ANNOUNCING THE BIRTH OF

BOBCAT MOBILE

The world of music is rapidly moving toward downloaded files – MP3s with poor fidelity, played on mobile phones. Major press (see the Rolling Stone link at the end) expresses the feelings of many people that sonic excellence is a thing of the past, previously available with analog LP's, but impossible to achieve with CD's and MP3's. Most available recordings have moments when the high frequencies are irritating enough to cause the listener to turn the volume down below the point of maximum enjoyment for the rest of the music- and sometimes to just turn it off. High frequency irritants can originate from the recording or transmission process, bit reduction, studio mixing, the musical instruments, and dry acoustics at recording and playback.

Using new high speed computer processing power unavailable when most music discs and file downloads were recorded, Dick Burwen developed a new process which reduces artifacts and irritants, allowing the music to come to life as it was originally played. This process is called BURWEN BOBCAT (abbreviation for BURWEN OPERATING SYSTEM – BEST COMPUTER AUDIO TECHNOLOGY). Audiophiles using this technology as audio software on their PCs love the absence of listening fatigue and regaining the feeling of the music. Now a special version for music in headphones, called BOBCAT MOBILE fits into spare digital signal processing (DSP) capacity of mobile phones.

BURWEN BOBCAT

BURWEN OPERATING SYSTEM · BEST COMPUTER AUDIO TECHNOLOGY

BOBCAT MOBILE is computer digital signal processing that reduces imperfections not part of the original music. It consists of a combination of unique high frequency reverberation and tonal rebalancing (equalization, EQ). Unlike existing natural or artificial reverberation which has practically no effect at highest frequencies, Bobcat's extreme high frequency reverberation averages out high frequency imperfections in the recording process, making the sound much smoother. It makes it possible to EQ the sound for clarity and naturalness, without deliberately losing its high frequency details in order to make imperfections less audible. BOBCAT MOBILE also enlarges percussive sounds that allow the music to regain its natural impact.

One of the most important benefits of BURWEN BOBCAT type of processing is reduced listening fatigue. Music has regained the lost emotional feeling of the original performance. Depending upon the degree of processing and quality of the recording, different versions of BURWEN BOBCAT can simply restore the music as just described; or can enhance the overall sound to make it more exciting. Very expensive CD players, DACs (digital-to analog converters), and other processors merely attempt to make the analog signal to your

speakers an accurate replica of the digital signal, dirt and all. BURWEN BOBCAT actually improves the signal from CDs, MP3s, and various digital formats by adding nearly inaudible high frequency reverberation and subtle tonal balance correction. It makes MP3s sound better than unprocessed CDs. Now BOBCAT MOBILE matches Bobcat processing to headphones plugged into mobile phones playing MP3s. It produces more natural, clear, sound that is easy to listen to. You can listen longer.

www.burwenbobcat.com
www.burwenaudio.com
http://www.rollingstone.com/news/story/17777619/the_death_of_high_fidelity/print

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BOBCAT MOBILE SIGNAL PROCESSING

Richard S. Burwen

BOBCAT MOBILE is a special version of BURWEN BOBCAT's patent-pending signal processing, now optimized for mobile phones. It enhances MP3 recordings played on a mobile phone via a combination of equalization (frequency response change) and high frequency reverberation unlike that produced by any physical enclosure or existing electronic system.

The present version is optimized for music listening via the phone's very low-cost headphones and audio system. A different version can be optimized to improve telecommunication intelligibility and ease of listening using the phone's microphone and speaker.

PURPOSE OF BOBCAT MOBILE

1. Produce musical sound from very low-cost headphones that is comparable with the sound from an expensive speaker system.
2. Improve imperfections in MP3 recordings and the limited mobile phone audio system to reduce high frequency irritants and listening fatigue – make music easy to listen to.
3. Produce a sense of ambiance and space otherwise missing from the anechoic headphone environment.
4. Enhance percussive or transient sounds for greater clarity and impact.

BACKGROUND

Mobile phones that include MP3 players produce very limited sound quality for music. Contributing factors are: poor D/A conversion, bass rolloff, distortion, less than 1 milliwatt headphone amplifier output, MP3 conversion and bad recordings. A very big factor is the poor frequency response of low-cost headphones.

The recordings often have poor tone quality and high frequency irritants. These problems can originate from the recording or transmission process, MP3 bit reduction, studio mixing, the musical instruments, microphones, and dry acoustics at recording and playback. Recordings are often described as "fatiguing" and a number of audio professionals believe their effect produces an "inner tension" or "stress" which BURWEN BOBCAT processing eliminates.

WHAT IS BURWEN BOBCAT PROCESSING?

BURWEN BOBCAT processing enhances sound recordings via a combination of equalization (frequency response adjustment) and high frequency reverberation that cannot be produced by any room or existing electronic system.

Hall reverberation consists of multiple sound reflections back and forth from various walls or reflecting surfaces added vectorially to the direct signal. Wavelength variations with frequency (shorter wavelengths at high frequencies) make the sum of the direct signal and all the reflections produce a frequency response with many hundreds of peaks and valleys. Following an impulsive sound the reverberation decays by 60 dB during what is commonly called the reverberation time, generally in

the range of 0.5 to 3 seconds. Due to physical Dimensions, no significant reverberant energy reaches a typical listener during the first 15 milliseconds. Sound absorption in the air and at the reflecting surfaces attenuates the reverberation at high frequencies. A listener receives very little reflected sound above 5 kHz. Contrary to what most audio designers think, inventor Richard S. Burwen found that ripples in the frequency response are what make music really musical.

BURWEN BOBCAT's reflections occur much sooner and have much more high frequency content. Depending upon the processing choice the reverberation may start as soon as 20 microseconds or as late as 4 milliseconds. The shorter the time, the more intimate is the sound. The amplitudes of the reflections do not fall off at high frequencies. Just the opposite. At 20 kHz the reflections, which are delayed replicas of the direct signal, may be about equal in amplitude to the direct signal. In the case of "Extreme" processing, the reverberation at high frequencies greatly exceeds the direct signal.

Almost no reverberation is used at extreme low frequencies because reverberation makes muddy sounding bass. The actual frequency response is a combination of how all the reflections and direct signal add up vectorially, and the equalization of the direct and reverberation components. Changing the number of reflections by only 0.2%, their spacing in time, and amplitude vs. time can make a drastic change in the sound. Creating a pleasing sound using Burwen's SLENDOR AND AMBIANCE software tool is an art, akin to playing a musical instrument.

In a room, reverberant sound following an impulsive sound usually makes the transient less clear. Bobcat's attenuation curve shape makes transient sounds much clearer.

HOW BOBCAT WORKS

Burwen thinks Bobcat reduces high frequency audio imperfections by averaging, somewhat like an averaging oscilloscope. In the scope, a repetitive signal adds to itself many times and the amplitude increases directly with the number of signals added. Noise that is random, adds more slowly, as rms. When a large number of signals is added and averaged, the signal-to-noise ratio increases and the waveform becomes clearer.

Each sample in Bobcat's high frequency reverberation contains hundreds to thousands of delayed reverberation inputs scaled and added together. The signals add up faster than the imperfections, thereby increasing the signal-to-imperfection ratio. As the reverberation input has boosted high frequencies, it has greatest effect at the highest frequencies. The other benefit of Bobcat is clearer transients. The time decay characteristic of the reverberation includes a huge overshoot during the first 10 milliseconds or so. This has the effect of a leading edge volume expander and it stretches transients longer in time so they are more easily perceived. Because the system is linear it works at all volume levels.

In Bobcat processing that sounds the most neutral, the reverberation signal is smaller than the direct signal. Reverbs that are most effective in fixing gritty high frequencies are much bigger than the direct signal. The overall system is equalized for good

tonal balance. In some new “Extreme” reverbs the direct signal is 35 dB smaller than the reverberation at 20 kHz.

BOBCAT MOBILE FOR TELECOMMUNICATION

BOBCAT MOBILE for music has a 1 second reverberation time and a big overshoot to give transients more impact. For voice communication a much shorter reverberation time is better. Burwen’s SPLENDOR & AMBIANCE program already has reverbs as short as 100 milliseconds and 20 milliseconds, that have been used so far for TV broadcast sound and movies. More experimenting is needed to choose or devise the best reverb for phones.

Between the microphone and the phone line, equalization is required to improve intelligibility and ease of listening on a variety of fixed and mobile phones at the other end. Separate equalization and reverb for the speaker in the local phone is required to make the sound from a variety of phones at the other end of the line sound pleasing and intelligible.

As LG phones gradually become more popular they can be optimized to work with each other instead of with other phones. Thus the equalization and reverb may continually evolve with new phone models.

Dick Burwen

Dick Burwen has been a major figure in the electronics world for over 57 years. At the early age of eight Dick knew he wanted to design electronic equipment. Inspired by his father Henry Burwen, who once worked in a radio store, he built several crystal radios, graduating to single tube, two tube, and three tube circuits. At 14 he acquired professional first class radiotelephone and second class radiotelegraph licenses and had built his amateur radio station, W1NMG. During his high school years in Melrose, Massachusetts, Dick and his dad serviced radios in their basement. Dick did the troubleshooting and his dad refinished the wooden cabinets. World War II was under way and Dick worked for a year after school at National Company Inc. aligning and troubleshooting the Navy version of the HRO short wave receiver. Dick got hands-on experience at the Navy Radio Technician training schools and theoretical training at Harvard where he earned Bachelor's and Master's degrees.

At Bell Laboratories during the summer of 1949 between semesters, he designed a tracking band-pass filter. His first job after finishing graduate school was at Spencer-Kennedy Laboratories, Inc. where he designed all the RF distribution networks, and planned and supervised the initial installation of the second cable TV system in the USA. At Krohn-Hite Corp. Dick designed the laboratory UF101 Ultra-Low distortion Power Amplifier. Using type 6550 output tubes in a multiple-loop, high-feedback system, this amplifier, rated at 0.005% distortion was manufactured in small quantity for 20 years. From 1955 to 1961 Dick designed hi-fi equipment at National Company, Inc., circuits for military equipment at Norden-Ketay Corp., sensitive DC measuring instruments and a 1 kW transistor power for Navy sonar research at Honeywell Corp., Boston Division. During weekends and evenings he designed circuits as a consultant to other companies.

In September 1961 Dick quit his job at Honeywell to become a full-time circuit design consultant, working at his well equipped home laboratory for more than 60 different companies during the next 46 years. He has authored more than 30 technical articles and received 10 patents; others are pending. Among the circuits Dick has designed are numerous medical instruments, industrial controls, laboratory test instruments, power supplies, aircraft instruments, automobile ignition, detectors, high resolution video displays, and analog IC's. Dick got into a lot of really interesting projects. Among the more challenging projects were ultra-low drift chopper-stabilized DC data amplifiers, IC multipliers and function generators, magnetometers, and low-noise switching power amplifiers. He designed circuitry of the first transistorized blood cell counter, a seizure detector for epilepsy, photoelectric relays, high resolution CRT displays, early projection color TV, a military satellite spin detector, and magnetometers for ground use and aircraft. His spacecraft magnetometer circuits successfully measured the magnetic field of the moon from orbit.

When the government shut down ham radio for security reasons during World War II Dick became interested in hi-fi sound reproduction. In college and graduate school at Harvard, Dick's advisor was F. V. Hunt, inventor of the first low-pressure phono pickup – it tracked 16-inch transcription discs at only 5 grams instead of ounces. Dick was inspired to spend every afternoon in the Physics Library reading every article in every publication that had anything to do with acoustics and music recording and reproduction. When Dick asked to take courses outside the normal curriculum, Dr. Hunt asked: "Do you want to become a scientist or an audio nut?' Dick's answer: "Both".

Dick's passion for audio has been steady for more than 65 years. Much of his life's work in both audio and consulting for various companies has been in multiple-loop high feedback systems. His developments in audio led to advances in his consulting projects and vice versa. The op amps Dick designed for his own hi-fi system started semiconductor manufacturer, Analog Devices, Inc over 43 years ago. He worked for the company for a number of years as a consultant, designing many analog modules, and later, integrated circuits. For the past 24 years his consulting work has been almost entirely for Copley Controls, Corp., of which Dick was a founder. The company started producing Burwen designed switching servo amplifiers. A customer in the MRI business found that seven of the book size Model 220 amplifiers in parallel on each of three axis eliminated two racks full of linear amplifiers, allowing an MRI system to fit into a trailer. Since then Copley Controls has become dominant in gradient amplifiers. About 25% of the worlds hospital MRI systems use Dicks circuits.

One of Dicks clients in 1961 was Lafayette Radio, a New York parts distributor. Technicians in the store basement manufactured a 160 Watt Transistor Stereo Power Amplifier of Dick's design. The output stage used series connected germanium power transistors. In the early 1970's a new company, Burwen Laboratories, Inc developed the Model 2000 Noise Eliminator, a 3:1 companding noise reduction system that extended the dynamic range of an analog tape recorder to 110 dB. It did not quite sell to A&M records who feared setting a new industry standard different from Dolby. Burwen Laboratories did sell about 150 of its $3500 Model 1000 Dynamic Noise Filters. These one-way noise reduction systems for existing records and tapes were used by recording studios and FM stations for many years. The Burwen Laboratories product line expanded to lower cost professional Dynamic Noise Filters and consumer versions. Later KLH acquired and updated the consumer products.

After 30 years a few KLH Burwen Research Dynamic Noise Filters and Transient Noise Eliminators are still in use.

Dick built his first major hi-fi system when he was in high school and a freshman at Harvard. In contrast to his present 20,000 watt system, it used a 3-watt amplifier. In common with the present system, it used feedback to boost extreme high and low frequencies to compensate for speaker loss and it had colored lights – Christmas tree lamps. You can read about Dick's present system and his Audio Splendor software at www.burwenaudio.com. In the years between these two hi-fi systems Dick built ever more powerful and flexible systems. Much of the improvement resulted from tone control development that compensated the speakers and program sources.

As a consultant Dick helped Mark Levinson with the first products of Mark Levinson Audio Systems and Cello LTD's Audio Palette. Millions of National Semiconductor DNR chips licensed under Dick's patents appeared in car stereos and other products. Now mostly retired from consulting, he is busier than ever with new computer audio software. He has been married to his wife Barbara for 52 years.

Memberships

ASA Acoustical Society of America - Member
AES Audio Engineering Society - Life Fellow
IEEE Institute of Electrical and Electronics Engineers - Life Senior Member
SEG Society of Exploration Geophysicists – Member

DICK BURWEN'S DESIGNS

AUDIO
Tone Control Software
Reverberation Software
Audio Pallete
Noise Eliminator
Dynamic Noise Filter
Transient Noise Eliminator
Rotating Speaker Simulator
200 Watt Ultra Low Distortion Power Amplifier
8 Kilowatt Color Organ
Minus Noise Mixer
Tape Recorders
Volume Expander
Compressors
Electronic Reverberation
Portable Transistor Music System
Peak VU Meter
Tone Control Systems
Binaural Headphone Driver
Microphone Mixer
Musical Instrument Enhancement
Speaker Equalizer
Mixer Bass Blender
Phono Preamplifier
50 Watt Integrated Stereo
Graphic Equalizer
High Speed Limiter
Pitch Shifter
120 DB Dynamic Range Equalizer
4 Channel Power Amplifier
Antenna Amplifier
Op Amp Stereo
Overload Protection
Half Octave Filters
Electronic Crossovers
Low Noise Microphone
20 KW Speaker System
Intercom Systems
Stylus Force Gage
Low Noise Preamplifiers
Hum Filter
Wide Range Remote Equalizer

AUTOMOTIVE
Ignition Systems

DETECTION
Magnetic Gradiometer Electronics
Chopped Light Photoelectric Relay
Magnetometer Electronics
Radar IF Strip
Metal Detector
Proximity Switches
Photolectric Controls
Burglar and Fire Alarm

POWER SUPPLIES
HIgh Performance Regulators
Current Sources
50 KV Supply
Frequency Changers
Overload Protection
Line Voltage Regulator
SCR Converters
Phase Controlled Regulators
Precision AC Sources
Subminiature Power Converters
Shunt Regulator Modules
Neon Sign RF Supply
Switching Regulators
Subminiature Dual Supply
Battery Float System
Hiqh Isolation Converters
Low Noise Medical Supplies

GROUND SUPPORT
Pressure Transducers
Strain Gage Amplifiers
Intercom Amplifier

INTEGRATED CIRCUITS
Multipliers
FET Operational Amplifier
Low Drift Amplifier
CRT Distortion Corrector
Proximity Switch

FUNCTION MODULES
Precision Rectifiers
Wide Band Gain Controller
Power Supply Regulators
DC Operational Amplif iers
Chopper Stabilized Amplifiers
Sample Hold
Analog to Digital Converter
Binary to BCD
Active Filters
Comparators
Voltage Variable Filters
PWM Multipliers
Data Amplifiers
Peak Followers
Multiplexers
Low Noise Amplifiers
Oscillators
Automatic Level Control
Active Transformer
AC Operational Amplifiers
Servo Amplifiers
Digital Tape Head Electronics

AIRBORNE
Temperature Gage
Low Altitude Warning System
Scan Converter
Magnetometer
Aileron Control
Synchro Amplifier
Temperature Controller
Lamp Flasher
Noise Rejection Amplifier
Servo Amplifier

INDUSTRIAL CONTROL
Switching Servo Amplifiers
DSP Servo Amplifier
AccuData II Chopper
Stabilized DC Amplifier
Laser Trimmer Control
DC Operational Amplifiers
Particle Size Analyzer
100 Watt Valve Driver
Digital Analog Position Programmer
Photoelectric Relays
Power Operational Amplifiers
MultiplIers
Pulse Width Modulators
Lamp Dimmers
Chopper Amplifiers
Peak Voltmeter
Logarithmic Amplifier
Liquid Mixture Control System
Braking Energy Absorbers
AC Current Limiter
Nanovolt DC Amplifiers
Motor Speed Control
Temperature Measurement
Integrators
Proximity Sensors
Voltage Controlled Oscillators
Phase Shifter
Stable Oscillators
Precision Charge Dispenser
Phase Sensitive Demodulators
AC DC Converter
40 Watt Torque Motor Driver
Die Bonder

VIDEO
Projection Color Receiver
Image Storage Systems
Community TV Amplifiers
Facsimile Video Processor
Precision Deflection Amplifiers
Linearity Correctors
Video Amplifiers
IF Strips
Cable TV Distribution Networks
Barre, Vermont Cable TV System
Character Deflection Amplifier
Crystal Oscillators
Chroma Demodulator
Precision Pulse Delay
Blanking
Grid Bias Controllers
Precision Sweep Generators
Focus Regulators
Digital Programming
Dynamic Focus

MEDICAL
MRI Gradient Power Amplifiers
Ultrasound Monitor
Blood Pressure Module
Blood Cell Counting and Sizing
Cardiotachometers
EEG Preamplifiers
EKG Preamplifiers
Seizure Detector
Response Analyzer
Linear Ohmmeter
Amplifier Noise Filter
Continuous Performance Tester
Channel Selector
Baby Monitor
Blood Oxygen Monitor
PH Preamplifier
Temperature Measurement System
Automatic Gain Control
Temperature Controller
Battery Charging System
Carbon Dioxide Monitor

SPACE VEHICLE
Analog to Digital Converter
Magnetometer Electronics including:
Phase Locked Loop
Spin Demodulator
Carrier Amplifier
DC Signal Processing
Milliwatt Power Converter

CABLE TV
System Distribution Networks
Giant Horn Antenna
Barre, Vermont System, 1952
Other Towns

LABORATORY
Gas Pollution Monitors
Magnet Controller
Audio Time Correlator
DC Data Amplifiers
Pen Motor Drive Amplifier
Servo Recorder
Beam Current Controller
Accelerometer Amplifier
Square Wave Generator
Humidity Sensor
Microwatt Meter
Semiconductor Testers
Low Noise Preamplifiers
Electronic Thermometer
Multiplier Tester
Streaming Current Detector
Film Motion Controller

GENESIS OF BURWEN BOBCAT

By Dick Burwen

When my amateur radio station W1NMG shut down due to World War II, I became interested in Hi-FI audio. At that time it was an accomplishment to design a vacuum tube power amplifier having extended frequency response from 30 to 15,000 cycles per second (now called Hertz). In my first major hi-fi system in 1945, I realized the losses in speaker response at extreme low and high frequencies required frequency response equalization (EQ) to extend the range. My 3-watt, 6L6G pentode power amplifier design used feedback to boost 30 Hz and 15 kHz for brilliant highs and deep bass without boom. It had bass and treble controls too.

My successively better audio designs over many years used ever more elaborate, feedback tone controls as a key element in improving the sound. I learned that the frequency response of the entire system, including the recording, phono preamplifier, power amplifier, speakers, and room is the number one factor in producing high quality sound. Besides low distortion and the usual specifications for high fidelity equipment, two other most important elements of fine sound are the acoustics of the recording environment and the listening room. When sound is reflected from various walls and surfaces, differences in travel times cause it to add to or subtract from the direct (original) sound at different frequencies, producing big ripples in the frequency response. Contrary to many professional opinions that ripples are bad, I found they are what make music sound really musical. So, I prefer live rooms over dead rooms which are clearer, but too revealing of imperfections.

For more than 20 years I was privileged to record in what to me is the best hall in the world, Jordan Hall at the New England Conservatory of Music, in Boston, Massachusetts. I recorded the Boston Philharmonic Orchestra, the Civic Symphony Orchestra of Boston, and Boston Baroque using two omni-directional microphones pointed at the ceiling. Omni-directional microphones are actually quite directional at 20 kHz and the increased high frequency reflections, together with a little EQ, made the recordings smoother and more musical. I always loved the reverberation in recordings made in Jordan Hall, but I hated the artificial reverberation I heard in many commercial recordings. Jordan Hall's reverberation makes the sound brilliant, full, and musical. Artificial reverberation can turn instruments like cymbals into mush. Newer sampling reverberation more closely resembles real halls, but I find it is not really what the ear likes to hear.

My 20,000 watt hi-fi system has been in development since my home was designed and built around its five walk-in speaker horns 43 years ago. Before acquiring modern computers, I used three microphones to pick up the sound from the speakers and add a little of it into the input signal. Due to the 22 milliseconds or so sound travel time from the speakers to the microphones the additions and subtractions at different frequencies caused ripples in the frequency response that made the sound pleasingly brilliant and very musical.

Although I was equipped for genuine 4-channel analog recording with a mix to 5 channels, I discovered I actually preferred my 2-channel recordings processed to 5 channels. The contributions from the front left and front right channels to the front center and rear speakers produced a fuller, smoother, more pleasant, room-filling sound.

When fairly powerful digital signal processing (DSP) chips and circuit boards became available I designed software that used four $7500 processing boards inside a Pentium 1 computer together with two stereo external digital-to-analog converter (DAC) boxes. The software system replaced the microphones and the tone controls for my front speakers. It generated simple, but pleasing reverberation for my rear speakers. My analog equipment was able to mix a little of the rear channel reverberation into the front channels for greater smoothness.

The completed reverberation software, in conjunction with my rear channel tone controls, added subtle ambiance extending to frequencies as high as 20 kHz. For the first time, I got to like artificial reverberation – my own. It didn't sound like reverberation. Not only that, it nicely supplemented the reverberation already present in phonograph records and CDs.

I realized the improvement my new ambiance software made was just a taste. I wished I had 500 times the processing power to produce many more sound reflections. In 2002 this became possible with Intel's development of the Pentium 4 processor, which I estimate was equal to 400 of the Motorola DSP96002 chips used on my old DSP boards.

In the fall of 2002, when I retired from circuit design consulting, I embarked on improving my hi-fi system, and maybe producing a commercial product to share with others, via new software. After five years of intense work, averaging more than 60 hours per week, I now have AUDIO SPLENDOR and its derivative BURWEN BOBCAT. What took so long was writing 1,400,000 equations, some, more than 150 characters long, and making them all work.

Besides improving my sound with new tone controls and ambiance generation in 5 channels a principal objective was to make my sound system easier and quicker to operate. With the availability of 5-channel SACDs and movies, switching back and forth to 2-channel CDs and optimizing my system had been a complex task. By the time I finished the setup my audience became bored and often I made a mistake. Now, after saving my settings from a rehearsal, clicking on a track in the Windows Media Player causes AUDIO SPLENDOR to set up my whole system by setting 298 on-screen sliders and selecting among 364 buttons. Settings saved for each musical selection in the TONE library automatically recall from 6 libraries: tone control settings, reverberation characteristics, the mix, reverberation mix, source compensation, and speaker or headphone compensation. Rehearsing is easy, as most recordings require setting only 12 controls, affecting all 5 channels. The software also works in 2, 5.1 and 7.1 channels.

Part way through the development of this comprehensive software, I recorded test CDs one of which I mailed to my long-time friend Mark Levinson. For many years prior, Mark had been telling me how bad and fatiguing CDs and other digital recordings were and why he liked old-fashioned analog recording. "Dick, solve this problem! If we can't improve CDs I will get out of audio." As I had always used my ever-improving tone controls to rebalance the sound, so almost every CD sounded decent to me, I was not convinced there was such a problem. Upon listening to the test recording and others, Mark reported I had indeed solved the problem of listening fatigue. My new ambiance generation, which had its greatest effect at extreme high frequencies, really smoothed the sound, got rid of irritants, and made transients clearer, all without losing high frequency resolution. I didn't even know I was working on the problem!

Mark was so enthusiastic that he urged me to make a simplified version of AUDIO SPLENDOR without controls, available and affordable for everyone. We will call it BURWEN BOBCAT - BURWEN OPERATING SYSTEM, BEST COMPUTER AUDIO TECHNOLOGY. It was all Mark's idea!

Around that time iPods and MP3s were becoming popular. Audiophile magazine writers often derided the quality of MP3s as unlistenable on a good hi-fi system. Back to phonograph records! Tests we and others made listening to BURWEN BOBCAT processed MP3s showed the processed MP3s were actually preferable to the original CDs, even SACDs and LPs. Additionally BURWEN BOBCAT processing reduced the audible difference between processed MP3s and processed CDs from which the MP3s were made.

BURWEN BOBCAT RE plugs into the Windows Media Player (WMP) and for listening it processes the signal on the way to your computer's sound card or DAC. It processes at 44.1, 48 kHz, 88.2 kHz, or 96 kHz, whatever WMP plays - CDs, WMA compressed or lossless, and MP3s. I save my CDS on an external USB drive in WMA lossless format. When I make MP3s for my iPod there is only one compression degradation, not two. If I want to, I can apply BURWEN BOBCAT processing when ripping or burning CDs. It has an efficient file converter too, that can make 128 kbps processed MP3s or losslsess WMAs at high speed from hundreds of WMA files in a folder.

BURWEN BOBCAT RE incorporates all the slider and button settings of AUDIO SPLENDOR, but I have set them for you, giving you a simple choice of 19 processing selections on click-buttons for 2-channel stereo. When you listen to BURWEN BOBCAT processed audio you don't hear it adding what sounds like room reverberation or echo. The reverberation you notice is almost entirely that already present in the recording itself. BURWEN BOBCAT adds what I describe as ambiance without echo. It includes a lot of what audiophiles call "air". Rough sounding recordings become smoother and more musical because the extreme high frequency reverberation averages out the grit. Unlike natural reverberation, which tends to obscure transient sounds, BURWEN BOBCAT stretches transients in time so they are more easily perceived and become clearer. After getting used to this type of processing many listeners find their original CDs played loud are quite irritating.

Real room reverberation and ordinary electronic reverberation have their greatest effect at middle and low frequencies. When I first discovered the benefit of my high frequency reverberation, I tried boosting the high frequency content of various sampled reverberation programs to obtain a similar effect. That did not work at all. No resemblance.

To produce the brilliance and clarity of BURWEN BOBCAT's high frequency reflections in the real world, imagine a saxophone player has a wall-size reflector with a hole through which the neck of his instrument protrudes and the reflector is only 1/4 inch from the top open valve. The reflector is in a different position for each different note. Physical dimensions make such high frequency reflections impossible. They have to be produced electronically. You can't get this effect at a live concert. Yet I find quick, high frequency reflections are what your ear really likes to hear for clear, musical sound. Even at Jordan Hall, I sometimes think the sound ought to be processed with my new high frequency reverberation technique.

In addition to its high frequency ambiance BURWEN BOBCAT incorporates a bit of tonal rebalancing (EQ). The four different *basic* selections are designed to change the overall sound very little while making it smoother and more musical, so they are suited to all kinds of program material. *Vocal*, *jazz*, *pop*, *classical*, and *movie* modify the sound more and are better suited to fixing certain problems in recordings. Once you get used to listening to the smoother high frequencies, unprocessed recordings become irritating to listen to. Mastering engineers tend to use the basic selections because they don't want to tinker with the intent of the original recording.

When I listen to my own CDs I don't mind changing the sound completely. Frankly, among the 3000 or so CDs in my collection there are very few I care to hear sounding anything like the unprocessed recording. One reason, I am told, is many older recordings were equalized via monitor speakers that attenuated the 3500 Hz region where voices become shrill. These recordings now sound screechy when played through more accurate speakers.

I use AUDIO SPLENDOR to augment extreme low frequencies, attenuate piercing high frequencies, sweeten violins, widen the acoustic image, and fill the room with spacious ambiance via 5 speaker systems. An important lesson I learned is you need to preserve the high harmonics of musical instruments, but a little too much makes the sound unmusical. For poorer quality CDs and TV audio I often use what I call *extreme* processing that almost completely substitutes artificial reverberation for the main signal at high frequencies. My latest product at this writing is BURWEN BOBCAT MONITOR which incorporates this sound in 5.1 and 7.1 channels.

Extreme processing also includes a feature I call NO SCREECH. It attenuates the 3500 Hz region only during a singer's loudest high notes. BURWEN BOBCAT RE vocal settings have a dip in frequency response in the same region and make a big improvement. However, fixed attenuation can be carried only so far before the orchestra and a singer's quieter refrains become muffled. With NO SCREECH in BURWEN BOBCAT *extreme* everything is clear and screech is gone.

BURWEN BOBCAT MONITOR is my full AUDIO SPLENDOR software without the controls and is designed to work with a MOTU 828MK3 8-channel A/D-DAC. It produces its multichannel output from a 1 to 8 channel analog input signal or the Windows Media Player where it is a plug-in. It is also a DirectX plug-in for professional audio editors. Audio is processed at 88.2 kHz and you can record and play 32-bit BURWEN BOBCAT multichannel files at 88.2 kHz. You can convert a folder full of stereo files to 88.2 kHz multichannel. In addition it includes BURWEN BOBCAT RE and a new simplified unreleased product, FRIENDLY BURWEN BOBCAT, with all their listening, recording, and file conversion features. For studio monitoring or broadcasting BURWEN BOBCAT MONITOR can apply any of 7 different processings to 1, 2, or 3 stereo analog inputs.

My newest development is BOBCAT MOBILE which adapts Bobcat processing to fit into spare DSP processing capability for mobile phones. Its high frequency reverberation and EQ are matched to a particular pair of headphones for music listening.

Read about AUDIO SPLENDOR, more of Dick's audio developments, and his sound system at www.burwenaudio.com .