

Education

B.S. Cum Laude, University of Newcastle. Thesis: "A Study of the Glare Characteristics of Locomotive Headlights" (United Kingdom, 1964)

Ph.D., Illuminating Engineering, University of Newcastle. Thesis: "A Study of the Factors Affecting Visual Performance under Industrial Lighting Conditions, with Particular Reference to Disability Glare and its Measurement" (United Kingdom, 1967)

Lighting Certified, (LC), Qualified Professional

Professional Positions Held

President and CEO, Lighting Sciences, Inc., Scottsdale, Arizona (1998-present)

President and Founder, Lighting Sciences Inc., Scottsdale, Arizona, USA, (1979-98)

President and Founder, Lighting Sciences Canada Ltd., Waterloo, Ontario, Canada, (1979-98)

Co-founder and Director, Lighting Sciences Australasia, Pty Ltd, Melbourne, Australia. (1984-92)

Principal, Director and Co-founder, Environmental Research Laboratories, Scottsdale, AZ (1973-79)

Research Director, Holophane Co., Newark, Ohio (1967-73)

Honors/Awards

1997 Medal of the Illuminating Engineering Society of North America. (The society's highest honor for technical contributions).

Louis B. Marks Award of the Illuminating Engineering Society of North America. (The society's highest honor for administrative contributions).

Fellow of the IESNA.

Distinguished Service Award of the IESNA.

Man of the Year, 2001. Aerospace Lighting Institute.

Honorary Life Member, Institution of Lighting Engineers, United Kingdom.

Keynote speaker, 25th quadrennial session of the CIE, "Light, Dark Skies and Space." San Diego, 2003.

Author of 5 of the selected 100 most significant technical papers in 100 years, IESNA centenary, 2006

Memberships

President, Illuminating Engineering Society of North America (IESNA). 1999-2000.

Member, Optical Society of America.

Member, American Institute of Physics.

Member, International Society for Optical Engineering, (SPIE).

Member of the U.S. National Committee of the International Commission on Illumination (CIE).

Member, Society of Automotive Engineers, (SAE).

Chairman of the IESNA Roadway Lighting Committee, 1994-1996.

Chairman of the IESNA Board of Fellows, 1989-90.

Chairman of the IESNA Medal Award committee, 2004-2005.

Chairman of the IESNA Marks Award committee, 2001-2002.

Director of the Illuminating Engineering Society of North America, 1985-86.

Alternate Director for the United States, CIE Division 2, Measurement of Light and Radiation, 1992-2007.

Member and past-chairman, Testing Procedures Committee of the IESNA.

Member of IESNA committees: Standard Practice Subcommittee, Research Subcommittee, and Measurements and Calculations Subcommittee, Roadway Lighting Committee.

Member and past-Chairman of the Lamp Spectral Effects Committee of IESNA.

Chairman of the Sign Lighting Subcommittee of the Roadway Lighting Committee of IESNA.

US representative to CIE Committee on "Photometry of Luminaires" Standard.

US representative to CIE Committee on "Lighting and Crime."

Teaching Positions

Gateshead College of Technology, United Kingdom. Instructor in Lighting Technology, intermediate and advanced courses. (1964-67)

Arizona State University. Faculty member, School of Architecture, Illuminating Engineering courses. (1979-82)

Instructor in numerous courses sponsored by the Illuminating Engineering Society, the Electric League, and Edison Electric Institute. (1967-present)

Examples of Research and Product Development:

1. Exterior lighting systems for NASA International Space Station: Development of multiple designs for outer space operation
2. Development of FAA Advisory Circular for use of Light Emitting Diode (LED) devices on airport taxiways
3. Mag-Lite® – variable beam optical systems with moving lamp for flashlight
4. Research on the relationship between lamp color, safety and security
5. Modular Wallpack luminaire, refractor and mechanics. (Holophane Module 600)
6. High Intensity Discharge luminaire for highway signs. (Holophane Expresslight)
7. Light trespass research, (for Edison Electric Research Institute)
8. Space Shuttle Orbiter - optical systems for fluorescent and incandescent floodlights
9. Space Shuttle Orbiter – cockpit enunciator display control lenses
10. Development of a scene luminance photometer using digital photography
11. Dental lighting optical system for examination light
12. Roadway luminaire reflectors for cut-off luminaires. (Patented)
13. Parabolic specular louvers for interior lighting. (Patented)
14. Downlight lens and louvers for interior lighting. (Patented)
15. 3-E lens for high efficiency, widespread distribution interior lighting. (Patented)
16. Triumph I lens for discharge lamps, with high efficiency, widespread distribution. (Patented)
17. Wall mounted refractor/reflector optical system. (Patented)
18. Anti-reflection interference coatings for metal substrates. (Patented)
19. High reflection interference coatings for glass substrates. (Patented)
20. High efficiency digital display signs
21. High mast system reflector optics for highway interchange lighting
22. Indirect ambient lighting optical systems for offices. (3 Patents)
23. Underwater floodlighting systems for unmanned submarine surveillance, U.S. Navy
24. Floodlight optics for sports lighting. (Hubbell Lighting)
25. Development of computerized mirror goniophotometer systems
26. Development of automated spectroradiometer system for ultraviolet, visible and infrared measurements for Bureau of Radiological Health, US Food and Drug Administration
27. Computerized design system for automotive headlights. (Sylvania)
28. Design of compression molding facility for lens prototypes
29. Hydroponic plant growth under artificial illumination. (General Mills)
30. Development of square distribution area lighting optics
31. Floodlight reflector design for 3 KW metal halide lamps for open pit mining
32. Projection screen optics for large screen television
33. Sun tracking reflectors for reusable solar energy system
34. Aircraft lighting systems for Boeing 757 and 777 aircraft
35. Compliance testing program for automotive lighting devices. U.S. Dept. of Transportation, National Highway Safety Administration, 1985 - on

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36. Optical system for surgical illumination. (American Sterilizer)
37. Research of traffic signal optical and electrical efficiency, Federal Highway Administration
38. System of 480 moving mirrors under computer control for daylighting capture, Bank of Hong Kong and Shanghai
39. Development of traffic signals using Light Emitting Diodes (LED's)
40. Daylighting and building energy monitoring system for improved energy usage
41. Development of outdoor lighting optical controls for use in the vicinity of astronomical observatories
42. Design of tunnel lighting luminaire with asymmetric distribution
43. Research and development of a new navigational lighting system for ships, U.S. Navy
44. Development of airport lighting optics for runway delineation
45. Development of anti-collision warning system for aircraft
46. Development of computerized electrical test apparatus for luminaires and ballasts
47. Visibility research on battlefield decoys & camouflage, U.S. Army, Fort Belvoir
48. Development of a self-leveling photometer for street lighting measurements
49. Design of landing and taxing lights for the F16 aircraft, U.S. Air Force
50. Research and development of a portable photometer to measure traffic signal performance, Federal Highway Administration. (Patented)

Technical Papers

(Acronym key at end of list)

1. *Absolute Photometry has Relative Benefits for LED and SSL Performance Evaluation.* LEDs Magazine, July/August 2008.
2. *Improved Techniques in Aviation Photometry and Optical Design.* Proceedings of the Aviation Lighting Institute, February 2008.
3. *Lighting Energy Efficiency – Visibility Effectivity Correlation.* American Society of Engineering Education. Annual conference proceedings, 2005.
4. *Security and Parking Lot Lighting – The CalPoly Experiments.* Paper to the IESNA Roadway Lighting Committee, April 2006.
5. *An Economic Study of Three Light Sources.* Paper to the IESNA Roadway Lighting Committee. Spring 2004. To be published.
6. *A Long and Winding Road. (The History of Street Lighting).* LD+A, December 2004.
7. *Roadway Lighting: An Investigation and Evaluation of Three Different Light Sources.* Final report to the Arizona Department of Transportation. May 2003.
8. *Lighting in Outer Space.* Proceedings of the 25th quadrennial session of the CIE. San Diego, June 2003.
9. *Lights that Circle the Earth.* LD+A, July 2003.
10. *Skylights as Luminaires: PIER Skylight Photometric Test Results.* Paper to the IESNA Annual Conference, August 2002.

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11. *Lamp Color Influences Energy Usage and Night Safety.* Proceedings of the Intertech Conference on Energy Efficient Lighting, Tucson, Arizona 2002. Leukos JIES, January 2005.
12. *Photometric Test System for Skylights and Luminaires.* Leukos, JIES. Vol. 1 no.3. January 2005.
13. *Towards an Understanding of Lamp Spectral Effects at Night.* Proceedings of the 2002 Conference of the IES of Australia and New Zealand, Sydney.
14. *White versus Sodium Light: The Newest Developments.* Proceeding of the ILE Annual Conference, Cardiff, Wales, 2002.
15. *Lamp Color Affects Visibility.* Luce Journal, Italy, 2001.
16. *Minimizing Light Trespass – Comparing Fixtures.* Electrical Contractor, July 2001.
17. *Light Trespass – What Does It Mean for Electrical Contractors?* Electrical Contractor, July 2000.
18. *Light Trespass – Research, Results and Recommendations.* Publication TM11 of the IESNA, New York, 2000.
19. *Light Trespass and Light Pollution – Practical Approaches to Dealing with the Problems.* Proceedings of the IESNA Street and Area Lighting Conference, 2000.
20. *Aspects of Recent American Research in Lighting Technology.* Proceedings of the Joint Conference of ILE and CIBSE, York, England, 2000.
21. *Lamp Color, Visibility, Safety and Security.* Seminar proceedings, Lightfair, May 2001, 2002, 2004
22. *IESNA Approved Method for the Photometric Testing of Fiber Optics Lighting Systems.* IESNA Publication no. LM-73-02.
23. *Lumen Effectiveness Multipliers for Outdoor Lighting Design.* Journal of the IESNA, Summer 2001
24. *Light Trespass Research.* Final Report to the Lighting Research Institute, 2000
25. *Metal Halide Lamps - A Technology Review.* Aerospace Lighting Institute Seminar, January 2000, Conference Proceedings
26. *Photometrics of Fiber Optic Systems.* Proceedings of Lightfair 2000, New York
27. *Should Vision Influence Roadway Lighting Design?* Better Roads Journal, US Federal Highway Administration, October 1999
28. *Visibility Factors in Outdoor Lighting Design.* Institution of Lighting Engineers Conference Proceedings - Portsmouth, UK, 1999
29. *Accuracy of CCD (Digital Camera) Photometric Testing.* Council on Optical Radiation Measurement, 1999
30. *Development & Analysis of a Pedestrian Crossing Warning System.* Journal of the IESNA, Summer 2000
31. *Improved Luminaire Performance by Use of Reduced Envelope Metal Halide Lamps.* IESNA Conference, 1999
32. *Optical Component Relationships in the Design of Efficient Fiber Optic Illuminators.* Journal of the IESNA, Winter 2000.
33. *Road Scholar (The influence of lamp type on driver visibility at night).* LD+A, March 1999
34. *Photometric & Optical Methods of Lamp Analysis.* Society of Automotive Engineers (SAE) 1998. SAE transaction

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35. *Lamp Spectral Effects at Roadway Lighting Levels.* The Lighting Journal (UK-ILE), 1999
36. *Luminaire Photometry Using Video Camera Techniques.* JIES, Winter 1999
37. *Advanced Techniques in Lamp Characterization.* International Society for Optical Engineering, (SPIE), Conference Proceedings, 1997
38. *Backlighting for Direct View & Projection Displays.* Information Display Journal, Vol. 13. No. 11, November 1997
39. *Lighting On Three Continents.* CIE/SANCI International Conference Proceedings, South Africa, 1997
40. *Accuracy Analysis of Video-based Light Measurement.* SAE 1997 Congress Proceedings
41. *On the Road Again (Visibility-based lighting design for improved road safety).* LD+A May 1996
42. *Advances in Measurement Technology for Vehicle Lighting Systems.* SAE Congress Proceedings, 1996
43. *The Design of Illumination Optics: Hardware and Software Aids.* Optical Society of America, 1995 Annual Conference Proceedings
44. *The Design-Link for Aerospace Lighting.* Proceedings of the Aerospace Lighting Institute Conference, February 1995
45. *High Accuracy Photometry Using CCD Technology.* International Society for Optical Engineering, (SPIE), Conference Proceedings, 1995
46. *Optical Design Applications for Enhanced Illumination Performance.* International Society for Optical Engineering, (SPIE), Conference Proceedings, 1995
47. *The Application of Light Emitting Diodes to Traffic Signals.* JIES, Winter 1996
48. *Monte Carlo Techniques for the Design of Illumination Optics.* Paper to the IESNA annual conference, 1995
49. *Requirements for Application of Light Emitting Diodes (LED's) to Traffic Control Signals.* NCHRP Digest, (US Government), January 1995
50. *The Design-Link: Advances in Automotive Lighting Design, Measurement and Quality Assurance.* Conference of the Lighting Committees, SAE. Santa Fe, November 1994
51. *The Development of a High Performance LCD Backlighting System.* Conference Transactions of the Society for Information Display, SID 1994, May 1994
52. *Design Technologies for Flat Panel Display Backlighting.* Aerospace Lighting Institute, February 1994, Conference Proceedings
53. *Liquid Crystal Displays - Meeting the Lighting Challenge.* LD+A, July 1994
54. *Understanding and Using Photometric Test Reports for Interior Lighting. Part 1. The Basics.* Published by Lighting Sciences Inc. 1993
55. *Principles of Liquid Crystal Display Backlighting.* SID seminar publication 1993
56. *Measurement of Small Target Visibility and Visibility Level and the Reasons for Possible Deviations.* Proceedings of the Lighting Research Institute Symposium on STV. October 1993
57. *Backlighting Technology for Color Liquid Crystal Displays.* Aerospace Lighting Institute, February 1993, Conference Proceedings
58. *Where No Luminaire Has Gone Before.* (Exterior Lighting of the NASA International Space Station), LD+A, December 1993
59. *The Design of Metal Halide Lamps for Space Station Freedom.* JIES, Summer 1993

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60. *Exterior Lighting Systems for Space Station Freedom.* Proceedings of the Aerospace Lighting Institute Conference, 1992
61. *Video Photometry for Quality Control.* LD+A, January 1992
62. *Aviation Lighting Systems for the Space Station.* Proceedings of the IESNA Aviation Lighting Conference, 1992
63. *Light Trespass: Problems and Directions.* LD+A, June 1992
64. *Photometry of Traffic Signal Output Using a Portable Traffic Signal Photometer.* National Research Council Symposium, Washington, DC, June 1992
65. *Development of a Portable Traffic Signal Photometer.* (Federal Highway Administration sponsored), JIES, Winter 1992
66. *Application of Video Camera Techniques to Photometry.* LD+A, January 1992
67. *American Techniques in Outdoor Lighting Design.* Lighting Journal, (UK), Sep. 1992
68. *Near Field Photometry: Part 2.* Lighting Magazine, Canada, 1991
69. *New Directions in Automotive Lighting Photometry.* SAE conference, San Antonio, Texas, April 1991
70. *Using Video Cameras in Photometry.* Lighting Magazine, Canada 1991
71. *Photometry: How Near, How Far?* Lighting Magazine, Canada, February 1991
72. *Further Developments in Tunnel Lighting Computations.* JIES, Winter 1991
73. *Lamp and Ballast Effects on HID Luminaire Performance.* Lighting Magazine, Canada, April 1990
74. *Lens Development for Improved Performance of Daylighting Systems.* JIES 1990
75. *Improving Standards in Roadway Lighting Design.* Lighting Magazine, Canada, 1990
76. *Changing Standards in Outdoor Lighting Design.* Lighting Magazine, Canada. June 1988
77. *Integrating New Technologies into the Lighting Industry.* 1989 Joint Lighting Conference of the IES of New Zealand and Australia; Auckland, New Zealand, November 1989. Lighting in Australia Journal, April 1990
78. *Development of New Photometer Concepts for Quality Control Applications.* JIES, Summer 1990
79. *Optical and Energy Efficiency of Signal Lights.* LD & A, January 1989
80. *The Use of Microcomputers in Roadway Lighting Design.* Paper to the Edison Institute Street and Area Lighting Workshop, Boston, MA, September 1989
81. *Relating Candlepower and Lumens.* Lighting Magazine, Canada. August 1989
82. *Thermal Effects on Fluorescent Luminaires.* Lighting Magazine, Canada. June 1989
83. *How Valid are Luminaire Spacing Criteria?* Lighting Magazine, Canada. Vol. 3, No 1, February 1989
84. *Specifying Reflector Materials.* Lighting Magazine, Canada. Vol. 3, No 2, April 1989
85. *An Index of Lamp Hiding Power for Lensed Fluorescent Luminaires.* JIES, Winter 1989
86. *Taking the Mystery out of Photometric Test Reports.* Lighting Magazine, August 1998
87. *Automated High Speed Photometry of Aviation Lights.* Transactions of the Aviation Lighting Conference, IESNA, October 1988
88. *Reading Photometric Test Reports: The Fundamental Four.* Lighting Magazine, Canada. Volume 2, Number 4, August 1988

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89. *Reading Photometric Reports: Luminaire Efficiency.* Lighting Magazine, Canada. Volume 2, Number 5, October 1988
90. *Photometric Reports: The Absolute Truth or Just Relatively Speaking?* Lighting Magazine, Canada. December 1988
91. *Real World Use of Photometric Test Reports.* January 1988, Lighting Design and Application
92. *Luminaire Quality Control in the Microcomputer Age: Part 2. Lighting Design by Microcomputer.* Lighting Magazine, Canada. Volume 2, No. 2, April 1988
93. *Specification Methods for Reflector Materials.* 1988 IESNA Annual Conference
94. *Luminaire Quality Control in the Microcomputer Age: Part 1. Electrical Testing.* Lighting Magazine, Canada, February 1988
95. *Luminance Calculations for Tunnel Lighting Systems.* JIES, Winter 1988
96. *Photometric and Field Performance of Metal Halide Luminaires.* JIES, Winter 1988
97. *Optical Design of Airport Lighting.* Transactions of the Aviation Lighting Conference, IESNA, October 1987
98. *Setting the Standards for Visual Comfort.* Lighting Magazine, Canada, December 1987
99. *A Computer Standard for Lighting Designers.* Lighting Magazine, Canada, Volume 1, No. 2, September 1987
100. *Who Writes the Standards?* Lighting Magazine, Canada, Volume 1, no. 1, June 1987
101. *Variables in HID Luminaire Photometry.* Paper to the Commission Internationale de l'Eclairage, (CIE), Venice, June 1987
102. *Photometric and Field Performance of High Pressure Sodium Luminaires.* JIES, Summer 1987
103. *Computer Simulation for Optical Design.* Transactions of the Aviation Lighting Conference, IESNA, October 1986
104. *Hong Kong Bank Scoops the Sun.* LD+A, November 1986
105. *Control of Light Pollution - An Engineer's Viewpoint.* Proceedings of the International Conference on Identification, Optimization and Protection of Optical Telescope Sites, May 1986
106. *Using Microcomputers in the Lighting Industry.* LD+A, June 1986
107. *The Optical and Energy Efficiency of Traffic Signals.* Public Roads, (Federal Highway Administration). December 1985, Vol. 49, no. 3
108. *Performance Characteristics of Fluorescent Lamp and Ballast Combinations.* JIES, October 1983, Volume 13, No. 11
109. *Optimization Techniques for Outdoor Lighting Design.* LD+A, March 1983
110. *The Effect of Room Obstructions on the Calculation of Inter-reflected Components.* IESNA Annual Technical Conference. 1982
111. *Solar Lighting Using Sun Tracking Reflectors.* IESNA Annual Technical Conference, 1981
112. *Optical Radiation Emissions from Selected Sources.* Project final report to the Bureau of Radiological Health, US Food and Drug Administration, 1980
113. *Improved Techniques for Luminaire Photometry.* IESNA Annual Technical Conference, 1980
114. *A Designer's Guide to Illumination Optics.* Optical Spectra, November 1979
115. *Developments in High Speed Photometry and Spectroradiometry.* JIES, July 1979
116. *Theoretically Speaking.* LD+A, January 1977

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117. *New Techniques for Reflector Design and Photometry.* JIES, July 1977
118. *Computer Design of Luminaires.* LD+A, August 1977
119. *An ESI Study for Different Tasks.* JIES, October 1976. IESNA Transaction
120. *ESI Computation Becomes More Versatile and More Useful.* LD+A, November 1976
121. *Computerized Methods for Outdoor Lighting Design.* LD+A, December 1975
122. *Computer Modeling of Illumination Systems.* Proceedings of the Lighting Energy Symposium, US Federal Energy Authority, October 1975
123. *Computerized Methods of Outdoor Lighting Design.* LD+A, April 1975
124. *Automating Point-by-Point Illumination and ESI Computations.* LD+A, August 1974
125. *A Proposal for ESI Ratings.* JIES, April 1974. IESNA Transaction
126. *Advances in Luminaire Photometry.* Optical Spectra, October 1974
127. *ESI and Polarized Photometry.* LD+A, January 1974
128. *A Luminance Approach to Highway Sign Lighting.* JIES, January 1974. IESNA Transaction
129. *The Application of ESI Predetermination Techniques.* JIES, April 1973. IESNA Transaction
130. *RQQ Report No. 5 - Its Use and Meaning.* LD+A, January 1973
131. *The Determination of Luminaire Projected Area.* JIES, July 1973
132. *Visual Comfort Probability - For All Luminaires.* LD+A, March 1973.
133. *Outdoor Lighting and Astronomy - A New Problem.* LD+A, July 1973
134. *New Concepts in Direct Glare Control.* JIES, April 1973. IESNA Transaction
135. *The Effect of Illumination Systems upon Visual Performance.* US National Bureau of Standards Special Publication 361, vol. 1, March 1972
136. *Veiling Reflection Control.* Electrical Consultant, November 1971
137. *Numerical Evaluation of Veiling Reflections.* Proceedings of the Commission Internationale de l'Eclairage (CIE). Barcelona, 1971
138. *Luminaire Design Related to Visibility.* IEEE conference proceedings, October 1971
139. *Veiling Reflection Control by Candlepower Distribution.* Illuminating Engineering, October 1970. IESNA Transaction
140. *Physical Factors Affecting Visual Performance.* Optical Spectra, Nov/Dec 1969
141. *The Human Eye.* Optical Spectra, 1969
142. *Photometric Units and Terms.* Optical Spectra, 1968
143. *Luminance Measurement by Photographic Photometry.* Illuminating Engineering, November 1968. IESNA Transaction
144. *A Basis of Luminance Design for the Lighting of Road Tunnels.* Commission Internationale de l'Eclairage, (CIE), Washington, D.C., 1967.

References:

CIE:	Commission Internationale de l'Eclairage (International Commission on Illumination)	LD+A:	Lighting Design and Application
IEEE:	Institution of Electrical and Electronics Engineers	NCHRP:	National Cooperative Highway Research Program
IESNA:	Illuminating Engineering Society of North America	SAE:	Society of Automotive Engineers
ILE:	Institution of Lighting Engineers (UK)	SANCI:	South African National Conference on Illumination
JIES:	Journal of the Illuminating Engineering Society of North America	SID:	Society for Information Display
		SPIE:	International Society of Optical Engineering

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Patents Held

1. US patent no. 3,763,369	Refractive Grid lens	Optical grid for concentration of light from a lighting fixture, removing glare.
2. US patent no. 3, 988,609	Fluorescent lens	Means of providing high efficiency control from fluorescent fixtures
3. US patent no. 4,065,667	Indirect luminaire	Reflector system for providing work plane illumination by reflecting light from room surfaces
4. US patent no. 4,173,778	Optical coatings for illumination systems	#1 of four patents covering unique applications for control of visible and infra-red radiation in high efficiency optical systems
5. US patent no. 4,112,483	Optical coatings for illumination systems	#2 of four patents covering unique applications for control of visible and infra-red radiation in high efficiency optical systems
6. US patent no. 4,310,876	Optical coatings for illumination systems	#3 of four patents covering unique applications for control of visible and infra-red radiation in high efficiency optical systems
7. US Patent no. 4,081,667 .	Optical coatings for illumination systems	#4 of four patents covering unique applications for control of visible and infra-red radiation in high efficiency optical systems
8. US patent no. 4,229,782	High Intensity Discharge	Reflector system for ambient lighting
9. US patent no. 4,344,111	High Intensity Discharge	Reflector system for ambient lighting with cut off
10. US patent no. 4,262,326	Lens	For control of High Intensity Discharge lamp
11. US patent no. 4,388,675	Luminaire	Fluorescent, indirect
12. US patent no. 4,383,289	Optical system	Forward throw optical system
13. US patent no. 4,575,788	Segmented luminaire	Refractor/reflector system for providing adjustable lighting patterns
14. US patent no. 4,652,851	Signal	Method for providing high efficiency signaling device
15. US patent no. 4,559,587	Wall mounted luminaire	High efficiency wall mounted area lighting system
16. US patent no. 4,564,888	Wall wash lighting system	Luminaire for even illumination of vertical surfaces

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17. US patent no. 4,703,405	Glare reducing lens	Improved lens system for reducing glare and providing improved lamp hiding power
18. US patent no. 5,149,191	Lens/Louver	Combination for interior lighting
19. US patent no. 5,185,637		Portable traffic signal photometer
20. US patent no. 5,278,737	Lighting unit	Wall and ceiling lighting unit
21. US patent no. 4,709,312	Reflector	Improved floodlight reflector
22. US patent no. 4,059,754	Louver	High efficiency specular louver
23. Applied/Pending	Night metering system	NightMeter light trespass metering system
24. Applied/Pending	Lens	Applicable to roadway and area lighting luminaires

Expert Witness Services

30 years of experience working for plaintiff and defense, over 100 cases, including more than 40 depositions. State and federal court testimony.

Consulting, visibility reconstruction, light measurement, standards interpretation. Patent suits. Scientific and technical matters related to light, vision and lighting equipment.

Casework includes:

- Traffic accidents: pedestrians, bicycles, automobiles, tractor-trailers
- Trip-and-fall accidents
- Assault and murder
- Photography and visibility representation
- Patent infringement Validity: Prior art and obviousness
 Infringement, non-infringement
 Markman claim construction
 Enablement
- Restriction of trade
- Breach-of-contract

References and details of recent casework available on request.