

**Norman N. Axelrod, Ph.D.**  
**Curriculum Vitae**

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## **Expertise**

- ElectroOptical, Optical Devices:  
Laser, Multi-spectral, LED
  - Digital & Analog Signal-Processing  
(optical & electronic images)
  - Displays: LCD, LED, flat panel
  - Fiber Optic/Free Space Communicatn
  - Illumination & Lighting
  - Imaging, Image Processing
  - Medical Devices & Imaging
  - Optical Alignment, Gauging, Sensing
  - Photonics
  - Real-time, On-Line Sensing:  
QC and Product / Process Control
  - Software & System Integration
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## **Professional Summary**

Dr. Axelrod has over 25 years of experience in design, development, troubleshooting of a broad range of optical, sensing, computer software, and associated products in both domestic and international markets. Industries served include optical, consumer, biomedical / medical and industrial products.

Dr. Axelrod has been an expert witness. He has provided depositions, assessments of patents and technology (including validity & tests) for U.S. and **ITC** (Section 337) litigations.

Clients have included:

G. E. (3 divisions), Gen-Probe, Image Processing Systems Ltd., J & J (5 divs.), Lockheed Martin, Materials Research Corp., Medtronic (3 divs.), PerkinElmer, P&G , Teledyne, Timken, Unilever Research and Wall Street Journal.

## **Brief CV**

**Dr. Axelrod consults on optical, sensing, computer integration and associated systems. He produces simple, effective solutions for urgent as well as long-standing problems.**

Dr. Axelrod served as an expert witness on Liquid Crystal Displays patent litigation.

Summary judgments of invalidity and non-infringement (for client Samsung).

French Atomic Energy Commission v. Samsung. Law Firm: **Baker Botts.**

He served as an expert witness on bar-code imager/reader before the International Trade Commission (Section 337). Symbol Technologies (client) awarded \$13.4 million plus ongoing licensing fees.

Law Firm: **Jones Day.**

He was Certified by Stature as a Certified Manufacturing Engineer in Machine Vision by the Society of Manufacturing Engineers (SME).

**Employment:**

<b>Bell Labs</b> , Lucent, Alcatel	Murray Hill, NJ
Norman N. Axelrod Associates	NY, NY

**Biographical Listings:**

Who's Who in America  
Who's Who in Science & Engineering  
Who's Who in Technology  
Who's Who in the World

**Education:**

B.A. Physics	Cornell University
NSF-NATO Materials Program	Ecole N. Superieure, Paris
<b>Ph.D. Optics &amp; Physics</b>	Institute of Optics University of Rochester
Post-Doctoral Fellow	University of London, UK
Post-Doctoral Fellow	NASA, Washington, DC
Certificate in Strategic Planning	American Management Association

**Patents & Papers:**

Patent assignees include:

- Bell Labs.
- Perkin-Elmer Corp.
- Labatt Ltd. (Canada)
- Information Retrieval Systems Corp.

11 US patents granted; one patent was issued in 18 countries.

More than 50 papers and articles published.

Editor, Optical Properties of Dielectric Films (book).

The Technical Director of AeroComm wrote to Dr. Axelrod:

“The successful development of the laser communication system is completed and we would like to thank you for your efforts and performance...

“You provided a driving force to see this project to a successful conclusion...

“Your expertise and experience were invaluable. The success of this project was primarily due to your ability to apply and integrate optical and other technologies to produce impressive practical outcomes, to anticipate and cope with problems... As issues arose, you demonstrated professional resources that exceeded what we had anticipated.”

## Litigation Support Experience

- 2013      **Kenyon & Kenyon**  
Case      Optical Devices v. **Lenovo(client), ITC** Section 337  
Project:   Expert Witness on: Optical Detection System Using Retroreflection  
Status:    In Progress
- 2012-13   **Fish & Richardson**  
Case      Graphics Properties Holdings v. **Research in Motion (Blackberry) and Samsung\_\_ (clients), ITC** Section 337  
Project:   Expert Witness on: Concerning Certain Consumer Electronics and Display Devices and Products Containing Same  
Status:    Settled favorably.
- 2012      Goldstein et al.  
Case:      Spectros v. Thermo Fisher Scientific  
Project:   Expert Witness on spectro photometer instrument using optical fibers to excite & sense fluorescence and measure optical absorption.
- 2011      Gibson, Dunn & Crutcher  
Case      Sharp v. AU Optronics, **ITC** Section 337  
Project:   Expert Witness (with Sharp) on LCD Display Technology  
Status:    Settled
- 2010-      McDermott Will & Emery  
Case      Hitachi Koki v. Techtronic Industries N.A.  
Project:   Expert witness on laser alignment systems.  
Status:    Feb 2013, motions filed.
- 2010-      Fulbright & Jaworski  
Case      Snap-On Inc. v. Robert Bosch LLC  
Project:   Expert witness on optical, self-calibrating alignment systems.
- 2008      Wilson Sonsini Goodrich & Rosati  
Case      Hansen Medical v. Luna Innovations Inc.  
Project:   Expert consultant on fiber-optic position sensing and strain sensing used in remotely-operated surgery systems.

2006-07 Jones Day  
Case Symbol Technologies v. Metrologic. **ITC** --- Section 337.  
Project: Expert witness on laser scanning, bar code reader.  
Provided reports on infringements & practices (with bench tests),  
witness statement, depositions, claim construction, etc.  
Status **Client (Symbol) awarded \$13.4 million plus on-going licensing fees.**

2005-06 McCormick Paulding & Huber  
Case One World Technologies (Ryobi et al) v. Rexon et al  
(Suppliers to Sears).  
Tasks Expert witness on laser alignment system and laser eye damage.  
provided reports (with bench tests), deposition  
Status Settled favorably.

2005 Kirkland & Ellis  
Case Pre-litigation.  
Project: Vision system patent infringement.

2003-05 **Baker Botts**  
Case **Commissariat a L'Energie Atomique (French Atomic Energy  
Commission) v. Samsung (client)**  
Project: Expert witness on liquid crystal display (LCD) devices  
Status: **Summary judgment of invalidity and of non-infringement for client.**

2004-05 Katten Muchin Rosenman  
Case Commissariat a L'Energie Atomique (French Atomic Energy Commission)  
v. Sanyo  
Project: Expert witness on LCD optical display devices.  
Status: Settled

2005 West European Ophthalmology Clinic  
Case: Pre-litigation  
Project: Developed practical tests to assess performance of Lasik system,  
a laser eye-treatment system.

2003 McKool Smith  
Case: Confidential pre-litigation for Lockheed Martin  
Project: Identify possible patent infringements in patent portfolio.

2001 Robins, Kaplan, Miller & Ciressi  
Case: Nortel (CoreTek) v. Nitor

Project: Optical MEMs ( OMEM) for scanning, switching in communications  
Status: Settled

1999-00 Finnegan, Henderson et al in Washington, D.C.  
Case: Revlon v. L'Oreal  
Project: Tests on proprietary consumer product

1998 Inside Counsel for CNA Insurance  
Case: Cox v. Southwestern Bell  
Project: Monitored testing of fiber optic communication cable  
Status: Settled

1995: Sybron In-House Counsel  
Case Sybron v. Nixon, Hargrave, Devons & Doyle  
Project: Patent infringement / Legal Malpractice.  
Status: Found prior art that invalidated the patent

Case: Sybron v. Patent Licensor  
Project Acousto-optical filter device acquired by Sybron. Work narrowly defined to determine if device actually worked pursuant to the claims of the patent.

1987 Julian & Schlesinger PC  
Case: Patient v. New York Hospital  
Project: Medical malpractice. Deposed and provided testimony before jury that resulted in a \$1MM offer by New York Hospital.  
Status: Jury verdict.

Case: Johnson & Johnson  
Product Liability  
Project: Deposed as fact witness because Dr. Axelrod was a consultant for J & J on optical image processing and digital image processing for on-line inspection & control systems.

One I. P. lawyer wrote to Dr. Axelrod: *“Your ability to analyze technology in the field of optics as well as other areas and crystallize complex technical issues into easily understood concepts has been of great assistance in connection with patent matters.”*

## **Services: IP, Litigation, Technology and Corporate Assessments**

### **Domestic US**

Baker Botts	Lockheed Martin
CNA	McKool Smith
Finnegan, Henderson	Nadler & Nadler
Fitzpatrick, Cella, Harper & Scinto	Nixon, Hargrave, Devons & Doyle
Frost & Sullivan	Recognition Equipment Inc.
Imaging Systems Ltd.	Revlon
Jones Day	Samsung

## **Services: IP Litigation, Technology and Corporate Assessments**

### **Foreign**

Angenieux (France)	Matsushita Research Institute (Japan)
Calor Ltd. (England)	Samsung (Korea)
Dai Nippon (Japan)	Sanyo (Japan )
Image Processing Systems (Canada)	Sharp Opto-Electronics (Japan)
Konishiroku Photo Industries (Japan)	Teijin (Japan )
Labatt (Canada)	Toshiba (Japan)

### **Pro Bono**

Graduate Program in Biology, CUNY-City University of New York  
Georgetown University Medical School, Washington, DC  
Marine Biological Laboratories, Woods Hole, MA  
Metropolitan Museum of Art., New York, NY

### **Employment History**

Present Norman N. Axelrod Associates  
Position: New York, NY  
President

Norman N. Axelrod consults on optical, electro-optical, laser and vision devices, optical instruments, optical systems, science and technology, and intellectual property disputes. Areas of Applications include sensing, detection, illumination, displays, lasers, fiber optics, gauging, recognition, imaging, image processing, system integration, etc.

### **Representative Examples of Projects:**

- Developed biophotonic optical/illumination, imaging techniques for diagnostics & detection: displays, DNA sequencer, immuno-assays (fluorescent, absorption & scattering), catheters, fiber optic sensors, etc.
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- Designed, developed & delivered on-line inspection and process control system (illumination/imaging/sensing/electronic/computer-controlled/displays).
  - ... Optical gauging (+/- 0.01 mil) of thickness for on-line real-time adjustment and optical detection & marking of 0.1 mil defects for quality control.
  - ... System **won the annual award of Medtronic**, a multi-billion dollar Fortune 500 medical sensing and control corporation.
- Developed, assessed and/or improved illumination & display systems for:
  - ... LED array to illuminate material for on-line, real-time inspection
  - ... patterned, vertically aligned LCD films on large displays [Samsung]
  - ... electronics (thin-film-transistors TFTs) for AM-LCD displays
  - ... LED & LCD wrist-watch displays [Timex]
  - ... plasma displays [TI and Burroughs]
  - ... upgraded design of medical display units [Picker Ultrasound]
  - ... airplane cockpit displays [GE Aerospace]
  - ... LCD controlled printing masks for integrated circuits [Jupiter Communications]
- Consulted on real-time imaging, targeting, guidance, and ranging of smart bombs (for in-flight use at 600 mph on F-18 attack jet planes) with design, analysis, systems, assembly and QA groups.
  - ... Improved performance of 2<sup>nd</sup> generation Advanced Targeting Pod Sniper XR for US Air Force & NATO planes [with Lockheed-Martin].
- Developed & delivered 3-D vision positioning & guidance system, with LED illumination, that enabled automation of 3-D welding: significantly reduced airplane production cost. [MTS]
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- Assessed & upgraded rapid-scanning laser systems:
  - ... to read document pages for production of the Wall Street Journal at regional printing plants
  - ... gauge 3-D railroad track profiles from trains moving at 60 mph [Conrail]
  - ... to trim thin-film resistors on integrated circuit production line
  - ... gauge points (3D) of surgical needles.
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- Strategic technical planning program for upgrading optical reading of codes and print on wrinkled paper and cardboard coupons:



- ... Generated & assessed alternative system approaches
- ... Developed practical design that dealt with large depth of focus. [MEI]
- Expert witness on:
  - ... laser scanning (Symbol Technologies v. Metrologic)
    - with Jones Day before International Trade Commission (Section 337)
  - ... liquid crystal displays (French Atomic Energy Commission v. Samsung)
    - with Baker Botts,
- Identified & assessed applicability of laser & optical technology to U.S. markets (Teledyne, Lockheed, Matsushita Research Institute, Recognition Equipment, GE).
- Developed optical techniques to detect & discriminate sub-micron and micron features in complex photomask & semiconductor wafer patterns.
  - ... Techniques only imaged defects (and eliminated circuit pattern info from image). [with Perkin Elmer and Bell Labs].
- Developed & installed real-time inspection system that detects defects, applies pattern recognition to identify critical defects, and applies criteria to determine rejects. Outputs control signals to robot to reject /accept. Improves quality.
  - ... Used during assembly of high-density disk modules. [for Iomega].

Norman N. Axelrod Associates provides a full range of services including contract development, feasibility, turn-key systems, system integration, computer control and software as well as technical planning, project reviews, troubleshooting and related services.

In-house resources include computer-based vision systems and data acquisition systems, fiber optics, lasers, software, electronics and proprietary systems and programs for hardware and software development.

Organization: Bell Telephone Laboratories

Position: Member, Technical Staff

Summary: Responsibilities included research and development on optical sensing equipment for detection & characterization of materials and for communication-related components and devices.

Patents issued (assigned to Bell Labs.) on pattern recognition, optical inspection system for manufacturing, barrier-diode electronic device for signal mixing, etc.

Organization: University of Rochester  
Position: Graduate Student  
Summary: Taught laboratory course on Radiometry.

Organization: Cornell University  
Position: Undergraduate Student (senior)  
Summary: Taught laboratory course on Physics for Engineers.

## Professional Associations and Achievements

- American Men & Women of Science
- Certified by Stature as a Machine-Vision/Manufacturing Engineer Technologist (CmfgE) by SME (Society of Manufacturing Engineers)
- Fellow, AAAS
- Member, IEEE
  
- Who's Who in America
- Who's Who in Finance & Industry
- Who's Who in Science & Engineering
- Who's Who in Technology
- Who's Who in the World
  
- Sigma Xi
- Sigma Pi Sigma
- Pi Mu Epsilon
  
- Boldt Scholar at Cornell University

## Client List

Below is a partial client list organized by industry:

### Optical & Electronic Products

AeroComm  
Angenieux  
Bausch & Lomb

Materials Research Corp.  
MEI Group  
National Semiconductor Corporation

Burroughs Corporation  
CompuScan  
Dolan-Jenner  
Dover Corp.  
Dynatech  
Fisher Scientific  
Frost Lighting

Pemco Aviation  
Penn State Applied Physics Labs.  
Perkin-Elmer Corp.  
Self-Powered Lighting  
Recognition Equipment Inc  
Sensor  
Sharp Opto-Electronics

General Electric (Schenectady, NY)  
General Electric (Wilmington, MA)  
General Electric (with Kodak & TI)  
Honeywell Corporation  
Image Processing Systems, Ltd.  
Information Retrieval Systems Inc.  
International FiberCom, Inc.  
Iomega  
Konishiroku Photo Industries Ltd.  
Lear Siegler  
Lockheed Martin

Skana-A-Matic  
Stryker Instruments (IRDA)  
Sybron Chemicals, Inc  
Teradyne  
Thomas & Betts  
Timex  
Toshiba  
Universal Instrument  
Wall Street Journal/Dow Jones  
Westinghouse (Pittsburgh, PA)  
Westinghouse (Horsehead, NY)

Medical, Surgical, Biomedical, etc.

American Dade  
C. R. Bard, Urological (NJ, GA)  
C. R. Bard, USCI Division (MA)  
Baxter Labs  
Becton Dickinson  
Bio-Rad  
Boehringer Ingelheim  
Computed Anatomy  
Dentsply  
Dynatech / Organon  
EndoTherapeutics  
Ethicon (J&J)  
Gen-Probe  
Geometric Data / SmithKline  
Georgetown University Medical  
Instrumentation Development Co.

Johnson & Johnson (5 divisions)  
Kyphon  
Marine Biological Laboratories  
Medical Laboratory Automation  
Medtronic, Advanced Mfg Technology  
Medtronic, R & D  
Medtronic, Promeon  
Picker Ultrasound  
Schering-Plough  
Sensor  
Squibb, E. R, Theragran M Tablets  
Squibb, E. R., Parenterals  
Stryker  
U. S. Surgical / Tyco  
Vistakon (J&J)  
Wesley-Jesson / Tyco

Consumer Products

American Consumer Products Inc.  
Calgon  
Chesebrough-Pond's / Unilever

MEI Group  
Nabisco  
Polychrome / Dai Nippon

Cone Mills  
Delco Electronics  
Emhart  
Federal Cartridge  
General Foods  
Henson Associates (the Muppets)  
Kortec  
Labatt

Procter & Gamble  
Progresso  
Revlon  
Shulton / Colgate  
Stanley Tools  
Timex  
Unilever Research  
Woodgrain Millwork

## Education

<u>College/University</u>	<u>Degree</u>
University of London	Post-Doctoral
NASA – Goddard Space Flight Center	Post-Doctoral
Institute of Optics & Physics, University of Rochester	Ph.D., Optics and Physics
University of Paris	Ecole Normale Superieure, NSF-NATO
Cornell University	B.A., Physics

Further information available at: [www.axelrodassociates.com](http://www.axelrodassociates.com)

## Patents

12 patents granted; one patent was issued in 18 countries.

Patent assignees include:

American Consumer Products Inc.  
Bell Laboratories – Lucent/Alcatel  
Information Retrieval Systems Inc.  
Labatt  
Perkin-Elmer

Patent disclosures have been provided to other corporations and to a Research & Patent group of a large public university. Many of Dr. Axelrod's significant contributions have been considered as proprietary by clients with no related patents filed.

## Selected Related Publications

Axelrod, Norman, "Optically Enhancing Images: for Inspection & Control. . . Using Optical Spatial Filtering & Diffraction" *Quality*, May 2013

Axelrod, Norman, Bell Labs: Technology Innovation & Planning, NYTimes Letters, Mar 11, 2013

Axelrod, Norman, "The LED Basics" *Vision & Sensors in Quality*, July 2012  
<http://tinurl.com/The-LED-Basics>

Axelrod, Norman, "Best Practices for Developing Sensing Systems for Production & QC" *Quality*, January 2012. [Quality Best Practices](#)

Axelrod, Norman, "Color: It's Not Always What You See," Cover story, *Vision & Sensors Quality*, January 2012. [Quality Color](#)

Axelrod, Norman, "Cognitive Biases & Project Planning", *Quality*, Jan 2012  
[Quality Biases & Planning](#)

Axelrod, Norman, "LEDs 101, " *Vision & Sensors in Quality*, Sept 2011, [LEDs](#)

Axelrod, Norman, "3D Imaging for On-line Product & Process Control," *VisionSensors*, July 2011.  
**Cited by V&S in September 2011 as "Most Emailed Article."** [3D Imaging](#)

Axelrod, Norman, "Smart Machine Vision Systems", *Quality*, Feb 2011 [Smart Vision](#)

Axelrod, Norman, "Image Processing Broken Down" *Quality*, Jan 2011 [Image Processing](#)

Axelrod, Norman, "LED: Smart Lighting for Machine Vision", *Vision & Sensors*, Sept 2010  
(Invited cover story)

Axelrod, Norman, "Machine Vision Adds Value", *Vision & Sensors*, March 2010  
(Invited cover story)  
***Cited by V&S in Sept 2011 as one of three "Most Emailed Articles"***

Axelrod, Norman, Book Review of "Fiber Optic Sensors, 2<sup>nd</sup> Edition", by Yin et al, BarnesandNoble.com, July 2009

Axelrod, Norman, P. Kaitkay, "Detect Defects Optically", *Quality*, May 2006

Axelrod Norman, A.M. Ballangrud, "Optical/Imaging System," *Vision Systems Design*, 3, 30, May 1998.

Axelrod Norman, A.M. Ballangrud, "Machine Vision Provides Reliability by Design, 'Smart Optics' Improve Machine Vision without Massaging the Data." *Photonics Spectra*, Mar 1997.

Axelrod Norman, "Gauging with Light," *Production Engineering*, 27, 58, March 1980.

Axelrod Norman, "Planning and Technology," *Physics in Technology* (London), March 1979.

Dr. Axelrod is an invited blogger in *Vision & Sensors* magazine where he posts regularly. His most recent posts were:

- "Photonics, Electro Optics, or Optoelectronics?" (Feb 2012)
- "Auto-Compensated Optical Sensing for On-Line Applications" (Sept 2011)
- "Automated Vision & Sensing: Truth or Consequences" (June 2011)
- "Quality Communication of Optical Information" (May 2011)
- "Fiber Optics: Beyond Simple Light Pipes" . . .(Nov 2010)
- "Lighting: Fluorescence from NDT to QC to DNA" . . . .(July 2010)
- "Lighting Strategy" (June 2010)



view at:

[www.visionsensormag.com/Articles/Blog\\_VS\\_Round-Up](http://www.visionsensormag.com/Articles/Blog_VS_Round-Up)

Dr. Axelrod has had over 50 articles published. He has given talks at almost all of his clients and at professional meetings in the U.S., Canada, and Europe.

He has taught lecture courses on Physics for Engineers, Optics, Electricity & Magnetism, Basic Physics, Solid State Physics, Statistical Mechanics, etc. at University of London, American University, University of Delaware, and Parson's School of Design (The New School).

**Personal:**

Local sailing in New York harbor and on Hudson River.

Sailing trips on 45 to 51 foot boats with 4 to 7 people to:

- Greek Islands
- Caribbean Islands
- Brazil
- Dubrovnik

Swims 3x/week for 45 to 60 minutes per session plus workouts on other days.

Family & Friends

Restaurants, Museums, Plays

Lectures (CUNY Graduate Center, 92 St Y,  
NY Academy of Science, etc.)

Technology & mind-function paradigms

Reading, Chess, Poker

END