Glenn D. White, Acoustician, Interview by Erik 4-A

Glenn D. White has had a long and colorful career in Acoustics, Sound Reinforcement, Education, Studio Design, Piano and Organ Repair for over 40 years. He has had the privilege to work with people such as Kearney Barton (of Audio Recording Inc.) acoustics genius Paul Veneklasen, and of all things to also do the sound for The Beatles at the Coliseum in August of 1964! He also wrote a Textbook called " The Audio Dictionary" [published by UW Press, ©1987, ©1991 ISBN 0-295-97088-X] that is now going into its 3rd Edition. All in all, quite a range of experience for someone who was born on a wheat farm in Kansas and grew up on Queen Anne Hill in Seattle.

Where were you born? What was your family's background?
"I was born on a wheat farm in Lewis, Kansas. (in 1933)"
"My father was born in the same town... he wasn't much of a farmer, he liked technical stuff. He built the first radio station in Kansas in about 1920. He also built a movie theater, and he got a job with Western Electric going around the country; this is a few years later in the later 20's, and putting sound heads on existing projectors and putting sound into theaters."

What is your earliest audio related memory?
"When I was a kid, I used to go out in the kitchen and I would pull my mother's pan lids out of the cabinets, and I'd spin them on the floor and listen to them. You know how when you spin the pan lid it would go, [makes a noise] 'WRRM-WRRM-WRRM!' and they all sounded different. They all had different pitches and different characteristics and different lengths... I was fascinated by that?"

How old were you when you were doing that?
"I was about 3 or 4."

Is that what pulled you into audio?
"I've always been interested in sound... that just seemed like the most important sense to me ever since I was a kid."

Where did you go to school?
" We moved to Seattle when I was 6 years old. I went to Queen Anne High School and then I went to the University of Washington, majoring in Physics. I got my degree in 1955."

What inspired you to learn about acoustics?
"Since I was interested in Sound and interested in Audio (Hi-Fi at the time as they called it) I thought it would be a good thing to get a degree in Physics, because Physics was, in my estimation the basic science. I loved high school Physics and I took all the science classes I could in high school. I aced all of them, they were easy enough, and I though Physics was a good thing to Major in."

Were there classes in that field and how did you find out about them?
"I investigated the Physics department at the University of Washington and I found out that Professor Kenworthy was an Acoustician. I read a couple of the papers he had written for the Acoustical Society of the American Journal, and I thought he was a really sharp guy. I was offered a scholarship at Wazzu (Washington State University) for their Physics Department, but they didn't have any Acoustic Guy and they didn't have any Acoustics Curriculum either. So I turned that down, and I figured it wasn't that expensive to go to school in those days, and I was living on Queen Anne Hill with my folks... Dr. Kenworthy was my Advisor."

What sort of Pre-requisites did you have to have to get into these classes?
"I declared a Physics major so I could therefore take any course in Physics that I wanted to, as long as my Advisor approved; and of course Dr. Kenworthy approved of everything in Acoustics [laughs]."

What was your first job?
"The first real job that I had after graduated was at the Boeing Company. I had hoped to be able to get a

job in their Acoustics Lab. I went down there and the Acoustics Lab was not hiring anybody. However, right next door to it was the Vibration Lab, in the same building (this was at the old Plant 1 building Boeing facility), so I took a job in the Vibration Lab. They had an opening in the Tape Room, which is where they did Data Analysis (handling all the data that has been recorded on tapes. Mostly data from accelerometers and velocity probes and occasionally microphones). I liked that, and I liked tape recorders, I knew how they worked pretty much. I stayed there for about 8 years. When I left there [Boeing] I was in charge Instrumentation for the Environmental Test Lab.

Was that your first experience with tape machines?
"No, I had been using audio tape machines before that, I had an Ampex 600 (which I subsequently think is a piece of junk. I think it is a very poorly designed machine [laughs], but at the time there was nothing like it.). I enjoyed making recordings, and I befriended people in the [UW] Music School when I was a student... I asked them if I could record concerts, because they were putting on many concerts in the Music Department and they let me record them. I collected a bunch of Tapes. I still have some of those old tapes from the 50s."

Those would be interesting to hear. Where were they recorded?
"They were recorded in various places, some them in the Old Meany Hall, which has been torn down for long time. It was replaced by the present Meany Hall that was build in 1975. The building had been torn down a few years before that. It was damaged by the previous earthquake that was in 1965 and they condemned the building. So I had experience doing recording, I really enjoyed recording different ensembles and trying to see what this was all about, as far as getting the proper tonal balance and that kind of stuff.

Did you do audio recording while were working at Boeing? Outside of working at Boeing did you work with tape Machines?
"Oh yeah, my hobby was still making recordings."

How did studying Physics affect your perception of Acoustics, Recording and/or Music? Was it hard?
"Physics is very detailed, its not easy, but I was sort of attuned to it. I didn't have a hard time with it. The problem I had at the University [of Washington] was that there was so much stuff in the university catalog that I wanted to take, I wanted to take everything. I didn't want to go for more than 4 years, because I needed a job, so what I did was for a couple of Summer Quarters I went to school just so I could take a some electives. That way I took a year of German and a year of French and I already had 2 years of Spanish. Then later on, I took one quarter of Russian (which I don't remember any of hardly, except a few words) [laughs].

Why did you leave your first Job?
"I left my first job to become the first Sound Engineer at the Seattle Center, the location of the Seattle World's Fair of 1962. I heard about the position from Lou Guzzo's column in the Seattle Times (Lou was the music Critic for the Seattle Times [back then]) and he was writing a series of articles about the construction of the Seattle Center Opera House. He had some interviews with Paul Veneklasen who was the Acoustician. That's the first I had heard of Veneklasen, was reading about him in the paper and he was in fact doing the acoustics at the Opera House. I was intrigued with that, because I was just nuts about getting there and seeing what they were doing (of course you couldn't do that during the construction. He said that the Opera House was going to look for a Sound Engineer to work with Veneklasen, to do some more acoustical changes at the Seattle Center and also would be in charge for Sound Re-enforcement for the entire Seattle Center. In other words, head up the Sound Department. I found out that 140 other people also applied for it. I figured well, I'll take my chances. I was interviewed by Paul Veneklasen and also at the same time the opera house architect B. Marcus Priteka (Ben, as he liked to be called), was there and he was great guy and very sharp, he was old [then], but just a super guy. Anyway, I got the job of Sound Engineer [at the Seattle Center]."

Who is Paul Veneklasen? How did you meet him?

"I met him because he interviewed my for the job at the Seattle Center. He was an Acoustician, he lived in Santa Monica and he came from UCLA. He had been a student of Vern Knudsen, who was the relatively well known Acoustician that had worked with Harvey Fletcher in the old days (The Bell Labs acoustics guy, who had many, many Patents and many accolades over the years and the father of the famous Fletcher/Munson effect [A historic study dealing with how humans selectively hear things])." I met Harvey Fletcher once. He was about 90 and wasn't in very good health"

"Paul Veneklasen and I had a nice relationship because we seemed to speak the same language and we seemed to think the same way, and I learned a tremendous amount about acoustics from him. He was really my mentor in architectural acoustics. Kenworthy was a Theoretician, and I got all the Theory and all that stuff from him, but as far as practical acoustics was concerned Veneklasen is where I really got started in that. I was fascinated by that."

About how old were you?
I was 30.

What is you most significant memory of working with Paul Veneklasen?
"One thing that was really impressive was that he designed a wooden exponential horn to replace the horns that Altec/Lansing was using on their drivers (and also JBL). It is made out of wood, it's his own design and it is the most amazing thing. It is an 800 Hz cutoff horn, it's multi-cellular, with 8 cells and I swear it doesn't sound like a horn. You could never tell that you were listening to a horn by listening though this thing. I was just amazed by that."

"The [Seattle] Opera House had the first Stereophonic Sound System in a permanent installation in the Country [in 1963]. It was 3 channel stereo. It had 2 of these Veneklasen horns in each channel and 3 15" JBL Woofers for each channel. Plus, we had a fourth channel, which was the Soloist reinforcement channel. A portable speaker with the same horns and same woofers, that we could hang at various locations on the stage or put it on the stage and wheel it around. We used it like a monitor. Just working with that new system, because it was the only stereo system in the country used for sound re-enforcement, it was just really fun experimenting with it. Veneklasen, of course was also interested in our experience with it, because it was the first one he had designed. We had lots and lots of back and forth [conversations] by telephone. He visited up here a lot and I went down there a few of times to see him. Just the relationship with Veneklasen dealing with that sound system and getting it perfected, making subtle changes and stuff..."

"The sad part of it is, after I left the Seattle Center... they quit using it as a Stereo System. They just Paralleled everything. They took out those beautiful wooden [Veneklasen] horns, and just recently I was able to dig 2 of those wooden horns out of the surplus junk they have down there."

What effect did working with him [Paul Venklasen] have on you?
"It taught me a tremendous amount about auditorium acoustics. Also about the politics of dealing with architects. Which was (and still is) a real problem with a lot acousticians. Mostly he was my mentor."

How long did you work at the Seattle Center? What is your most significant Experience there?
"I was there for 5 years [1963-1968]. The most memorable experience was when I was doing the sound for The Beatles in 1964 in the Seattle Center Coliseum. That was a monumental experience in my life. I had no idea what to expect. I was just amazed at the audience reaction of course. It was great experience."
What was it like working under a situation like that?
"First of all, in 1964 bands like The Beatles and every other band didn't travel with their own sound systems. They relied on what was in the venue that they were performing in. The Beatles sent two guys from New York ahead of them, two advance guys. They wanted to talk to me and they wanted to talk to the security people etc., because they new that security was going to be a big problem. They knew the crush of humanity that would occur as soon as the Beatles came into town. Of course we had no experience with that, because we'd never had anything like that happen at the Seattle Center. They asked me about the sound system, and they said, 'Can you augment the system to make it just as loud as

possible, to get the music over the noise of the audience is going to be really difficult." and I said, 'Well yeah, we have quite a bit of equipment around here, so we can add to the system.' So I did that. All of our amplifiers in those days were tube amplifiers. All of the Amplifiers in the Coliseum were 80 Watts each. So I added three Altec/Lansing 300 Hz two cell horns (model 203, on 288 C Altec drivers). I put two of those, one on top of the other facing one of them back to cover the far end of the auditorium, the other one facing down a little bit to cover the far end of the main floor. Then we had some 800 Hz. horns also Altecs. They were 805s, two rows of 4 cells each, and I had one of them pointed right down on the stage so that The Beatles could hear themselves and also to cover the audience close to the stage. The speaker cluster was right above the stage."

Was that the "State of the Art" P.A. system circa 1964?
"Well I don't know about that, there may have been more powerful systems elsewhere, but I couldn't go out and buy anything. I had to scrounge amplifiers from other locations around the Seattle Center and put them in there. Each of those horns was driven by its own 80 Watt amplifier and the Woofers were JBL 15' woofers and I don't remember how many we had, but we put them into this cluster."

How did you overcome all that Screaming? (or did you?)
"We didn't. During the screaming, the sound system was inaudible. What I did do, is I hung an EV655C microphone up in the superstructure of the Coliseum about seventy-five feet forward of the stage, and just recorded the concert. Of course I couldn't record it off the sound system, because The Beatles people were there and they were looking over [everyone]... They knew that people were trying to make recordings, so I couldn't do that."

I heard one recording of that concert and it was inaudible and if you've heard it [laughs] which I am certian you have, it was nothing but almost white noise at one point.
"It was be a big wave of screaming and then that would die down until they could hear a few words and then there came another wave of screaming and so on for the entire 22 minutes the Beatles were on stage."

And they [The Beatles] were using maybe 100 Watt [Vox AC100] amplifiers [laughs].

"I don't exactly know what the amplifiers were. I used EV655C microphones for the 4 performers. I used 1 mic for Ringo and his drums. Those are omni directional dynamic microphones. Very good quality dynamic microphones. The Beatles were really intrigued by that.

They said, 'These microphones are so small. How come they're so small?"

I said, 'They're small because they sound better when they're small.'

'Oh is that so, really? No kidding!'

Ringo tapped the mic with his drums stick! He'd say, 'Is this really working?' [makes a sound] (tick-tick)."

Were they actually able to hear themselves on stage from the way you set things up?
"Oh yeah."
That must have been a surprise for them.
"The only opportunity they had to rehearse with the sound system was just very short. What they did was spend a lot of time in their dressing rooms practicing. I was floored by that. I went back there and listened at their door and they went over and over all the tunes they were going to use.. They were just really tight, really precise. I was very impressed by their ability and their musicianship. They knew exactly what they were doing."

"We also had a Press Conference for them and we set that up right outside their dressing room (which was in the Coliseum). Pat O'Day was the MC for that. I had known Pat for quite a while working with him with other shows in the Opera House. He was the first guy to put on a Rock 'n' Roll show in the Opera House. We had a lot of fun doing that. Roy Orbison was one of the first guys we had in there. He was a

nice guy to work with.

How did you deal with the Hysteria?
"I just put in ear plugs and tolerated it."
"The Coliseum was set up with sort of stadium seating, portable seating all the way around on the floor underneath the permanent concrete tiers. There were girls in the audience that would hide underneath the stands hoping they could stay there until the whole thing was over and be able to touch one of The Beatles, or something like that. Of course, the Cops just kept running them out of there. It was also the time when the audience would like to throw peanuts in their shells at Ringo for some reason. One of them bounced off his shoulder and because it bounced off toward me (along side the stage)I caught it. I took that peanut and I gave it to a 10 year old friend of the family and she treasured peanut that for years and years [laughs]."

Did you get to meet the Beatles? What were they Like?
"Very serious, as far as knowing what they wanted to do. They were curious. They were good guys. I was impressed with them They didn't seem to be arrogant at all. They liked to joke around. They joked around a lot with themselves. But they were really serious and they all agreed on what they wanted to do and how they were going to do it. There was no quibbling or anything like that."

Did you get any souvenirs and/or autographs from them?
"No. I probably could have gotten their autographs. At the Press Conference, of course there was a pretty high stress level among the [crowd]. Pat O'Day was being inundated by requests for all kinds of favors."

"Paul dropped his guitar pick on the stage at the end of their set, and both I and my assistant sound guy (his name is Dick Lavers), ran for it. He beat me to it and picked up Paul's pick and he still has it."

Did this affect your Life in any way? or your Opinion of Popular Music at the time?
"No, I wouldn't say so. I certainly enjoyed it, I certainly liked their music. It was before A Hard Day's Night came out, which was also 1964. I really enjoyed that movie, having dealt with them, because it was very realistic as far as the audience was concerned."

What other big artists did you work with while at the Seattle Center? What challenges did you face doing each show?
"I liked to experiment with stereophonic reinforcement, but that didn't go over well with a lot of performers. That was something new and they didn't want to risk trying it. But, I convinced the Smothers Brothers to use 3 channel stereo. I set three [EV]655Cs on a mic stand, and when they were doing their thing together, one of them was more in one mic than the other so they were actually reinforced in stereo. The center mic (the mic that was halfway between them) acted like a center fill. It really sounded good. It sounded very realistic out in the auditorium. The audience seemed to be very happy with it. Even the critics said they though the sound was unusually good at this particular event."

"We also had a lot of shows in the old Ice Arena (now it's just called the Arena). We also had a three channel system in there, that was put in after I started working there. It was also designed by Veneklasen. I was the guy that made sure that the contractor did everything correctly and everything met specs."

"We had a lot of shows down in there. We had Joan Baez, and she had this unknown guy with her named Bob Dylan. They said it was his first public performance. He played Harmonica and sang. I thought, wow that's kind of a Strange Guy! But he was Good and nice to deal with!"

"There were a lot of local groups too. One group I liked was Paul Revere & the Raiders. I think they were from Portland. Their drummer [Michael "Smitty" Smith RIP, 1942-2001] was terrific."

"Another interesting thing about drummers; we had the Beach Boys in the Coliseum and we used the same sound system that we had used for The Beatles. I notice at the rehearsal that the drummer was reading music. I had never seen a Rock drummer using a score before.

So I asked him at a break, 'How come you are using music? I never saw a Drummer use music before!' He said ‘I'm not their drummer. Their drummer [Dennis Wilson] is sick. They just got me at the last minute and I had no idea what we were doing, so I'm just sight reading all this stuff.'
I said,'You’re Kidding!',and he said,'No, I'm just sight reading it.' He was really good, I don't remember his name."

Did you do sound for any NW bands (i.e. The Sonics, The Wailers,etc...)?
"We had the wailers. I don't remember the Sonics. We had Little Stevie Wonder (as they called him in those days). That was in the Opera House, not the Coliseum."
So they did a lot of Rock shows in the Opera House?
"Yeah."

What was your favorite Concert that you did sound for? Who was it? Why?
"That's a hard one. I enjoyed lots of them. One that was memorable was Stan Kenton in the Opera House. The concert that he was in, was a part of the National Music Educators Convention. The place was full of music teachers. Stan Kenton is about 6 foot 5 [inches tall] and he has these huge long arms, he was a terrific conductor. Boy he was good. His ear was absolutely acute, he really knew what he was doing. His arrangements were all really unusual and really good."

"Another one I really enjoyed was Jack Benny, playing the violin with the Seattle Symphony."
Jack Benny? Playing the violin?
"Yes, it was a benefit concert.[laughs]"
Because they usually told me Jack Benny couldn't play his violin very well.
"Oh yeah, he was a good violinist. He wasn't Heifetz of course, but he could play the notes. He was not an amateur violinist. He really could play, but he pretended like he couldn't play. Like he walked out on the stage with his violin (and I had mic for him too), the orchestra started and played for a bit and his part wasn't for about a minute into it, and he forgot his bow so he had to walk back to get it. The concert was a riot [laughs]. That kinda stuff. They played the last movement of the Wieniawski concerto, and near the end, the tempo speeds up, and Benny shouted ‘NOT SO FAST’ a couple of times. After the final chord, Benny kept on playing furiously for about 5 or 6 measures"

Why did you decide to leave working at the Seattle Center?
"Well by 1968 all of the new sound systems at the Seattle Center had been installed, we put everything in the Food Circus and the Arena and the Coliseum was up to snuff by that time. I was offered a job by Bill Bergsma, the director of the Music School at the University of Washington to become the University Acoustician. Also, I would have an instructor’s position in the Arts & Sciences department. I would teach a course in Electronic Music and Recording and Reproduction of Music and Musical Acoustics. So I thought, 'Wow that's good, I would like to do that', so I quit the [Seattle] Center, and went to the University. I was there for 13 years. That was a very good job, I really enjoyed working with the kids."

How did you come to meet Kearney Barton of Audio Recording Inc.?
"Well he was around for a long, long time. When I was in school he was around. I don't remember how I met him. I knew when he moved his studio from downtown up to 5th Avenue about Cedar St [2227 5th Ave]. He rented some space in there and he called me and wanted me to look at the space to see if he could put a studio in there. So I went down and looked at it and I said, 'Oh yeah you have plenty of space here.' He wanted to turn it into a studio, but he didn't really have a lot of money. We designed a Control Room and put that in, and then he also wanted some Reverb Chambers, so we built three Reverb Chambers in back behind his studio. They are nice big chambers, they're about 15 feet tall, three of them side by side, isolated from each other. Nice sounding chambers, they are still there, but Kearney isn't there anymore and I think the present tenant is using them for storage."

What were Recording Studios like in those days in the 60s, in Seattle?
"Stereo was just coming into favor and Kearney wanted to have Three Channels. There was lot of Two Channel stuff around, but Kearney wanted three channels and he wanted me to build him a console and that's what I did. I had help doing that. My assistant at the Seattle Center, that I also stole from Boeing was a very a good electronics technician, excellent. His name is Ken Heidt. Ken and I built this console

for Kearney [which he still owns and uses!]. The year was 1965 when we installed the console down there. It is a total custom job. The top plate is an aluminum panel that is engraved, and if you look in one of the corners the engraving has a little glitch in it. That was caused by the 1965 earthquake [laughs]. The guy was engraving it when the earthquake hit [more laughter]. So that is the reason I remember that it was 1965."

That's an amazing board.
"It uses all Langevin pots and passive graphic equalizers in there. It's only 3 channels and everything is interconnected by patch cords. Which I thought that was a good idea, because that's what we had at the Seattle Center in the Opera House and in the Arena also. It's a complete patch system. Flexibility."

What made Kearney's Place so special? What was significant about it?
"The console I think it sounds very good. It has those Langevin pre-amps, which are push-pull from the input to the output. It's 2 channels in parallel, every pre-amp and are very quiet and they sound really good. They hardly overload, but if you do overload them they smoothly overload, they don't sound bad when you do that. The line amps were also Langevin and they were also a very good design. I thought they were quite a bit better than the Altec designs at that time. I just think the electronics in there were good. For tape recorders he had Ampex 351-2 [track] and he also bought a 3-track Ampex MR70, a half-inch machine. He didn't use that very much because nobody wanted 3-track. Kearney still has that machine at his present studio and he converted to 4-track, and he took out that 3-track head assembly, which is still almost brand new."

What about the room? What was special about the room?
"Well he didn't have enough money to really do a Job on the place. We had to use the room as the size that it was."

How big was the room?
"It was about... [750-800 square feet]. It was fairly decent sized. We built a control room adjacent to it, but it wasn't [very deep but it was wide], we didn't have the space. It sounded alright. We put some fiberglass on the walls at various locations to get rid of echoes and stuff. We did have to cut through the cement floor. The cement slab went from his studio to the neighbors to the south of him. The guy just to the South of him had a woodworking shop in there and he had all of his tools sitting on the concrete floor. So all of his machinery whenever it was running would transmit vibration though the floor and into Kearney's studio. The only way we could fix that was we had to build another wall right across in front of the existing wall, and isolated it that way. Then we had to cut the floor. We took a diamond saw and sawed the floor right through and that decoupled it from the other floor and that worked O.K."

Were there any other obstacles that needed to be overcome?
"The place was not very sound proof. Aircraft noise was a problem. Once in a while you would get a loud airplane you could hear in the studio."
That Seattle Jet-Age sound.
"Yeah, right. [Laughs]"
"Kearney used [Altec] A-7's for monitors in there, 3 of them. I thought they sounded awful, but he was used to them."

Did you ever do any recording in his studio?
"I never did any recording myself, but I was there when a lot of recordings were done. I was there when he recorded Ian Whitcomb. I don't know whether the stuff that he recorded there was ever released or not? He recorded the Kingsmen in there too."

What are some basic Principles of Acoustics to remember that make a room sound good when designing and/or building a recording studio?
"That’s a whole Book. [laughs] You want me to give away all my secrets!"
Maybe just one, something obvious [more laughing!].
"In general, a recording studio should be as big as you can afford to make it. There is no such thing as recording studio that is too big, but there are lot of them that are too small. If it's small then it has to be

really dead. Otherwise, the room mode resonances of the place will interact with the music. The bigger it is, the more densely packed the natural frequencies are, and they're not so strong and you can get by with a lot less absorption in a big room. It's the boundary reflections and to a lesser extent the reverberation of the room that gives it its acoustic and musical character. If you get rid of that by making it completely dead you might as well perform out in the middle of the desert, you don't get sound coming back."

"Another thing is that a lot of people make mistakes in the ceilings in recording studios. The ceiling should be a diffuser, or a relatively good absorber, because you don't want a specular reflection off the ceiling. I have been in lots and lots of studios that had just plane surface ceilings, even if angled, if it is a plane surface, it's not good."

Do you have to spend lots of money to get good acoustics? Why, or why not?
"Lot's of money is a relative term depending on who you are talking to [laughs]. It depends on the requirements. If you have a sound isolation problem then it is going to be a lot more expensive to control that. You have to take special pains to isolate the noise sources from the studio and control room. That requires multiple walls and it requires special treatment of those walls, etc... "

What is important to remember about Control Room Acoustics?
"Control room acoustics, that's a controversial subject. Nobody seems to agree on what they should be. You have the Live End/Dead End Controversy (where one end should be live and the other end dead). Well that is a non-symmetrical acoustical space, and I don't think it sounds very good in either location, either at the live end, or the dead end. I think the Control Room has to be deader than the Studio is, because you don't want the natural acoustics of the control room to interfere with what you are monitoring. You want to hear what the studio sound is. It should be Dead, the whole place should be relatively dead. In my opinion, a live end is not a good idea."

Is it a matter of Taste?
"You have to design the studio to satisfy the guy who is paying the bill. The guy that's is using it. It isn't always to my liking, but if it is to the customer's liking then that is O.K. with me"

Is there a lot of Flavor of the Month ideas that come through when you are working with a customer?
"That's what the Live end/Dead end thing was. That was the fad for a while."
"There were also fads like at the old Kaye/Smith studio. They had this fancy speaker system built into the wall of the wall of the control room. The horns built into the walls, and the walls were very beautifully done woodwork, but they were no good as monitor speakers. They had so much unique characteristics of their own, what they needed was to have their monitors close to you, so you are not hearing excitation of the acoustical characteristics of the room itself."

What about Monitors? Ones you like and/or dislike? Is placement essential?
"Placement is essential for sure, and you have to experiment to find that out. As far as like or dislike I really don't have any preferences. The guy who is using it always has preferences; he always knows what he wants in my experience. I never had anybody ask me what kind of monitor speakers he should use and that's good, because you gotta satisfy him. If he is used to a particular kind of a speaker then that's usually what he wants to use. Unless it is something really bad, and obviously a disaster, then I might argue with him."

What about soffit mounting speakers?
"Usually the soffit is too high and I think it is better if the height of the speaker is not that different from the height of the engineer's head. I think if it is too far above you, it doesn't give you the proper tonal image."

What about field of dispersion?
"You don't have to have a very wide dispersion in monitors, because you are going to orient the monitors so that the sweet spot that they generate is right where the engineer is. If there is too much dispersion,

then you may excite too many of the Room Modes and you don't need that. Not that you couldn't deal with that, but why have to fool with it."

Is there a formula for that? or is it by eye and/or ear?
"There are ways you can calculate it. You can measure the critical distances in the room (which is the point where at which the Direct sound and the Reverberant sound are equal in level) and that will not be too far away from the speaker in a small room. You want to have your monitoring position within that critical distance. The speaker itself will have directivity cone, where most of the energy is, at least at high frequencies, of course at low frequencies they're not directional at all (especially small monitors). But the high frequencies above 700 or 800 Hz is where it is really important to get a relatively narrow distribution, if you don't want to excite all the Room Modes."

How do you "Tune" a Room?
"Probably the most obnoxious thing about a room is the existence of Flutter Echoes and very strong Room Modes. A Room Mode is a situation where sound bounces back and forth between two parallel surfaces and it interferes with itself either destructively, or constructively at different locations. The sound of that particular frequency is very non-uniform in level in the room. You get right up to the wall and it sounds really loud and you get out to the center of the room and it could be very soft. If it is a higher frequency, in other words if it has several wavelengths between the two surfaces, then you got this up and down variation in level just by changing your position by a few feet. You have to eliminate that in a room. You do that by selective absorption and also by using angles, you don't use rectangular shapes."

What are some tools that people use to tune rooms?
"People use a lot of stuff. There are people that use various software programs to try to optimize a room. These are approximations. I don't like any of them that I've heard. The best way to tune a room is by ear. Your ear is an amazingly sensitive measuring instrument if you train it. That is one of the other things I learned from Veneklasen. "

Any common errors that people make in control room acoustics?
"Usually the control room is too small, then they have to make it really dead, to prevent it being like a Boom Box. That is the most common problem I run into."

What is an "Echo/Reverb" Chamber? How does it work?
"An Echo Chamber really shouldn't have any echoes in it. An echo is a discrete reflection, and you don't want that. A Reverb Chamber wants to have a completely diffuse field, so that if you're in there you have no idea where the sound is coming from - its all over the place. You can make a fairly small reverb chamber with a fairly long reverberation time. You wouldn't want to record in a reverberation chamber, because the reverberation is to high in level and too long, but also it is too close to the direct sound. You might want to do that for a special effect for something, but it would not be good for general recording. The thing to remember about a Reverb Chamber is that you have to delay that reverberated sound into the mix that you are making, delay it with respect to the sound from that went into the chamber. That delay will give you the subjective impression of how big the room you are trying to simulate is. If you have a long delay then it will sound like a cathedral and if you have a shorter delay, it will sound like a smaller room, etc... But I don't think that digital reverb, or vibrating plate reverb, or spring reverb is anywhere near as good as actual three dimensional acoustic reverb. It gives a true logarithmic decay curve, where as these others don't do that and they don't sound natural, at least to me."

What are the advantages and/or disadvantages of building one?
"The advantages is that the result is that you get the best reverb you can get. You can't do any better than that if the chamber works. The pitfalls of a reverb chamber are that you have to avoid standing waves in them. You have to be really careful about the dimensions and avoid parallel surfaces and square corners. They don't have to be gigantic either to really work."

How would someone design and/or build one? What kind of location should they have? What do they need to make it work?
"The walls of the reverb chamber should be as stiff and solid as possible and concrete and/or concrete

blocks is a good material to use. You can make them out of lath & plaster, but you have to use lots and lots of plaster. The surface density of the boundaries in reverb chamber, should be about at least ten, or fifteen pound per square foot. The easiest way to do this is with concrete block, or with just cast concrete. Sometimes you are lucky and you find a concrete enclosure in a building that you can adapt to be a reverb chamber, like a space under stairway, or a stairwell. You've probably been in stairwells in buildings that just “echo” all over the place."

They had one down in The Evergreen State College that was in the Library Building that was quite good. "There was one in the Music Building [at the UW] that was pretty good too."

"My friend Joe Boles, I don't know if you heard of him, he was a guy who did a lot of home-studio recording back in the 60s."

He was the one who recorded "Walk, Don't Run" by the Ventures.
"He used his downstairs bathroom as a reverb chamber. He put an Ampex 620 in it for a speaker and he used a [EV]655 for the microphone and it didn't sound bad. He used a tape delay."

Is there anything important that they need to remember? Is it Hard?
"It is isn't so hard to do, but it can be tricky if you don't understand the principles. It has to have a good solid door and it should be a sound proof door if you can afford it. You have to keep background noise out of it. Ideally the reverb chamber should be a long way away to avoid sound leakage into or out of it. It could be in another building. Capitol Records has theirs underground, under the parking lot. They’re huge. Each one is as big as this room [750 square feet] and their all concrete, - talk about reverb!"

How many "Echo/Reverb" chambers did Kearney have at Audio Recording Inc? What was special about them?
"There were Three. They were similar in size, but they had different shapes, so they had different characteristics. They didn't sound all the same but they weren't drastically different. If you wanted stereo reverb, Kearney decided that that he wanted three-channel reverb (use one for each channel on his three channel system). The problem is, since they were different shapes, the reverbs didn't sound identical. So you are much better of putting three mics in one of them and spacing the mics out."

What kind of mics would you use in a reverb chamber?
"You need an omni directional microphone and one that has as flat [response] as possible. A good choice is an Altec 21 (if you don't have too much low frequency noise in there), or an [EV] 655 is a good dynamic mic, or a Neumann KM83 is a very fine microphone."

So low profile mics. Mics that don't have a lot of diffusion coming off the mic body.
"Veneklasen (and he did a lot of experimenting with reverb chambers) told me that the best place to put the microphone is glued into the corner about a foot, or 18 inches from the ceiling or the floor, but actually glued right into the wall. The next thing about that, if the microphone is on the surface of the boundary if it is right at the surface, then you don't have any reflection from the surface coming back into the mic. If you put a mic a foot from a wall and a sound hits the microphone and then the wall, at some frequency the reflected sound from the wall is going to cancel the direct sound, because it its 180 degrees out phase. Your response curve is going to look like a picket fence."

What about a PZM mic?
"A PZM mic would be fine, if you mount it on the wall of the reverb chamber. You don't have to have a PZM mic, all you have to do is put a regular mic right up against the wall. The smaller it is the better."

"By the way, concerning the PZM mic, the Crown people seemed to think they invented the idea, of a boundary microphone, but Veneklasen was doing that 25 years before that. He started doing it in the Hollywood Bowl, mounting the mics right on the floor. He made special little wooden mounts to hold the mics right on the floor. We did that in the Opera house and in the Arena."

Who do you know that has a working chamber these days?

"In Seattle? There is this crazy outfit called Vagrant Studios.'
I wonder who designed that one.

What was your most challenging Acoustics project? What made it so challenging? Why?
"The most challenging acoustics project I did was designing a church, it was challenging because the Architect thought he was an acoustician and he was not. He was completely at odds with everything I wanted him to do in the design of that place. We had argument after argument, and the church people were on my side, they believed me. We had all these meetings with the architect; me, and the church committee. Just knock-down-drag-out arguments and it was too stressful. I decided right then, the next time I get involved in an acoustic design I was going to talk with the architect at some length before I accept the job. Architects can be very difficult. On the other hand, a good architect is worth his or her weight in Gold."

Some Questions on the Audio Recording Dictionary. What made you decide to write this book?