Curriculum Vitae
John M. Strawn, Ph.D.
(contact information on last page)

Professional Profile

Several decades of involvement in software, digital audio, digital music, digital signal processing, and processor architecture. Successful independent software consultant in high-level languages and assembly language. Seasoned testifying expert with experience in patent and class action litigation, skilled at explaining complex ideas to attorneys and juries. Stanford Ph.D. Former Fulbright Scholar. Prolific author. Experienced manager with long-range research and development experience. Facile with foreign languages and working with people from outside the USA.

Professional Experience

From: 1992 **S Systems, Inc.**
To: Present Larkspur, CA
Position: *Owner and Full-time Consultant*
Duties: Full-time independent consultant:

- **Programming** hand-crafted audio and music software for signal processing, written in C, C++, JAVA, and especially assembly language for digital signal processing chips. Consulting on processor architecture and networking. See Consulting Assignments, below.
- **Testifying Expert witness** in patent litigation relating to software and source code, digital devices, processor architecture, media, compression, signal processing and client/server interactions. See Expert Witness section, below.

From: 1987 **Yamaha Music Technologies USA**
To: 1991 Larkspur, CA
Position: *1989-1991: President; 1987-1989: Vice President*
Duties: Helped establish and manage a nine-person Ph.D.-level research group, including site search, architectural design, construction, move-in, and hiring. Conducted original research on electronic musical instruments, software, micromachining, networking, and recent technological developments. Extensive experience designing scientific, engineering, and musical object-oriented applications, especially C++ (UNIX). Research on Yamaha's Vocaloid started in this group. Patent listed below.

From: 1986 **S Systems**
To: 1988 Larkspur, CA
Position: *Owner and Full-time Consultant*
Duties: This was my first stint as a consultant. See Consulting Assignments, below.

From: 1985 **Lucasfilm/Droid Works**
To: 1986 San Rafael, CA
Position: *Programmer*
Duties: Full-time programming experience as an employee, designing signal-processing modules and writing (96-bit VLIW) microcode for the ASP/SoundDroid developed by James A. Moorer. Experience in audio and video post-production. Extensive work in C (Unix). Another six months full-time experience writing tightly packed assembly code for the TI TMS32010 signal processor, especially for a two-channel hard-disk audio record playback unit that played without bugs on the exhibit floor of the National Association of Broadcasters convention, 1986.

From: 1976 **Stanford University**
To: 1985 Stanford, CA
Position: *Doctoral Student*
Duties: Nine years programming experience developing code in high-level languages (Algol, Fortran, SAIL) and PDP-10 assembly language for musical and audio signal processing applications during doctoral thesis work. My Ph.D. dissertation (*Modeling Musical Transitions*, 1985) involved original published research in spline fitting and pattern recognition, a 30,000-line two- and three-dimensional graphical editor for waveforms and spectra, implementation (with John Gordon) of the short-time Fourier transform, device drivers, and libraries for graphic user interfaces. Also part-time consulting work:

- SRI International (FORTRAN for mechanical engineering).
- Mattel Electronics (music in consumer electronic toys).
- IntelliGenetics (ALGOL-like code for biotechnology).
- Digital Keyboards (product specification and complete manuals for GDS and Synergy Synthesizers).

From: 1972 **Revox**
To: 1972 Long Island, New York
Position: *Summer intern*
Duties: Solder cables, write German- and Dutch-English translations, manufacture PC boards, assemble hardware.

Education and Training

Year	College/University	Degree
1985	Stanford	Ph.D., CCRMA. Advisor: John Chowning. Graduate course work in music, computer and processor architecture, high-level and assembly-language programming, digital audio, digital signal processing, acoustics, psychoacoustics, and digital hardware. Dissertation on analysis of music instruments with the short-time Fourier transform. Software development experience listed elsewhere in this resume.
1975-1976	IBM Thomas Watson Foundation	Grant to study electronic music, Tokyo, Japan, 1976. Live performances on piano and Roland System 700 analog synthesizer. Also travel through Turkey, Iran, Afghanistan, Pakistan, India, Thailand, and Hong Kong.
1973-1975	Technical University, Berlin	Fulbright Scholar. Graduate-level coursework in music theory/history, audio engineering, electronics, information theory, cybernetics, Japanese; all coursework in German. Extensive recording studio and live concert sound reinforcement experience. PDP-11 and PDP-8 assembly and machine language. Travel throughout Europe.
1968-1973	Oberlin	B. Mus, double degree in organ performance and music theory. Exchange semester, University of Hamburg, Germany, 1971, course work in German literature and psychology. Experience with analog synthesizers and digital music synthesis, BASIC, FORTRAN, MUSIC V on an IBM 360.

Expertise

- Implement/optimize signal processing algorithms: Fourier transform (FFT), discrete cosine transform (DCT), DTMF, speech synthesis.
- Port/optimize audio compression algorithms: AC-3, MP-3, AAC.
- Implement audio algorithms: reverberator, pitch shifter, sample rate converter, compressor, filter, flanger, 3-d audio (Dolby surround), dither.
- Implement music synthesis (additive, physical modeling, wavetable, FM).
- Create bug-free software from academic signal processing research.
- Work in floating- and fixed-point math.
- Assembler, object-oriented, C, C++.
- Extensive experience optimizing code in assembler
- PC, Mac, Unix.
- DSP architectures: Motorola 56000, 56300, and 56800 families; TI TMS320C10 and TMS320C54 family; Code Composer Studio; Analog Devices 21xx family and TigerSharc; VLIW; custom processors; I learn new architectures quickly.

- Embedded processors: Hitachi SH-DSP, SH3-DSP, SH-4, and SH-5; ARM7/ARM9; configurable processors (Tensilica).
- Processor architecture.
- Debugging hardware prototypes.
- Audio networks, such as AES/EBU (IEC 60958), IEEE-1394/FireWire, AV/C, 61883, mLan, and others.
- File downloading.
- Practical audio experience in live sound and in studios.
- Testifying expert witness (including expert reports, deposition).
- Software analysis for litigation.
- Functionally bilingual in German; able to read French, Dutch; some Japanese

Expert Witness and Litigation Support Experience

Summary: 15 depositions to date, 3 times testimony at trial. Patent litigation, ITC investigations, Inter Partes Reviews, USPTO declarations, class action litigation. Expert reports, declarations, prior art research and analysis, infringement analysis (*e.g.*, analyze devices, documents; source code analysis, source code comparison), claim charts, tutorials, Markman hearings. Technical areas include software and source code; computers, laptops, cell phones, mobile devices, handheld devices (*e.g.,* medical); processor architecture; user interfaces; media: audio, music, speech, video; compression (*e.g.,* MPEG, MP3); digital signal processing, mathematics, algorithms; file downloading, file streaming, client/server; protocols such as internet protocol (IP); video games.

Date: 2016 - present **Fish, Richardson**
Case: Two Inter Partes Reviews for Samsung.
Project: Patent related to real-time multimedia recording and playback. Research. Invalidity **declaration**. (IPR2016-01524; IPR2016-01712).

Date: 2015 - 16 **Denko, Coburn, Lauff**
Case: Andrea v. Intervenor Waves (Israel) and Respondent Dell, ITC 337-TA-949
Project: Patents related to noise reduction, adaptive filtering, echo cancellation for speech in laptops. Source code analysis (C, C++). Compare versions of source code. **Expert report** on non-infringement, two patents. **Deposition.**

Date: 2014 - 16 **Orrick**
Case: Blue Spike v. Texas Instruments, TXED 6-12-cv-00499, for lead defendant Audible Magic.
Project: Patents related to automatic recognition of video and audio, signal processing.source code analysis (C, C++, Visual Basic, SQL, XML). Declaration. **Two expert reports**, one on non-infringement (four patents), one comparing versions of source code. **Deposition.**

Date: 2014 - 15 **Wiley Rein**
Case: Six petitions for Inter Partes Review by Verizon (IPR2015-00349, -00350, -00364, -00376, -00380, -00383, -00391).
Project: Cell phone ring tones. Research. Invalidity declaration.

Date: 2013 - 16 **Greenberg Traurig**
Case: Petition for Inter Partes Review by Samsung, IPR2014-00044.
Project: Patents related to targeted advertising, user interfaces, client-server. Invalidity **declaration. Deposition.** Determined to be unpatentable. Determination upheld on appeal.

Date: 2011 - 14 **Kirkland & Ellis; Irwin IP; Fliesler Meyer**
Case: Adobe v. Wowza, CAND 3-11-cv-02243
Project: Five patents related to protocols for client/server real-time video and audio streaming. JAVA source code analysis. **Deposition** related to Markman. **Expert report** and **deposition** on noninfringement.

Date: 2013 - 14 **THAT Corporation; McDermott Will Emery**
Action: US Patent Application 11/445,670, BTSC Encoder.
Project: Application relating to audio in television. Patent prosecution had lasted 8 years. Three months after my **declaration** regarding non-obviousness was submitted, US 8,908,872 issued.

Date: 2013 - 14 **Novak Druce**
Case: SmartPhone v. ZTE, EDTX 6:12-cv-350
Project: Three patents relating to cell phone user interface, internet protocols, client/server.Android source code analysis (C, JAVA, XML). **Expert reports** for invalidity and non-infringement. **Deposition.**

Date: 2012 - 13 **Morgan Lewis Bockius**
Case: SmartPhone v. LG, EDTX 6:10-cv-74.
Project: Cell phone user interface, automatic call detection, client/server. Research. **Expert report** for invalidity, two patents. **Deposition**.

Date: 2011 - 12 **Quarles Brady**
Case: SmartSound v. Avid, WIWD 3-12-cv-00223.
Project: Automated composition of sound tracks for video. **Source code analysis**, two patents (C++, XML) regarding infringement.

Date: 2012 **Jones Day**
Case: LSI v. Vizio, CACD 8:10-cv-01602.
Project: Digital memory and MPEG audio. Invalidity and non-infringement for four patents. Settled before Markman.

Date: 2008-9, 2011-present **Alston Bird**
Case: Move v. Real Estate Alliance CACD 2-07-cv-02185.

Project: Real estate sales website. Source code analysis. Two **expert reports** on infringement, two patents. **Deposition**.

Date: 2011 **Quinn Emanuel**
Case: Motorola v. Apple, ITC 337-TA-745.
Project: Cell phone GPS. Analyze iPhone and Motorola Droid source code (C, C++, JAVA) and schematics. Three **expert reports** and two witness statements relating to infringement, technical prong of domestic industry, and validity. **Deposition**. **Testimony** at trial.

Date: 2010-2011 **Finnegan Henderson**
Case: HTC v. Apple ITC 337-TA-721.
Project: Cell phone user interface, memory, and caller ID. **Expert report** relating to technical prong of domestic industry for 24 HTC Windows Mobile cell phones. **Supplemental Expert Report**. Consulting expert relating to iPhone, iPad, and iPod touch concerning validity and power management.

Date: 2010-2011 **Robins, Kaplan, Miller, & Ciresi**
Case: Fair Isaac v. Actimize and NICE, DED 1-09-cv-00688.
Project: Credit card scoring. **Source code analysis** for infringement (C++, Java, XML, scripting language).

Date: 2010 **Orrick**
Case: Affinity v. Alpine, JVC Kenwood, et al., TXED 9-08-cv-00171.
Project: User interface and functionality of car audio, marine audio, and home theater products that connect to iPod/iPhone. **Expert report** on non-infringement, two patents. **Deposition**.

Date: 2009 **Wolf Haldenstein**
Case: In re Apple & ATTM Antitrust Litigation, CAND 5:07-cv-05152.
Project: Analyze iPhone source code for antitrust plaintiffs. Expert report and various declarations, in particular regarding class certification. **Deposition**.

Date: 2008-10 **Paul Hastings**
Case: Konami v. Harmonix, TXED 6-08-cv-00286.
Project: Analyze Rock Band video game source code (Playstation 2, PS3, Wii, XBox). **Expert report**s on infringement and validity, three patents. Two-day **deposition**.

Date: 2009-10 **Jones Day, Palo Alto, CA**
Case: SanDisk v. LSI, California Northern District, 3:09-cv-02737
Project: Attend tutorial and Markman hearing regarding MP3 patent litigation.

Date: 2009 **Weil Gotschal**
Case: Samsung v. Kodak, ITC 337-TA-671.
Project: Digital cameras in cell phones. **Analyze** Samsung cell phone **source code** (C, C++) for infringement relating to digital cameras. Study baseband chip documentation from Qualcomm, Philips, Agere, Texas Instruments; register-level code for camera image sensors from Samsung, Sony, Micron, Omnivision; Windows Mobile 5 and 6 device drivers; Qualcomm BREW 2 and BREW 3 cell phone OS; four patents involving Bayer subsampling, pixel interpolation; standard digital optical concepts such as RGB, YUV, YCbCr, EXIF, and JPEG.

Date: 2009 **Finnegan, Henderson**
Case: Voice Domain v. Philips, OKWD 5-08-cv-00701
Project: **Declarations** for Markman hearing on hand-held consumer devices, three patents.

Date: 2009 **THAT Corporation; McDermott Will & Emery**
Action: US Patent Application 09/638,245, BTSC Encoder.
Project: **Declaration** to USPTO regarding non-obviousness for audio in television.

Date: 2007-8 **Fish and Richardson**
Case: Nice v. Witness, DED 1-cv-00311.
Project: Telephone call centers (telephony, hardware architecture, digital recording, functionality). **Expert reports** on invalidity and non-infringement, three patents. **Deposition**, jury trial testimony.

Date: 2005-7 **Fish and Richardson**
Case: Microsoft v. Lucent, CASD 3-02-cv-02060.
Project: **Two days testimony** at three-week jury trial, after **deposition** and **seven expert reports/declarations** on non-infringement, invalidity, inventor not included, defects in specification, and secondary considerations. Patents related to audio compression and MP3 in Windows Media Player. **Source code analysis** (C, C++, assembler, machine code). Research. Analysis of German documents.

Date: 2007 **Morrison and Foerster**
Case: Seer Systems v. Yamaha, CAND 3-06-cv-07736..
Project: **Prior art** for music synthesis.

Date: 2006-7 **Mayer Brown Rowe & Maw**
Case: DTL v. Cingular Wireless, TXED 2-06-cv-00156
Project: Microphone in cell phones. Research, claim charts, invalidity.

Date: 2007 **Meyer & Associates, Columbus, Ohio**
Case: Health Science Products and Kairos v. Sage, GAND 1-2005-cv-03329.
Project: For class action *plaintiffs*, analyze database software before and after release of ACT 2005.

Date: 2005-6 **Black Lowe & Graham**
Case: Digeo v. Audible, WAWD 2-05-cv-00464.
Project: Internet file downloading. **Source code analysis** (C, C++). Apple iPod, Creative MuVo MP3 player. **Expert reports** regarding Markman, validity and infringement. **Deposition** for Markman hearing.

Date: 2006 **Ropes and Gray**
Case: MediaTek, ASUSTek & ASUS v. Sanyo, TXED 6-05-cv-00323.
Project: Prepare invalidity claim charts on 24 hour notice. Assist in preparation of tutorial.

Date: 2006 **Wilmer Hale**
Case: Information Technology Innovation v. Motorola et al., ILND 04-C-7121.
Project: Provide and supervise an expert witness colleague who prepared an expert report on non-infringement.

Date: 2004-5 **Weil, Gotshal & Manges**
Case: Antor v. Apple, Microsoft, RealNetworks, TXED 2-03-cv-00320.
Project: **Prior art** regarding file downloading.

Date: 2005 **Trop, Pruner & Hu**
Project: **Prior art** involving signal processors.

Date: 2003 **Robins, Kaplan**
Case: Intergraph v. Dell et al., TXED 2-02-cv-00312.
Project: **Prior art** for hardware architecture, virtual memory and cache memory.

Date: 1997-8 **Cesari and McKenna**
Case: Lucent vs. Young Chang/Kurzweil, MAD 1:97-cv-10310.
Project: **Prior art** for music synthesis, digital hardware, software, architecture.

Date: 1994 **Small, Larkin**
Case: L.C. Concept v. Digital Theater Systems (DTS)
Project: **Prior art** for cinema sound equipment in USA and Germany.

Consulting Assignments

From: 2011 **Client: iZotope**
To: 2011 Boston
Duties: Port iZotope's pitch correction effect from C++ source code to Avid TDM environment in Motorola 56000 family assembly language.

From: 2009 **Client: Congruity**
To: 2009 Palo Alto
Duties: For this music industry startup, create audio effects in Motorola/Freescale DSPM56364 assembly language. Write and debug code without access to hardware, working only with software tools. Initial delivery of code ran bug-free in target hardware.

From: 2008 **Client: DTS Digital Cinema (now Datasat Digital Entertainment)**
To: 2008 Location: Agoura Hills, CA
Duties: For DTS Digital Cinema/DataSat's XD20 Media Player eight-track cinema media player (this is the hardware that sits in the movie theater projection booths for playback of multi-channel audio and video), adapt audio algorithms from an earlier DTS Digital Cinema device. In particular, port DTS Coherent Acoustics decode (two versions, one 8-channel, one stereo), DTS Digital Cinema 8-channel decode, and DTS Neo6 5.1 decode from DTS Digital Cinema's existing XD10 cinema media player. This required me to extract Motorola DSP563xx assembly language source code from the earlier XD10 environment; isolate the four algorithms by stripping away unneeded code; integrate the four algorithms into Motorola 56721 dual-core processor; and write new wrapper code in assembly language. Responsible for approximately 25,000 lines of assembly-language source.

From: 2007 **Client: Berkeley Design Technology, Inc.**
To: 2008 Location: Oakland, CA
Duties: Contribute to research and writing of the following articles on processor architecture at BDTI's website Inside DSP (http://www.insidedsp.com/):

- TI Offers OMAP3 Application Processors to the Mass Market
- Avnera releases ASSPs for wireless audio applications
- XMOS Introduces Low-cost Multi-core Chip Family with Programmable I/O
- VeriSilicon's New Silicon IP Solution for HD Audio
- Behind the scenes: Dolby's acquisition of Coding Technologies
- Tips and Tricks for Debugging Audio

Other BDTI assignments are listed below.

From: 1995 **Client: Yamaha**
To: 2007 Location: Hamamatsu, Japan
Duties: Chair, AES standards working group SC-02-12 on digital audio networking via IEEE-1394 (Firewire), with the support of Yamaha. Involved a trip to AES conventions twice a year, including one in Europe. Past member, IEC TC100 TA4, Digital System Interfaces. Various public appearances worldwide and various company site visits to discuss multimedia networking, audio over 1394 and Yamaha's mLAN.

From: 2005 **Client: Sonic Network (now SoniVox)**
To: 2006 Location: Somerville, MA
Duties: For this well-known provider of wavetables, synthesis software, and cell phone ring tones (among others), provide and supervise subcontractors for these projects:

- Design and implementation of filters for sample rate conversion;
- Design and implementation of filters following the DLS-2 specification

(used in cell phones for ring tones);
- Port synthesizer code to Tensilica HiFi2 audio engine.

From: 2004 **Client: Bias**
To: 2006 Location: Petaluma, CA
Duties: For this well-known provider of audio software, provide and supervise a subcontractor to port a complicated digital signal processing algorithm into the DigiDesign TDM Environment, in Motorola 56K assembly language.

From: 2005 **Client: Audio Research Labs**
To: 2005 Location: Scotch Plains, NJ
Duties: For ARL founder Schuyler Quackenbush provide and supervise a subcontractor to design and implement a digital filter algorithm in Motorola 56K assembly language.

From: 2004 **Client: Verance**
To: 2005 Location: San Diego, CA
Duties: Working closely with Verance R&D staff, implement the Verance Content Management System/Audio-Visual (VCMS/AV) watermarking technology for motion picture sound (now known as Cinavia) in Motorola 56300 assembler in the TC Electronics M6000 environment. In use in major film studios starting early 2005. Travel at client's request to TC Electronics headquarters in Denmark to facilitate integration. Provide and supervise a subcontractor to assist with filter design, filter implementation, and other tasks. More than 30,000+ lines of 56K assembler source, several hundred pages of documentation, a dozen CD-ROMs of debugging data and lab notebooks.

From: 2002 **Client: Universal Audio**
To: 2004 Location: Santa Cruz, CA
Duties: For this well-known manufacturer of audio plugins, port two audio processing algorithms (Pultec filter, LN1176 stereo compressor) from C/C++ to Motorola 563xx assembler in the DigiDesign ProTools TDM environment, including numerical approximation and streamlining the original C/C++ implementation. Publicly released 2004. Contribute extensively also to port of an extremely complicated high-end reverberator, and to another equalizer.

From: 2003 **Client: Stretch**
To: 2004 Location: Mountain View, CA
Duties: For this software configurable processor startup, study how to port MPEG-2 AAC and MP-3 decode reference C++ code to 16- and 32-bit integerized C. Do the same for MP-3 encode based on publicly available source. Learn their software configurable architecture well enough to write optimizations.

From: 2003 **Client: Language Scientific (formerly RIC)**
To: 2003 Location: Cambridge, MA
Duties: For this major translation house, proofread German-English translations involving, among other things, audio compression (including German-language doctoral dissertations).

From: 2003 **Client: Analog Devices**
To: 2003 Location: Santa Clara, CA (Audio Rendering Technology Center)
Duties: Port music synthesis algorithms to ARM7TDMI assembler, following ARM's C calling conventions.

From: 2002 **Client: Dorrough Electronics**
To: 2003 Location: Chatsworth, CA
Duties: Implement in C and Analog Devices Sharc 21161 assembler a novel scheme based on their patented technology to improve the perceived loudness of audio signals sent over broadcast. Provide a subcontractor who made significant contributions to filter design.

From: 2002 **Client: Analog Devices**
To: 2002 Location: Wilmington, MA (Ray Stata Technology Center)
Duties: After an on-site visit to learn more about the technology and meet the team, I made recommendations on changes to architecture for a new version of an idiosyncratic signal processing chip. I also provided code examples for the new architecture.

From: 2001 **Client: Tensilica** (now part of Cadence)
To: 2002 Location: Santa Clara, CA
Duties: For this configurable processor IP core provider, implement a highly optimized version of the modified discrete cosine transform (MDCT) for audio compression. Extensive investigation of theory and variants of the MDCT. Also port MPEG-2 low-complexity AAC decode and MP3 encode from Thomson reference C++ code to 16-bit integerized C. Prepare various optimizations closer to the hardware than C++ usually allows.

From: 1999 **Client: Berkeley Design Technology, Inc.**
To: 2001 Location: Oakland, CA
Duties:
- For BDTI's Buyer's Guide to DSP Processors, 2001 Edition, contribute major portions of the text analyzing processor architectures including the Analog Devices TigerSharc, and contribute also to the analyses of Motorola 56300, 56800, and 56800E processors; verification and in some cases re-writing assembly-language implementations of BDTI's benchmarks;
- Prepare written analyses of Hitachi SH-DSP, SH3-DSP, SH-4, and SH-5 processor architectures. This again included verification and in some cases re-writing assembly-language implementations of BDTI's benchmarks;
- Implement assembly-language routines related to multimedia

compression in ARM7/ARM9 processor assembly language;

- Develop and present a four-hour presentation on audio compression, given first at Embedded Processor Forum, June, 2000; contribute to a four-hour presentation on digital audio and music given by Dana Massie at the same Embedded Processor Forum; revised and presented both talks at Microprocessor Forum, October 2000; both talks revised again with emphasis on streaming audio and presented at Embedded Processor Forum, June, 2001.

From: 1995-6 And 1998-9
Client: Audio Precision
Location: Portland, Oregon
Duties: For their System 2 audio measurement device, developed double-precision FFT in assembler for Motorola 56002, including (Microsoft) C code to study where to maintain double-precision. Also, extensive code for AES/EBU and square wave measurement test suite, including jitter and eye pattern (assembling bit map for display in 56002 data memory space). 28K+ lines of assembler source. 1998-1999: Revise Audio Precision System 2 code for new 96 kHz Cascade hardware (Motorola 56303).

From: 1997 To: 1999
Client: Euphonics (later part of 3COM)
Location: Boulder, CO
Duties: Implement Dolby AC-3 audio compression decoder in 16-bit integer assembler on new Analog Devices 16-bit integer AD1818 (PCI SoundComm). 20K+ lines of assembler source. Passed first round of Dolby testing on first try. Integrate with Euphonics' Real-Time Kernel.

From: 1996 To: 1997
Client: Digital Technics (DTI)
Location: Baltimore, MD.
Duties: Implementation of CCITT R2 encoder/decoder (similar to DTMF) in Motorola 56002 assembly language, based on Goertzel algorithm. 13K+ lines assembler. Deployed in the field in Asia and South America.

From: 1996 To: 1996
Client: VM Labs
Location: Los Altos, CA
Duties: For this multimedia chip startup, provide detailed critique of their proprietary DSP chip architecture.

From: 1993 To: 1995
Client: Oculix
Location: Switzerland
Duties: Motorola DSP 56000 assembler for numerical and FFT analysis of real-time data gathered by laser from the human eye. Based on NeXT Machine. 150K source.

From: 1993 To: 1994
Client: Centigram Communications Corporation.
Location: Silicon Valley CA (apparently now part of SS8 Networks)
Duties: Port TruVoice speech synthesis code from TI TMS320E17 assembly language to Motorola DSP 56002 assembly language on Motorola PC

Media card; port to Analog Devices ADSP 2115 assembly language on Echo Personal Sound System.

From: 1993 **Client: Atari**
To: 1994 Location: Sunnyvale, CA
Duties: Implement physical modeling music synthesis techniques on custom RISC/DSP chip inside Jaguar game console. Recommend improvements to new custom DSP architecture.

From: 1993 **Client: Euphonics**
To: 1993 Location: Boulder, CO
Duties: For this software music synthesizer company, write C routines to emulate certain hardware elements in the target architecture. This allowed the company to study aspects of caching parameter updates, for optimizing real-time performance.

From: 1993 **Internal Project**
To: 1993 Location: Bay Area, CA
Duties: For a research project involving DSP architecture, write a series of Java classes to emulate the typical components of a DSP chip.

From: 1987 **Client: Shure**
To: 1988 Location: Evanston (now Niles), IL
Duties: Working from the written specification for a proprietary algorithm, develop C and TI TMS 32010 assembly language for a multi-channel consumer audio product prototype.

From: 1987 **Client: NeXT, Inc.**
To: 1988 Location: Silicon Valley, CA
Duties: Developed, debugged, and documented more than 50 routines in the Motorola DSP 56000 assembly language vector library (with Julius O. Smith; source code printout is 2" thick, available on SourceForge). While working off-site for over a year before NeXT was publicly released, maintain secrecy about the fact that NeXT would include a 56000 processor.

From: 1986 or 1987 **Client: Sonic Solutions**
To: 1986 or 1987 Location: San Francisco CA
Duties: As one of the first consultants hired by Sonic Solutions (located in their first office in San Francisco), port their C-language noise-reduction code from one flavor of Unix to another.

Other experience:
- Studies of micromachining and nanotechnology.

- Experience with the Star Semiconductor SPROC chip, the IBM MWAVE chip and operating system, OS-9, and Spectron's SPOX operating system.

Patents

Patent Number	Date Issued	Title
5,569,871	October 29, 1996	Musical tone generating apparatus employing microresonator array (co-inventor; micromachining)

As Vice-President and President of Yamaha Music Technologies Inc., I supervised the patent applications by my employees that resulted in US patents 5,245,130, 5,288,938, 5,386,568, 5,422,956, 5,536,902, and 5,541,358.

Teaching appointments

From:	2003	**University of Colorado at Denver, College of Arts & Media**
To:	2008	Denver, CO
	Position:	*Lecturer, College of Arts & Media*
	Duties:	Teach special topics course on audio data compression to upper-level undergraduate and graduate students.

Major Publications

- "Approximation and Syntactic Analysis of Amplitude and Frequency Functions for Digital Sound Synthesis." *Computer Music Journal* 4(3):3-22, 1980.
- *Modeling Musical Transitions.* Ph.D. Thesis, Stanford University, 1985. 243 pp.
- (with C. Roads). *Foundations of Computer Music.* MIT Press, 1985. 600 pp.
- *Digital Audio Engineering: An Anthology.* Madison, WI: A-R Editions, 1985. 144 pp.
- *Digital Audio Signal Processing: An Anthology.* Madison: A-R Editions, 1985. 283 pp.
- "Orchestral Instruments: Analysis of Performed Transitions." *Journal of the Audio Engineering Society* 34(11):867-80, 1986.
- "Editing Time-varying Spectra." *Journal of the Audio Engineering Society* 35(5):337-51, 1987.
- "Analysis and Synthesis of Musical Transitions Using the Discrete Short-time Fourier Transform." *Journal of the Audio Engineering Society* 35(1/2):3-14, 1987.
- "Implementing Table Lookup Oscillators for Music with the Motorola DSP56000 Family." Presented at the 85th Convention of the AES, 1988. Preprint No. 2716.

- "Digital Audio Representation and Processing." *Multimedia Systems*, edited by John F. Koegel. ACM and Addison-Wesley, 1993.

- "Technological Change: The challenge to the audio and music industries" (written version of AES keynote address). *Journal of the Audio Engineering Society,* March 1997.

- (with James Grunke, Ben Novak, Bruce Pennycook, Zack Settel, Phil Wiser, and Wieslaw Woszczyk). "AES White Paper: Networking Audio and Music using Internet2 and Next Generation Internet Capabilities." *Journal of the Audio Engineering Society* 47(4):300-310, April 1999. Presented (with Betsy Cohen and AES President Marina Bosi) to White House National Economic Council, December 1998. http://www.aes.org/technical/i2.html.

- (with Yamaha's Mike Overlin). "Playing with Fire," *Electronic Musician*, May 2003, pp. 31-38 (http://emusician.com/ar/emusic_playing_fire/index.htm, on audio networking over 1394).

Professional Associations and Achievements

- Fellow (1996), Audio Engineering Society.
- Convention Co-chair, 2008 AES Convention, San Francisco.
- Convention Chair, 2006 AES Convention, San Francisco.
- Convention Chair, 2004 AES Convention, San Francisco. Recipient of an Anderton Award, Pro Sound News, December 2004, p. 30.
- Technical Papers co-chair, 2002 AES convention, Los Angeles.
- Keynote Speaker, November 1996 Audio Engineering Society Convention.
- Technical Papers chair, 1992 AES Convention, San Francisco (first AES San Francisco Convention).
- Conference Chair, 1987 Audio Engineering Society (AES) International Conference on Music and Digital Technology (Los Angeles).
- Elected member of the AES Board of Governors, 1992-1994; again 2005-2007.
- Chair, Audio Engineering Society Convention Policy Committee, 2006-2008.
- Former member of review board, *Journal of the Audio Engineering Society.*
- Assistant Editor, *Computer Music Journal*, (MIT Press), 1978-1982.
- Co-founder (1980), International Computer Music Association.
- Founder and Series Editor (1984-1996), *The Computer Music and Digital Audio Series*.
- Honorary Member (since 1998), The Midi Association, formerly Midi Manufacturers Association (MMA).
- Technical presentations and session chair at various conferences such as Audio Engineering Society, Acoustical Society of America, International Computer Music Conference, DSP World.
- Conference paper reviewer for many International Computer Music Conferences (ICMC).
- Member, Acoustical Society of America. Senior Member, IEEE.

Further qualifications

Functionally bilingual in German. Reading ability in French, Dutch. Some experience with Spanish, Italian, Japanese, Latin. Separate list of foreign language experience available on request. Extensive experience traveling abroad and communicating with foreigners.

Other activities

I currently enjoy spending time with my family, hiking, and weightlifting. In earlier years I have especially enjoyed travel, aikido, operating a Maerklin Z-gauge model railroad, performing a wide variety of folk and classical music, and attending musical events. Member of Toy Train Operating Society of America.

References

Full vita and references from industry, academia, and lawfirms available on request.

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