firms build sophisticated shutter systems that enable end-lit optical fibers to achieve chasing effects, without the complicated control systems and wiring required when animating electric lamps.

*Installation is simple* with manufacturers of fiber optics

CONTINUED ON PAGE 52

# LIGHTING WORLD

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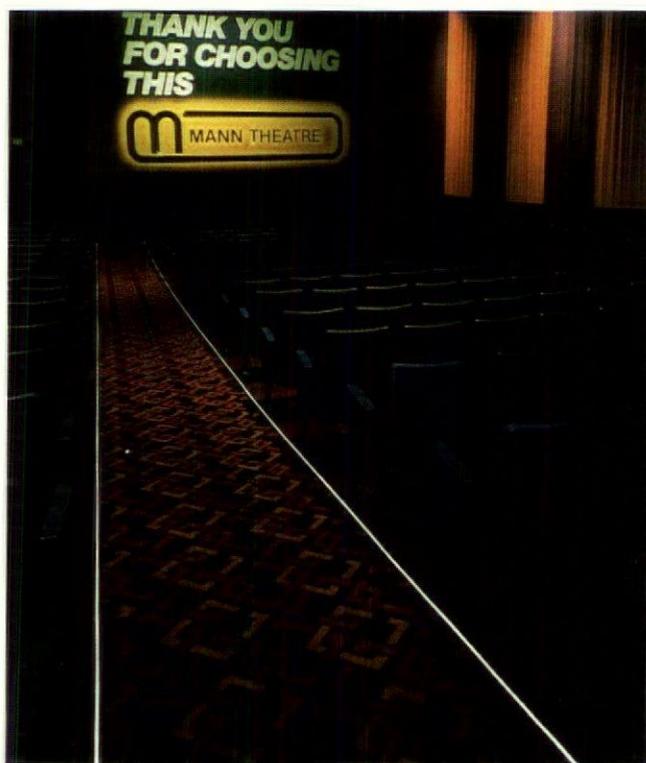


PHOTOS ABOVE AND BELOW COURTESY OF LUMENYIE INTERNATIONAL CORPORATION

## APPLICATION IDEAS

### SPECIALTY AREAS

**G**UIDING LIGHTS: Fiber optic in-ground illumination helps guide aircraft at helipads and airports (top). Fiber optics lead movie-goers safely to their seats in a darkened theater (below).



CONTINUED FROM PAGE 50

systems offering pre-engineered illuminators. They also provide a variety of mounting systems, which enable contractors, electricians, and even ambitious homeowners to install the simpler fiber optic systems themselves. Naturally, more complicated systems will require custom-built illuminators and the assistance of experts for installation.

### BRIGHTNESS IS RELATIVE

Although the efficiency of both the illuminator units and the optical fibers are improving, experts agree that users of fiber optics should not expect the product to be as bright as neon or cold cathode. The fiber optics are most effective in areas where there is little or no ambient light to overpower the light escaping the optical fiber. One manufacturer nicely summed up what designers can expect by saying, "Light from fiber optic cables is meant to be seen by the eyes, not measured by light meters."

### MOUNTING METHODS

Each manufacturer has invented its own system of mounting the optical fibers. Systems that use small multiple fibers bundled together are generally encased inside a Lexan housing, which may be either rigid or flexible depending upon the product application. The housing may be installed using silicon adhesive or clips, which can be secured using screws, nails, double-faced tape or a variety of other methods.

Larger fibers may be enclosed inside a housing and attached in a similar manner, or left entirely exposed. One manufacturer is now producing a product that allows the mounting device to be molded into the optical fiber jacket.

CONTINUED ON PAGE 54

**James L. Nuckolls Fund for the  
Education of the Lighting Professional**

---

**THE GOAL** To establish fully qualified lighting education programs at the university level.

# An Investment in the

**THE MISSION** To raise an endowment of \$250,000 and use the income to fund annual grants to university programs with courses in architectural lighting education. Grants were awarded to The Pennsylvania State University in 1989 and to the University of Virginia School of Architecture in 1990.

# Future of Lighting Design

**THE NEED** An additional \$140,000 in contributions to meet the goal.

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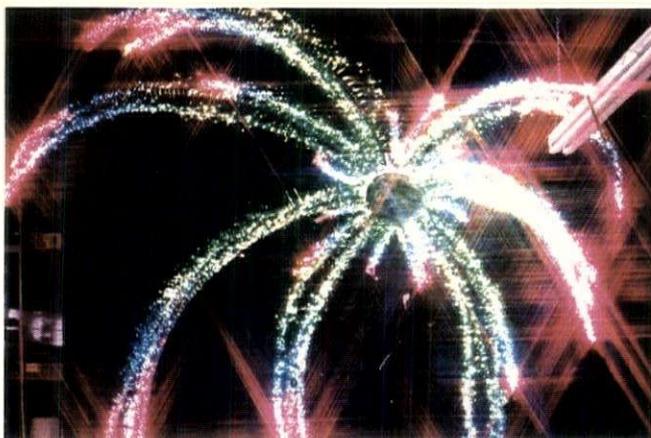
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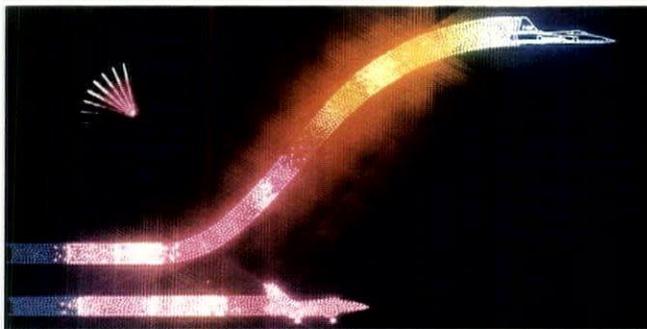
This ad space was contributed by Architectural Lighting magazine.



## APPLICATION IDEAS

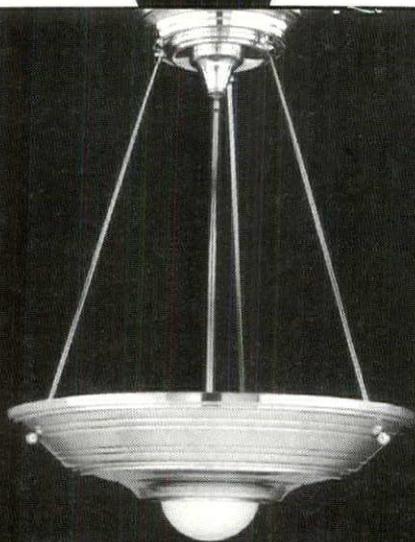
### SIGNAGE & DISPLAYS

**E**XPLODING COLORS: A 12-foot display of exploding fireworks has been built for the Walt Disney EPCOT Center in Florida. The partial display shown (left) has 82 miles of 30 ml optical fiber and is powered by one illuminator that contains ten, 75-watt lamps. Changing colors grab the attention of the viewers of MTV's visual display (below, left and center). Eye-catching airplanes serve as trade show exhibit signage for Northrop Corp. (below, right). Three hundred optical fibers punch up the power of the Mattel Power Glove backlit transparency display (opposite page).



PHOTOS ON PAGES 54-55 COURTESY OF LAZARUS LIGHTING DESIGN, WHICH DESIGNED FIBER OPTICS LIGHTING FOR THE DISPLAYS AS WELL

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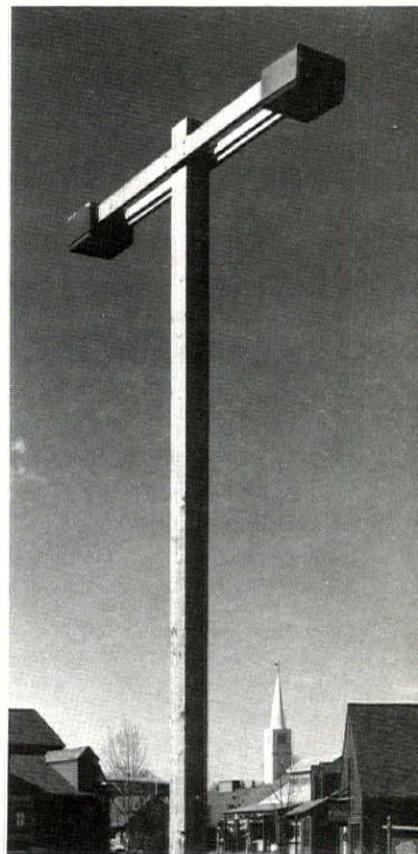
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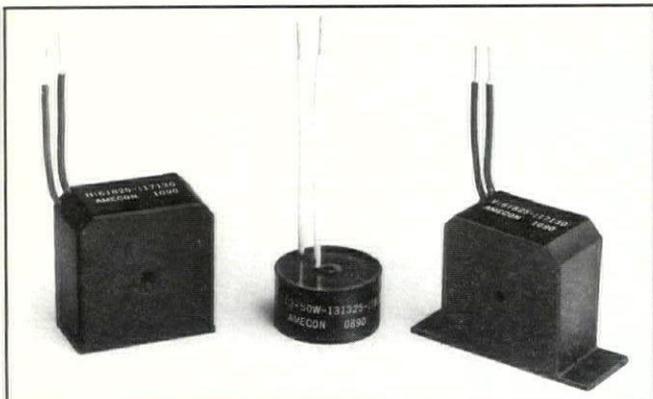


**PRESENT AND FUTURE DEVELOPMENTS**

The idea that fiber optics can be used to deliver light almost anywhere has not been lost on creative designers and entrepreneurs. One Japanese manufacturer has incorporated fiber optics into a device that delivers daylight into buildings using a sophisticated sun-tracking system (see *AL*, October 1987).

Another manufacturer is currently producing tiny suits made of fiber optic material worn by neonatal infants suffering from a disease called bilirubin anemia. Formerly infants suffering from the disease were isolated from their mothers for several days, while the disease was treated by exposing the child to intense light. Today, an infant wearing fiber optic clothing can be treated for the disease while living the first few days of life in a relatively normal manner.

Designers can look forward to improvements in the efficiency of the basic components that make up fiber optic systems for use in architectural lighting and an increasingly more sophisticated array of applications. Brighter, more efficient optical fibers, more efficient lighting sources, and improved mounting devices will be available in the near future, followed one day by computerized illuminators that control optical cable banked into displays, mimicking high resolution video screens. ■



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UL recognized materials. They're rated at 50 and 75 watts from 5 to 24 volts. Two models include (1) the high performance 2-1/16" square by 1-1/16" deep model with centerhole or vertical/horizontal mounting and (2) the standard performance 1-5/8" diameter by 7/8" deep circular model with centerhole mounting. Ask about our custom designs, too. Call, FAX or write for new Technical Bulletin/Selection & Design Guide ALC-0790.

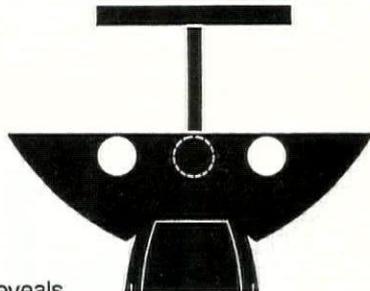


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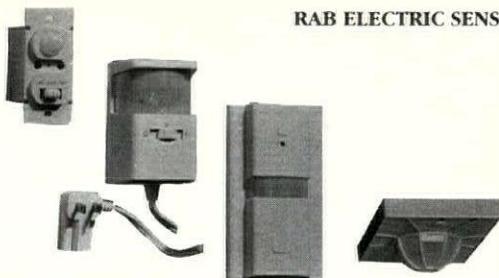
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## NEW PRODUCTS

### RAB ELECTRIC SENSORS

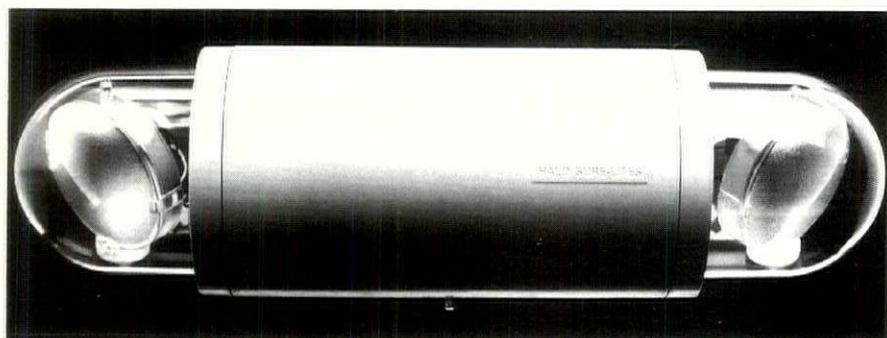


**OCCUPANCY SENSORS** to control indoor fluorescent and incandescent lighting from 300 to 4500 watts are available in various models. The LOS300 and LOS900 models replace existing light switches. The LOS2400 model can be installed in the ceiling and will cover a 50-foot  $\times$  50-foot area, and the LOS300P model is a plug-in sensor for controlling table and desk lamps. RAB Electric, Northvale, NJ. **Circle 62**



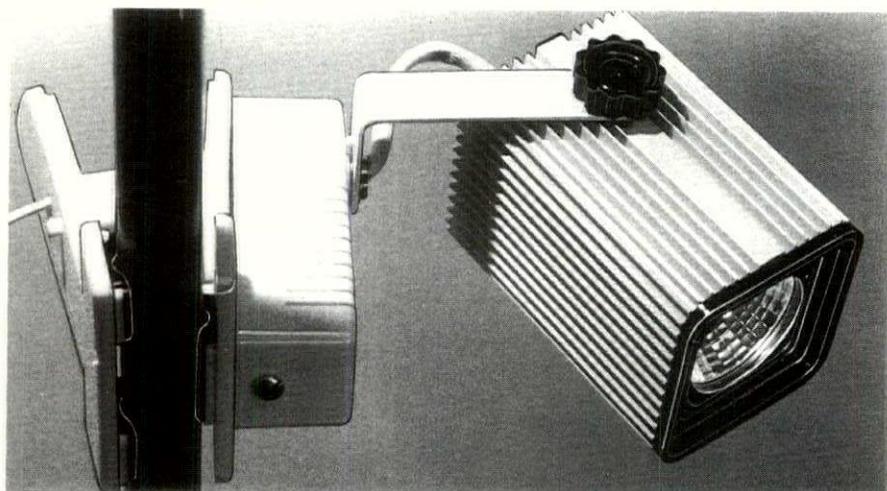
STONCO RML SERIES

**THE RML SERIES** Roadway Luminaire is available with HPS or metal halide lamps. The fixture is offered in several mounting arrangements and features sharp cut-off optics to minimize house-side throw and maximize street-side throw. The series seamless, one-piece diecast aluminum housing reduces the possibility of leakage and its architectural bronze polyester powder is damage-resistant. Stonco Lighting, Union, NJ. **Circle 63**



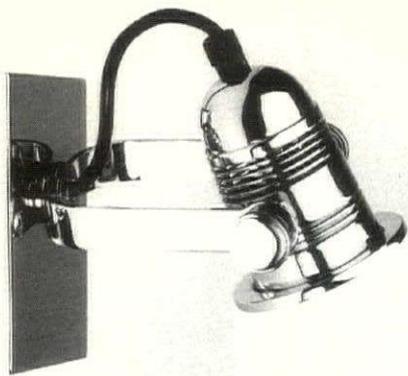
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**PRESTO EMERGENCY LIGHTS** measure 18 $\frac{1}{8}$  inches long and feature a wiring module that facilitates AC wiring connection in the J-box. A 5.4-watt wedge base incandescent lamp and a specular reflector that can be adjusted 180 degrees vertically and horizontally are located at each end of the housing. The unit's circuitry includes the latching, current limited charger, low-voltage disconnect, and overload and short circuit protection. Halo/Sure-Lites, Elk Grove Village, IL. **Circle 64**



ROXTER CLIP-ONS

**THE CLIP-ON HALOGEN LIGHT** weighs 1.5 pounds and can be used as a task light with a 50-watt halogen lamp. The clip-on opens to 1.5 inches for flat or round surface mounting, and a universal swivel allows for precise beam control. The fixture includes an 8-foot, two wire line cord, an on/off switch and a spot bulb. Roxter Manufacturing Corp., Long Island City, NY. **Circle 65**



NESSEN PRAGMA



AMERICAN LANTERN WILLIAMSBURG COLLECTION

**THE WILLIAMSBURG** "Style" collection of hand polished solid brass chandeliers is available in four sizes: 6-, 8-, 12-, and 18-light fixtures. American Lantern Co., Newport, AR. **Circle 66**

**MODEL NPW0540** of the Nessen/Pragma collection is crafted of solid brass, and features a 100-watt, 120-volt medium base halogen bulb or a 60-watt medium base incandescent bulb. The fixture has a spun glass diffusing shade and is available in polished chrome and black on special orders. Nessen Lamps, Port Chester, NY. **Circle 67**

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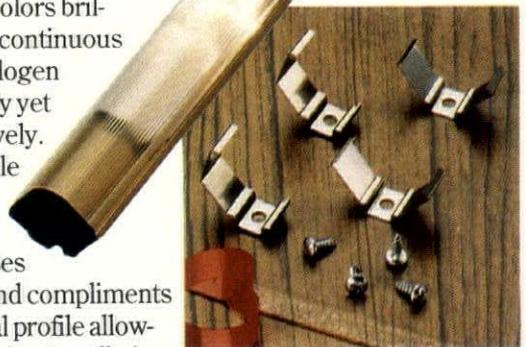
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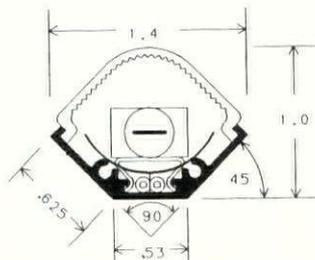


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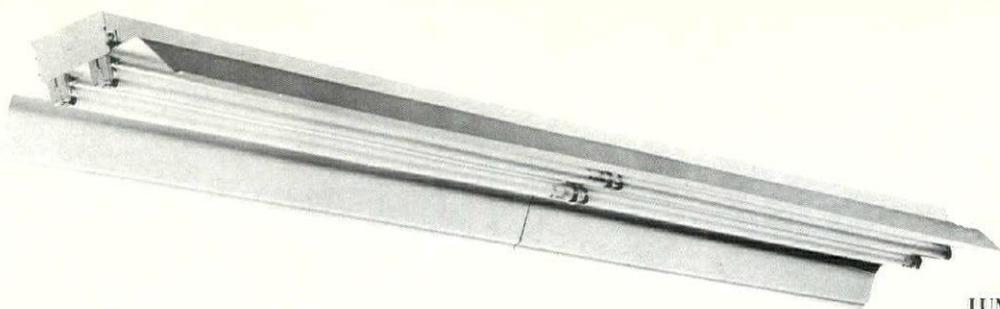
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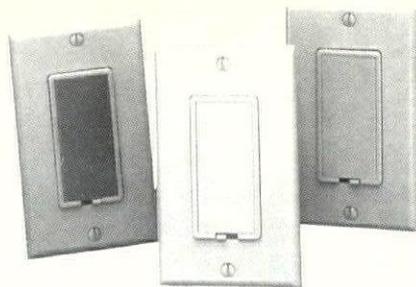
**THE OCTAQUAD 8-FOOT FLUORESCENT** fixture has four 4-foot T8 tri-phosphor lamps and a single electronic ballast. The fixture is available in open channel, industrial, and recessed open models, and offers reduced watt consumption, a longer lamp and ballast life, and a 105 lumens-per-watt system. Lumax Industries, Inc. Altoona, PA. **Circle 68**

**THE SUNTRACKER SERIES** of lighting controls electronically calculates the movement of the sun to turn lights on at dusk and off at dawn. The devices are available in one or two channel modes and both feature two SPDT relays, 15A resistive and inductive rating, 4-hour programming with skip-a-day, 365 day calendar, automatic daylight saving time and leap year adjustment, and 100 hours of battery carryover at 70 degrees Fahrenheit. Paragon Electric Co., Two Rivers, WI. **Circle 69**



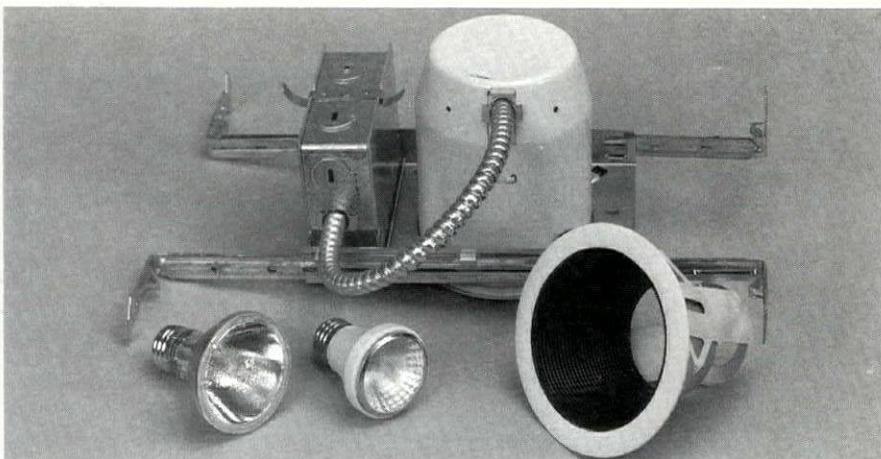
**PARAGON ELECTRIC SUNTRACKER SERIES**

**THE DECORA TOUCH DIMMER** is available in a wide range of colors and finishes. Now offered in white, ivory, gray, and black, the dimmers have a memory circuit that recalls the previous light level setting. Dimming and switching are accomplished by touching the metal plate. Leviton Manufacturing Co., Little Neck, NY. **Circle 70**



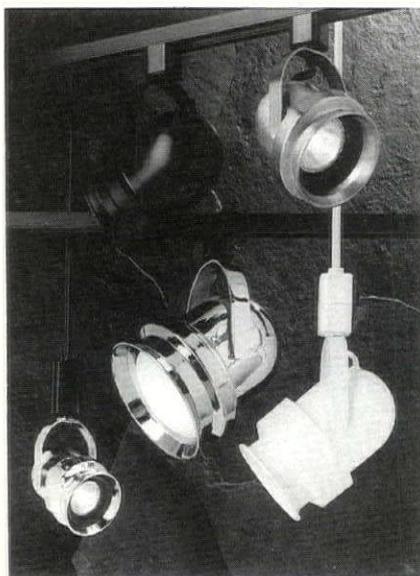
LEVITON  
DECORA DIMMER

**THE SMALL APERTURE** Downlight Series is a line of miniature recessed downlights designed for use with R 20 and quartz halogen PAR 20 and PAR 16 lamps. The fixtures have a 4-inch aperture for minimal disruption to the ceiling line. Also featured are die-cast aluminum trim rings, pre-installed locking bar hangers, Alzak reflectors, and a variety of trim styles. Prescolite, San Leandro, CA. **Circle 71**



PRESCOLITE SMALL APERTURE SERIES

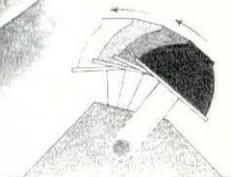
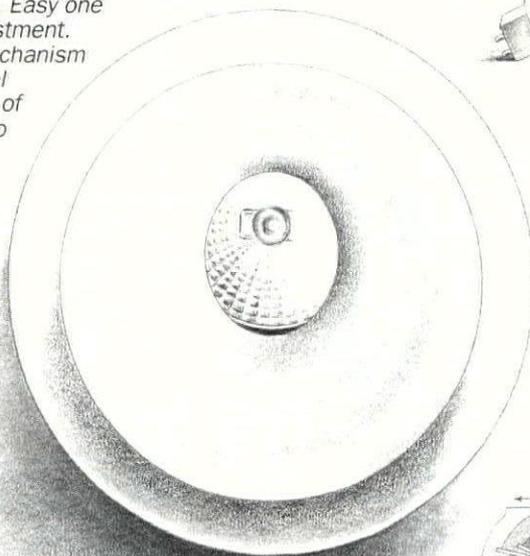
**THE NAUTILUS LINE** of bell-shaped, lantern-like track fixtures have adjustable yokes to better position and control light direction. Two of the fixtures in the line are low-voltage, using MR 16 lamps up to 50-watts, and the three other fixtures are line voltage. One takes R 20 lamps up to 75-watts, another accepts R 30 lamps up to 100 watts, and the third takes R 40 lamps up to 150 watts. All five models are available in black, white, polished brass, or antique brass finishes. Capri Lighting, Los Angeles. **Circle 72**



CAPRI NAUTILUS LINE

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*Adjustable accent light optimizes the popular MR-16 lamp. Our specially engineered reflector eliminates glare. Recessed depth is only 6 3/4". Easy one finger aiming adjustment. Unique locking mechanism guarantees original aim through years of relamping. We also offer a precisely designed MR-16 downlight with matching 4" aperture. Two new Standards from Edison Price. Call or write for further information and the name of your local representative.*



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**EMERGI-LITE  
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**ALVA LUNARAYL SYSTEM**



**THE LUNARAYL SYSTEM** includes standard black Rayl tubes, standard black Luna fixtures with recoil cords, remote and quiet transformers, and hangers for horizontal or vertical mounting. The tubes provide up to 1000 watts of 12-volt power and feature alternately controlled Luna fixture receptacles placed at 16-inch intervals. The Luna 111 low-voltage fixture is designed to accommodate the PAR lamp, and the Luna 16 is a compact, efficient MR 16 lampholder. Alva Lighting, San Francisco. **Circle 73**

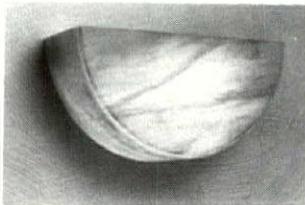
**THE SELF-POWERED TYPE 214 LIGHTMETER** makes field illumination measurements, is corrected for incident angle of light, and can be read directly in footcandles. A slide switch permits selection of one of three linear scales: 10-50 footcandles; 50-250 footcandles; and 200-1,000 footcandles. A ten-to-one multiplier attachment is included and allows the reader to make readings up to 10,000 footcandles permitting measurements in daylight conditions. The instrument comes with an instruction book that gives directions for making measurements of illuminance, luminance, and reflection factor. General Electric Co., Cleveland, OH. **Circle 74**

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Now there's a new freedom of choice in styles and colors of decorative sconces for contract lighting. We've combined the beauty of marble and the translucence of alabaster... but without their drawbacks. Elegant, durable LaMarbl', with PL fluorescents, offers an energy-saving, low-maintenance combination that fits easily into hospitality industry budgets.

See for yourself. Contact: LaMar Lighting Co., 80 Albany Avenue, Freeport, New York 11520. Tel: 516-379-4200. Fax: 516-379-4205.



**LAMAR**  
LIGHTING CO., INC.

LIGHTING THE HOSPITALITY INDUSTRY FOR OVER 30 YEARS

Circle No. 32 on product card.



**GE TYPE 214 LIGHTMETER**



**ROADWAY/AREA LIGHTING**

The Elements Line of roadway/area lighting is described in a 24-page, full-color catalog. The fixtures are available with arm mounting or a high-strength yoke mounting system. Two models feature acrylic or polycarbonate translucent domes, which provide a soft glowing accent. The fixtures also feature integral ballasts, extruded aluminum construction, and a high performance reflector design. Sterner Lighting Systems Inc., Winsted, MN.

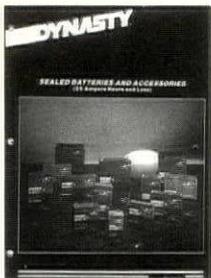
**Circle No. 54**



**POST-UP FIXTURE**

The Post-Up lighting unit for energy efficient LPS, HPS, and metal halide lamps features tool-free fingertip relamping, and is completely vandal resistant. The unit is prismatically designed for a 55-watt LPS lamp, and its high compression molded cover shields all direct uplight. Voigt Lighting Industries, Inc., Leonia, NJ.

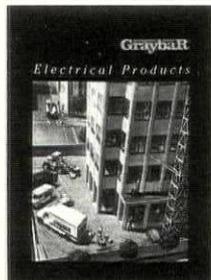
**Circle No. 55**



**SEALED BATTERY LINE**

An 8-page, full-color brochure describes the Dynasty line of sealed lead-acid batteries of 25 ampere hours and less. Technical, engineering, and installation data are included as well as details for a wide range of accessories including battery chargers and power packs. Dynasty batteries are maintenance free and designed to provide extended shelf and operational life in a compact, high-powered package. Johnson Controls, Inc., Special Battery Division, Milwaukee.

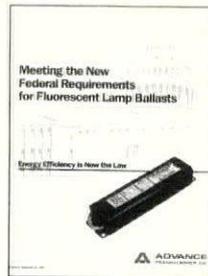
**Circle No. 56**



**ELECTRICAL CATALOG**

An 800-page catalog includes a selection of products and features a completely new section on power line conditioning, protection, and UPS products. Some of the categories addressed in the catalog are: wire and cable, conduit and enclosures; boxes, fittings, and wiring devices; lamps and lighting; and controls, timers, and motors. Graybar Electric Co., Inc., St. Louis.

**Circle No. 57**



**FEDERAL REQUIREMENTS**

A 16-page brochure, "Meeting the New Federal Requirements for Fluorescent Lamp Ballasts," provides current information on the provisions of the National Appliance Energy Conservation Act Amendment of 1988. Included is information on fluorescent lamp ballasts affected and exempted, and the schedule for compliance with the law's provisions. The brochure also contains formulas and accompanying power cost tables for computing energy savings and payback. Advance Transformer Co., a Division of North American Philips Corp., Rosemont, IL.

**Circle No. 58**



**AREA LIGHTING FIXTURE**

The ParkLane area lighting fixture is featured in a 4-page, four color brochure. The fixture is characterized by a one-piece integrated prismatic cube cone constructed of seamless acrylic. The fixture is available in 170 different shades of polyester powder as well as black or bronze anodized coatings. ParkLane may be used with HPS, metal halide, and mercury vapor lamps from 200 to 400 watts. Holophane Co., Inc., Newark OH.

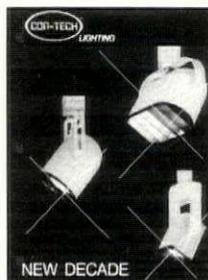
**Circle No. 59**



**QUARTZ PRODUCTS**

The 10-page, four-color "Fused Quartz" brochure highlights advanced quartz products and capabilities for the semiconductor and lighting industries. The brochure lists specific product grades, dimensional tolerances, and chemical analyses of fused quartz tubing. GTE Emissive Products, Exeter, NH.

**Circle No. 60**



**TRACK LIGHTING FIXTURES**

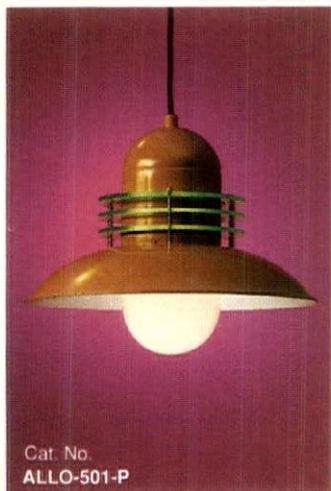
A 6-page color catalog describes the series of tracklight fixtures that are specifically designed to use tungsten-halogen mini-PAR 16, MR 16 low-voltage and T4 flood lamps. The brochure features two 120-volt mini cylinder flat back and round back fixtures, a 12-volt low-voltage flat black, round back, and fluted square fixture, and a louvered wall-wash fixture. Con-Tech Lighting, Deerfield, IL.

**Circle No. 61**

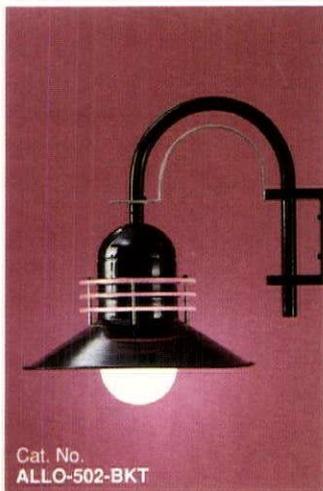
# LUMINOUS LIGHTING



Cat. No.  
ALLO-501-1A



Cat. No.  
ALLO-501-P

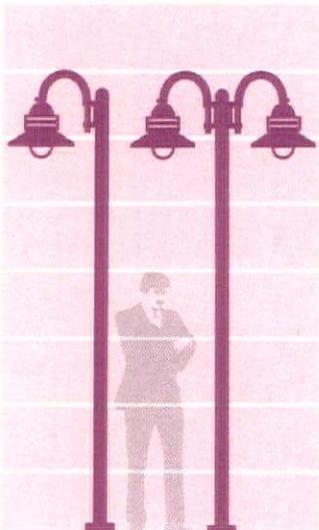


Cat. No.  
ALLO-502-BKT

## 3-RING REFLECTOR

Luminous Acrylic Rings

A functional/decorative luminaire with a new look in accent lighting, creating an optical illumination at the edge of an acrylic ring. Offered in H.I.D. or incandescent for exterior or interior applications.



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Circle No. 33 on product card.

# UPDATES



**SOUTHERN CALIFORNIA EDISON'S Customer Technology Application Center includes this industrial fixture area.**

## Lighting Design Center Aids West Coast Community

Because of the increasing importance that's been placed on high quality, energy-efficient business lighting, Southern California Edison has created a high tech demonstration center for use by its commercial and industrial customers, and the professional lighting design community.

The Lighting Design Center is one of six centers featured at Edison's Customer Technology Application Center located in Irwindale, CA. This 23,000-square-foot facility is a state-of-the-art complex that features the latest in energy-efficient appliances and lighting applications, as well as equipment designed to improve air quality.

"You can create, enhance, or visually destroy an environment just by the way it is lighted," says Jack Lindsey, a senior engineer and lighting specialist for Edison.

Customers, designers, and builders have the opportunity to visit the Lighting Design Center to observe demonstrations of assorted lighting products and techniques and see the effects of various lighting strategies. Designers also have the opportunity to visit Edison's Industrial Technology Center to observe demonstrations of state-of-the-art industrial lighting equipment and see firsthand how the equipment performs in distinct settings.

A variety of lighting is showcased. The Industrial Technology Center features three separate industrial lighting systems—fluorescent, metal halide, and high-pressure sodium. The entire area can be lighted with any one of the three systems.

In addition, 20 individual demonstration fixtures have been installed to show a variety of equipment such as high-pressure sodium aisle lighters, hazardous location fixtures, and high- and low-bay applications. Some fixtures have intentionally been misapplied to show the effects of ignoring good design practice.

Edison's customers in the manufacturing sector can bring their products to the facility to see how lighting can be used to ease the inspection process by using light sources and lighting techniques that make defects more visible. Customers

also can see how proper lighting can be used as a marketing tool to enhance the appearance of their products.

The Lighting Design Center employs many different fixture types and systems, including new low-brightness fluorescent parabolic troffers, compact fluorescent downlights, T 8 lamps, and commercially available metal halide and high pressure sodium downlights.

Large walk-in booths where the colors of various lamps can be compared are a highlight of the Lighting Design Center. These feature 60 fluorescent lamps in addition to both standard and color-improved high-pressure sodium, low-pres-

sure sodium, and several types of metal halide lamps, plus incandescent light sources.

Merchandise lighting is demonstrated in two areas. A full-size show window, complete with mannequin, shows how these important display areas can be effectively lighted with high-efficiency lamps and fixtures at wattage levels considerably below previous methods.

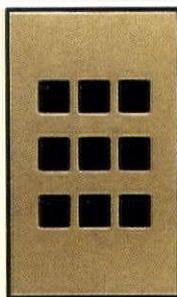
In addition, a large expanse of slot wall can be lighted by arrays of line- (120-volt) and low-voltage incandescet equipment, plus the new double-ended high-color rendering metal halide sources.

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# LiteTouch® 2000

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CONTINUED FROM PAGE 9

vide the optimal working environment.

Participants in the EPL Advisory Board, in addition to Mr. Churchill, include: Edward Friedrichs, vice president and managing principal of Gensler & Associates, Los Angeles, CA; John Harpest, electrical engineer at Heapy Engineering, Dayton, OH; Jerry Kugler, principal of Jerry Kugler and Associates, New York, NY; and Klaus Maack, managing director of Erco Leuchten Lighting, Germany.

## University of Colorado Gets Besal Grant

The Illuminating Engineering Society of North America is pleased to announce that the Robert J. Besal Memorial Education Fund, a trust established in 1982 to support illumination studies at selected universities, has expanded its scholarship

and faculty support program to a third university.

Rod B. Lee, chairman of the Besal Fund Committee, announced recently that the architectural engineering program at the University of Colorado has been selected as a Besal Fund recipient. Previous recipients are programs at the University of Kansas and Pennsylvania State University.

The committee selected the Colorado program after almost a year of review and deliberation. The selection indicates recognition of the university's lighting sciences curriculum and the efforts of Professor David DiLaura, director of the illumination studies program.

The Besal Memorial Education Fund is administered by the IESNA as part of the Lighting Research Institute's (LRI) Lighting Research and Education Fund (LREF). Proceeds are used to provide faculty assistance and scholarships to students. The fund has a principal of over \$1 million and is continuing to grow. Only the earnings of the fund are distributed.

The fund was established to honor the late Robert J. Besal, executive of Lithonia Lighting, whose career in the lighting industry spanned more than 30 years. ■

# MARKETPLACE

## CAREER OPPORTUNITIES

### ● GENERAL MANAGER ●

**Creative Designs In Lighting** is a growing leader in the architectural and theatrical design field, involved with on site lighting design solutions and theatrical productions.

We are seeking a take charge lighting professional to fill the position of General Manager. Responsibilities include, but are not limited to, overseeing the day to day operations, project management, and marketing.

The ideal candidate will possess a minimum of 5 yrs. experience in the lighting field with strong sales and management capabilities. Must have a high energy level and excellent interpersonal skills. Please send resume with salary history & requirements to: **Creative Designs In Lighting, 1900 E. Indian School Rd., Phoenix, Arizona 85016.**

### **Classified Directory:**

First line (boldface italics)  
 all caps or upper and lower case \$82.50/ea  
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 Mini-display Ad (3½" wide x 1" deep) \$160

**Situations Wanted:** \$60 for 4 lines per issue.

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## ACCENT AND DISPLAY LIGHTING (INTERIOR)

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## AREA LIGHTING (EXTERIOR)

EMCO LIGHTING, 7300 50th St., P.O. Box 1640, Milan, IL ..... 309-799-3111  
 SPRING CITY ELECTRICAL MFG. CO., Spring City, PA 19475 Call 215-948-4000 or Fax 215-948-5577  
 Historically authentic, cast iron ornamental lighting posts, bollards and adaptations.

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 ELECTRO-ELF, 10011 Olive St., Temple City, CA 91780 ..... 800-728-0081 Fax 818-579-1333  
 Energy Efficient Fluorescent lighting. Sealed Waterproof Fixtures available in many styles

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