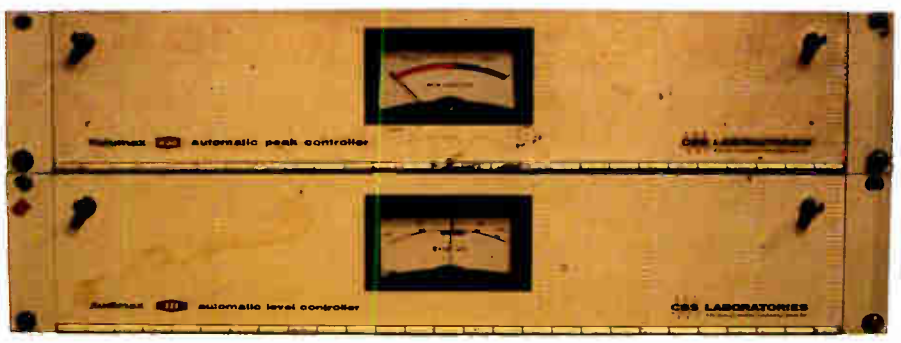
# Radio Guide

**Radio Technology for Engineers and Managers** February 2007

**This Month's Gear Guide – Automation, Digital Audio, Logging**


# Audio Processing – Radio's Signature Sound




## Inside Radio Guide

**Processing – Yesterday, Today and Tomorrow**

Page 4

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Audio processing has its roots in the need to prevent over-modulation. In the 1950s, which some consider to be the birth of modern day audio processing, it was also used to automatically ride gain. But today's broadcasters depend upon audio processors to do much more than just ride gain. Is this good or bad for broadcasting?

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# Radio Guide

## Contents

February 2007



**Cover Photo**

*Vintage processor photos courtesy of Greg Snow, Audio Engineer at the State University of NY at Fredonia.*


## Radio Guide

**Volume 15 – Issue 2**



PO Box 20975, Sedona, AZ 86341
Phone: 928-284-3700 Fax: 866-728-5764

**Ray Topp** *(Publisher)*
Email: radio@rconnect.com

**Barry Mishkind** *(Editor)*
Email: editor@radio-guide.com


Radio Guide: www.radio-guide.com
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## Radio Waves

by Barry Mishkind – Editor

### Problem Solving

Solving most problems is a three-part affair. First, identify the problem. The last step is using knowledge and skill to accomplish whatever repairs, changes, etc. are required to resolve things.

The middle step is what trips up a lot of us. In order to successfully solve problems, one needs the essential "tools" – the budget and the authority to act. Otherwise it often is impossible to get critical parts of the job done.

Most engineers are problem solvers by nature. A large part of our job satisfaction comes from the process of discovering a problem, isolating the issues, and solving them, especially if we can manage to pull off some neat trick or learn something new in the process.

However, as with many industries, broadcasting puts ever more pressure on smaller and smaller staffs. (Feeling "put upon" as an engineer? Just talk to the average traffic department person and ask how their workload has changed in the past ten years!) Fighting a corporate mentality (and the paperwork) that labels engineers foremost as an "expense" item does not help, especially where respect for the engineer's talent and experience is lacking.

Now, profit is good (where do you think your raise comes from?), although too many "profit driven" companies never get past the profit priority. But there is an old adage. If you are not part of the solution, you are part of the problem.

As engineers, we can start with the viewpoint expressed by Bill Weeks on Page 8. If we understand how to better serve the "customer" everybody wins.

More is needed, though. A national direction progam to help management appreciate the importance of the engineering department is as crucial is continuing education on technical issues.

***Radio Guide*** is committed to be part of the solution. Our next step starts this month in Orlando. How can we help you? Our contact information is to the left. – *Radio Guide* –

# Processing:
## Yesterday, Today, and Tomorrow
### *Part 1 – From Peaks to Power*

by Jim Somich

*With this issue we start a new series of articles on audio processing. While this article starts with a lot of history, the true focus of the series is the current state of the art – and where we are headed. Jim Somich takes us on this guided tour.*

Audio processing has its roots in the need to prevent over-modulation. In the 1950s, which some consider to be the birth of modern day audio processing, it was also used to automatically ride gain. But today's broadcasters depend upon audio processors to do much more than just ride gain. Is this good or bad for broadcasting?

## PAST PROLOGUE TO THE FUTURE

Audio processors are now almost completely controlled by one or more microprocessors. From wideband leveling to multi-channel, stereo-generating, look-ahead limiting and diversity delay capable, in many ways, they are the heart of a modern broadcast station.

The importance of the arcane field of broadcast audio processing is evident by the extensive work done in the field since the earliest days. From PROGARS through Uni-Levels and Sta-Levels into the Audimax years, processing was evolving into an artform to be mastered by a select adventuresome few. This is not merely an historical article, but to be prepared for the acutely competitive future, we had better know a little about the past and a lot about the present.

This series will be a quick look at the past, a lingering look at the present, and a glimpse into the future of broadcast audio processing, written by someone who has "been there, done that." The processing business will change radically over the next few years and, in a decade, you will not even recognize it!

I think back to the 1980s and a young engineer I hired who had a certain gleam in his eye. He did not have much experience but his enthusiasm was almost boundless. Little did I know that he would go on to become a true rock star in the processing world. This article is for you, Frank.

## THE GOLDEN EARS

One thing is for sure: there will be new players on the scene along with many of today's superstars. I, for one, cannot wait to hear what they accomplish. While some actively attempt to re-create the sound of the tube processors, the leading designers already are looking ahead to new horizons of audio control.

The names are legendary and few: Emil Torick, Mike Dorrough, Bob Orban, Greg Ogonowski, Eric Small, Ron Jones, Steve Hnat, Donn Werbach, Glen Clark, Jim Wood, and Frank Foti. Each had a vision of the way radio should sound and made it happen. What a heritage: Audimaxes, DAPs, Optimods, Aphexes, and Omnias.

As processors became more sophisticated, creative engineers and programmers found ways to use processing to develop a unique sound for their station. Some felt that a "wall of sound" with virtually no dynamic range was the way to snag listeners. Others felt that smashed audio only resulted in lower TSLs. The controversial world of modern audio processing was born.

## ADAPT, IMPROVE, OVERCOME

Some exceptional engineers, finding their hardware lacking, began to modify boxes to perform tricks never anticipated by their developers. Another group went one step further and designed their own custom processors from the ground up. In many cases, these custom boxes became products literally built in garages and sold to the industry.

Over the years, successful audio processing has not been the province of large companies or groups of engineers. In most cases, a single lone engineer with a vision struck out on his own to capture his aural imagination in a "magic box."

But who will be the gurus of tomorrow? And what will they have to work with? They are out there, working in the trenches. Guys like Scott Incz, Corny Gould, and John Burnill have dreams that just might come true.

It is not as easy to hotrod a DSP processor the way one could change component values in an Optimod or a DAP, but I know one thing for sure: there will be a new generation of processing gurus and they will have new ideas. They will do things with their boxes that we have not even dreamed of.

## THE PROCESSING TIME MACHINE: YESTERDAY

In the beginning, there was no audio processing. AM radio stations kept the modulation levels low – perhaps 30% on average – and used the technique of "manual gain riding" to avoid over-modulation. That meant a live person sat with his hand on the knob, trying to anticipate what was to come next.

The practice was reasonably successful, but hardly efficient. Failure to properly anticipate a spike in audio level often resulted in the transmitter overloading and dropping off the air – or worse.

Even the behemoth WLW 500 kilowatt transmitter was operated in the mid-1930s using only manual over-modulation control. The transmitter logs are replete with descriptions of outages caused by modulation peaks. Most were brief, but some notes indicated blown up capacitors, tube failures, and other problems that took longer to repair.

## FROM MANUAL TO AUTOMATIC

Gain riding was an art, and practiced diligently by the studio engineers of the 1930s, 1940s, and 1950s. When I started at WGAR, in 1959, almost all gain control still was done manually. By then there was a GE BA-5 peak limiter at the transmitter for over-modulation protection, but one of the primary duties of a studio "engineer" was to ride the gain. There was not a compressor in the entire studio plant.

The chief had installed a chart recorder in master control that made a permanent record of outgoing level to the transmitter every minute of every day. Each morning, one of his stops was at the chart to check up on the gain riding of the engineering staff during the past 24 hours. Each engineer was held completely accountable for his shift.

But, with the advent of post-Television radio broadcasting with its combo operation, fast-paced shows, short jingles and multiple elements, the need for an automatic form of gain riding became inescapable.

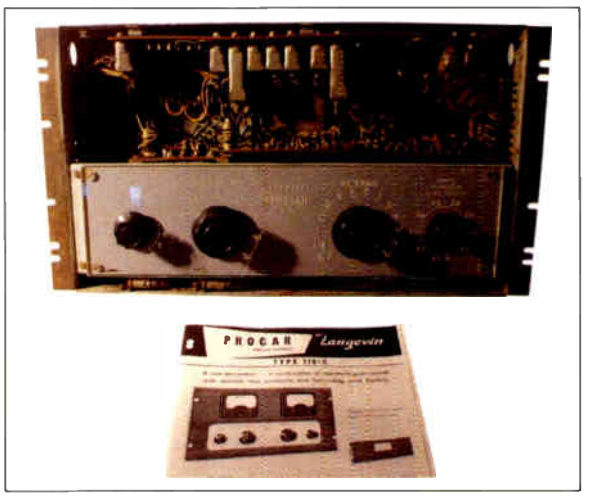
## EARLY PEAK LIMITERS FOR AM

The first peak limiters came to market in the mid-late 1930's. RCA introduced the 96A in 1936 and this may be the very first commercial peak limiter to hit the market. Western Electric introduced the 1126A in 1939.


**Early peak limiting kept the transmitter on the air.**

But you could hardly call these boat anchors audio processors. They were basically mundane tools to eliminate over-modulation, pure and simple.

The PROGAR (PROgram GuARdian), developed by Al Towne at KSFO, San Francisco in 1935 really was the first known audio processor: a combined intelligent compressor (automatic gain control - AGC) and peak limiter. But it took more than ten years for Towne to patent it, sell it to Langevin and bring it to market.




**The PROGAR brought automatic gain control and peaking limiting together.**

Then something exciting happened. Peak limiting became much more sophisticated. Even today we would have to agree, it was ahead of its time.

## DELAYING THE PEAKS

In 1947, General Electric introduced the BA-5 delay-line peak limiter and it took the broadcast industry by storm. It was cleaner than anything that came before because it used a feed-forward limiting scheme and a delay line to "give the audio a change to catch up to the bias generator." How clean was it? Back in those days, NBC had an iron-clad rule that they would only use RCA equipment.

Yet, they bought BA-5s and removed any evidence of GE manufacture. They repainted them RCA umber gray and added the RCA meatball. Magically, the new "RCA" peak limiter was born! Every NBC O&O began sounding much better thanks to some "midnight engineering."

GE did not rest on their laurels either. They continued their dominance of the peak limiter market by introducing the BA-6 in the early 1950s and the BA-7 in 1957. These boxes were really unique.

To make a long story short, the input audio modulated an RF carrier and all peak limiting was applied to this carrier. After demodulation, the audio was fed to the transmitter. Many processing artifacts were eliminated by this scheme, but it was an absolute bear to keep in alignment and it took two engineers or one bodybuilder to wrestle one into a rack!

## RESISTANCE TO PROCESSING

Throughout the 1950s, many FM stations eschewed audio processing entirely. I remember one old-timer studio operator telling me that "you really couldn't overmodulate the FM."

Later, some FM stations installed a Fairchild Conax pre-emphasized clipper to tame the pre-emphasis, but that was all. In fact, it was not at all unusual in those days to watch the modulation monitor "pin" on muted trumpets even when using a (conventional) peak limiter. There was quite a way yet to go in developing effective FM processors.

## EFFECTIVE COMPRESSORS

The most important part of a compressor or peak limiter is the gain control element. During the early years, this was usually a tube. The PROGAR used a 6L7 heptode tube. The 6L7 was designed as a variable mu (amplification) tube – that was the purpose of the extra grid.

All tube compressors and limiters functioned by mixing a DC control voltage with the audio at the grid of a variable mu tube. These amplifiers used push-pull operation so the control voltage could be effectively canceled at the output. This reduced the "thumps" that were common when these boxes got out of balance due to tube aging.

## THE 6386 RULES!

There were a few remote cutoff tubes designed before the GE-6386, but this tube became the rock star of the 50s in audio processing. It was the basis of the GE Uni-Level, Gates Sta-Level and Level-Devil, and the CBS Audimax. The 6386 was a remote cutoff dual-triode, which made it ideally suited to push-pull gain control operation.

A remote-cutoff tube has a grid that is wound in a non-linear fashion and this gives the tube the unique characteristic of reducing its mu with increased signal levels. This was a valuable characteristic in a compressor or limiter. Conventional sharp-cutoff tubes tended to operate with substantially more distortion and artifacts.

*(Continued on Page 6)*

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# Processing

## Yesterday, Today, and Tomorrow

*Continued from Page 4*


**The Gates Sta-Level, a solid performer used well into the 1970s.**

The Gates Sta-Level was a straightforward compressor, using the 6386 as a gain control element. A 6AL5 dual-diode was used to rectify a sample of the output from a pair of 6V6 tubes operating push-pull. This DC control voltage was fed, via an R/C time constant network to the grids of the 6386 tube. The circuitry was very similar to the GE Uni-Level, which preceded the Sta-Level by a year or two.

The Gates Level Devil added a level dependent expansion gate that released about 10 dB of expansion when the input level was above "noise level." This gate did not work very well and resulted in a lot of "sucking and wheezing." However, those were the humble roots of intelligent audio processing.

### A CLEVER MARKETING SCHEME

The year was 1959 when CBS Laboratories introduced the Audimax I. Designed by Emil Torick and marketed specifically as a "gain rider," the Audimax I made no pretense to being an "audio processor." Yet, the unique design of the Audimax ushered in the era of audio processing.

**The Audimax I**

The Audimax I was also the first broadcast audio processor to be sold on a 30-day trial basis. A broadcaster could submit a purchase order for a unit and put it on the air for a month. If they were not happy with the sound they could return it at the end of the trial period with no questions asked. I am sure they got a few back, but the vast majority of users were quite satisfied with this box.

I believe the original price was around a kilobuck (in 1959 dollars) and most of those who gave it a try became true believers in the Audimax concept.

### THE MAXX BROTHERS

Just like in the Uni-Level and Sta-Level, the 6386 dual-triode was used as the gain control element, but with enhancements. A "platform mode" of control kept the Audimax gain constant over a 6 dB gain platform. This resulted in a lot less "busy-ness" in the sound. Should the input audio move outside the platform range, gain was quickly readjusted to define a new platform.

The Audimax II quickly followed, which added an adjustable noise gate that froze the gain when input level fell below a user adjusted threshold. The Audimax II-RZ added a "return to zero" function which did just what you might think. It slowly returned gain to the zero gain point during periods when the input audio was below the threshold of the gate.

The Audimax really started something and it transitioned into solid state versions and later added a biased-diode peak limiter called the Volumax.

**The Volumax 400. Together the Audimax and the Volumax were known affectionately as "The Maxx Brothers."**

The development of the Audimax was indeed a mega-event in the history of audio processing for broadcast. The "Maxx Brothers," Audimax and Volumax, ruled for a decade and continued to be in demand for another ten years after that! Truly a remarkable record.

In its later years, Thompsen acquired the Audimax line and produced a thin, one rack-unit version of the Audimax and Volumax.

### DAWN OF MODERN DAY AUDIO PROCESSING

There were several modifications applied by engineers who just could not accept the parameters that were fixed in the units. Most of these were attempts to speed up the release action, but there were many others. It seemed like every creative engineer had his own set of Audimax and Volumax tweaks.

Basically, General Electric and CBS Laboratories ruled the roost when it came to state-of-the-art audio processing in the 1950s and 1960s. But nothing stays the same – and things were about to change big-time in the 1970s.

*A former major market chief engineer, Jim Somich is President of MicroCon Radio Systems and the designer of the FlexiMod FM Processor, among other products. He can be reached at jimsomich@alltel.net*

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# Engineering Guide

by Bill Weeks

# The Functioning Technology Department

*Once it is understood how Engineering – or, as Bill Weeks calls it, the Radio Technology Department – properly "fits" into the structure of a broadcast facility, it is possible to make it function more effectively and really enhance the efforts of the rest of the station's staff.*

The Radio Technology (RT) Department provides *service* to its users. The users may not know or care what RT resource actually provides any particular service. But since they are part of the department's customers – management – they will expect the service to be there when they want it.

For example, the "last mile" of radio broadcast delivery service to the general public is provided by a transmitter and its associated systems. Most of the users of RT's services may never have seen the transmitter. They may not know what it looks like, nor perhaps even where it is. For them, this is not necessarily a problem.

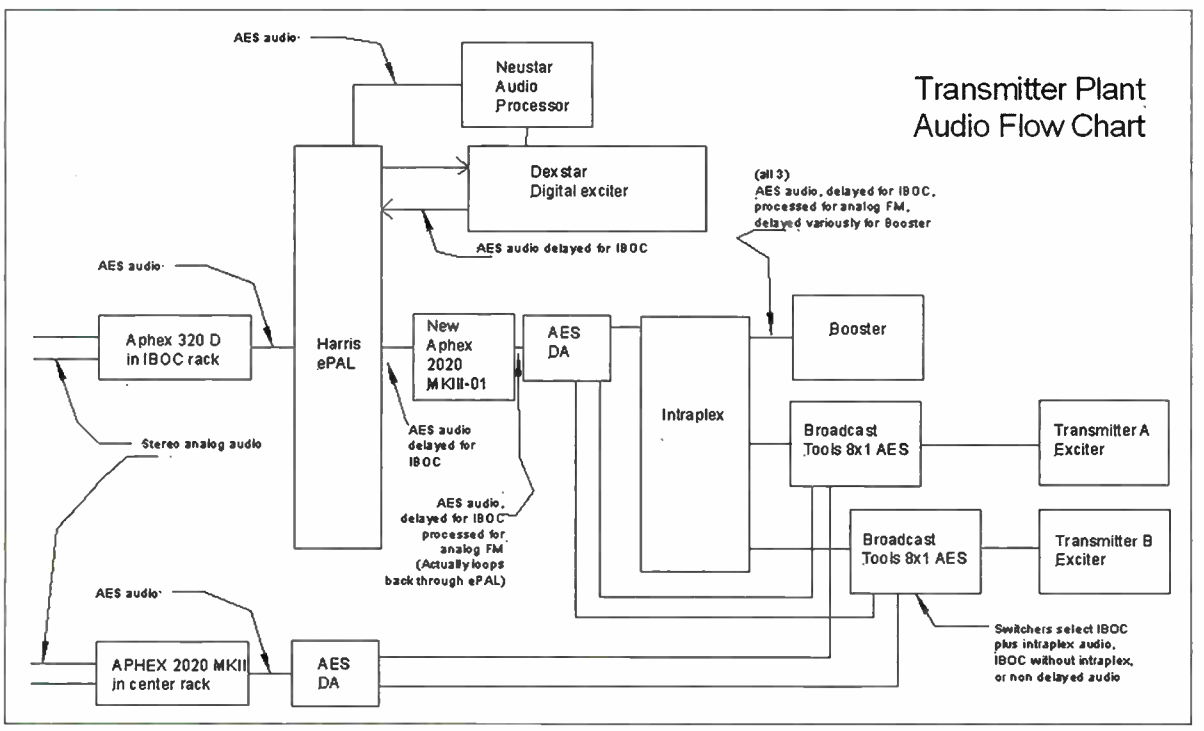
The RT staff, in contrast, must know about all of its resources if it is to be efficient in providing all its services.

## MANAGING RESOURCES

The RT department resources include hardware, software, and people. The staff must know what all of these pieces are, how they interact, and how well they behave.

The sum of this knowledge is a database, although it can – and probably will be – in various physical forms. The overall transmission system may be represented by a diagram of some sort. The maintenance history of a transmitter may be in a paper log kept at the transmitter site. Some of the information will no doubt be kept only in the heads of the RT department members.

This last is a poor option – both because all data should be backed up and because all data must be available both to be accessed and to be amended by each member of the RT staff.




**The "last mile" of a station's transmission chain can be fairly complex.**

## THE TECHNOLOGY DEPARTMENT DATABASE

The best physical form for the database will be determined by the size and complexity of the operation and the size of the RT staff.

However, regardless of department size, the means of entering new information into the database must be readily accessible at each location where resources are located or repaired and each location where services are provided. If it is not convenient to amend the database, it will not be amended – and it *will* promptly become useless. In a more complex enterprise, this may require syncing laptops or PDAs among the RT staffers.

At the same time, it may or may not be reasonable to have separate databases in different forms or different locations. For example, it may not be necessary to have the cross connect information for a studio complex punchblock wall available at a remote transmitter site. On the other hand, there are likely to be times when it would be convenient to have the entire database available for review and planning.

## BENEFITS FROM COMPLETE DOCUMENTATION

Overall, the database or databases, in whatever form, should document all of the RT resources. It should document what each resource contributes towards department services.

Certainly the program chain for each broadcast signal should be clearly documented and understood. Any backup facilities for each broadcast signal should also be clearly marked. But, since resources or services often may overlap, the database should indicate interconnections and interdependencies between resources..

For example, a single computer may provide a number of different services, just as a person may be responsible for different things. If there is inadequate documentation of the services that a resource contributes to, a technician might take down a computer for some maintenance and find out later that it was supposed to be performing some function of which he was unaware.

A connection between facilities – whether copper, fiber, or RF, owned or leased – may provide different services at different times. A studio might be taken apart for repairs over a weekend, only to find out that some leased time program normally originates from it on Sunday mornings. Or a staff member might go on vacation, leaving behind a mystery when it turns out that no one else knows how to do some obscure but essential function.

## COMPLEXITY

This very well can be even more complex than it might seem at first glance. These days a single radio station may receive regular programming from several different transponders on several different satellites, as well as from several other off-premise sources by way of various delivery systems.

This programming then may be stored in several different forms and processed in several different rooms (and on several different computers), routed through several different processors, and combined with text from still another source, run through a couple more computers and some sort of STL.

Finally at the transmitter site, the received program stream may be fed through two exciters, two transmitters, and two antennas to produce a broadcast in analog and HD. The program stream can also be utilized for the backup transmission system or a parallel stream may exist.

## MAINTENANCE DATA

The Radio Technology Department database should track hardware and software resources as to the date of acquisition, manufacturer, model or version, location, and maintenance and repair history.

These histories are important to show trends suggesting maintenance intervals, spare parts stock, weaknesses of design of either the resource or its interconnections, impending critical trouble, and the coming need for reallocation or replacement of resources.

For example, an item may become more economical to replace than to repair because the manufacturer no longer supports it, because it no longer adequately supplies the needed service, because it no longer adequately interfaces with other resources (common with software), because repair is becoming too expensive, or because breakdowns are becoming to frequent or too critical.

Another way to analyze the balance of "maintain, repair, or replace" is to ask often can you afford to allow a particular piece of gear to put you off the air during morning drive?

## AN UNFORTUNATE TREND

We used to be almost religious about the history part of the database, when we called it a maintenance log.

In those days, there would be dated, signed, formal notes about every little thing that went on with a transmitter, including meter readings taken every half hour. Now, the lowest priority AM transmitter site in a medium market cluster may get a visit only when there is some trouble that cannot be corrected by remote control.

Without some discipline to our record keeping, we may not remember what things were supposed to look like (does the light mean that the interlock is open or closed?) or what was wrong last time it did this. Is that spare final tube (sorry, spare module) good, or a dud left over from last time?

In a relatively small RT department, the database entries for the department staff are likely to be informal and unwritten. Human resources are allocated by time, skills, and inclination. Nevertheless, someone has to know the available time, skills, and inclinations, in order to make the allocations.

## DEALING WITH DISASTERS

Disaster will come to the services of the RT department. There will be many small disasters. Hopefully there will be few major ones.

Recall, the overriding purpose of the RT department is to provide services to its users. Disasters are not good excuses for not providing those services. Of course, every piece of equipment will fail eventually, every piece of software will crash eventually, and every human being will make a mistake eventually. Therefore some thought should be put into risk analysis, risk management, and contingency planning.

*(Continued on Page 10)*

# Engineering Guide

by Bill Weeks

## The Functioning Technology Department

– *Continued from Page 8* –

The questions are never "whether" but "when" and "what do we do then?" Every answer to "what do we do then?" will require a balance between how much doing it would cost and how much it would cost the enterprise to be without the service.

### JUST A SLIGHT PROBLEM DOWN HERE

I once worked at a cluster whose main studios were in a one story building on flat terrain. The primary tech center – AM transmitter, STLs, servers, processors, and so forth – had a concrete floor that was a step down from the rest of the building.

Since Murphy guarantees what can go wrong will go wrong, eventually the fringe of a hurricane drove home the truth that this floor was actually about eight inches below grade and that there was enough upslope on one side of the building to direct water into our indoor pool. The water was only eight inches deep but the power to the racks was down there along with some of the UPSs and, well, you guessed it: the *whole cluster* was down until we could get it pumped out.

### GETTING AHEAD OF MTBF

Every transmitter will fail eventually. Some are more likely to fail soon than are others. Some of the information needed to decide how likely it is that a given transmitter will fail soon (or often) is contained in the database information about that transmitter and its repair history.

Mean time between failures and then mean time to repair are both figures that can and should be estimated. The costs associated with a standby transmitter can fairly reliably be compared with the cost to the enterprise of the loss of the broadcast signal for a period of time. Additionally, the costs to the enterprise for varying lengths of that failure can be compared to the costs of varying sizes of stocks of spare parts.

The availability of RT personnel and the difficulty of access to the transmitter site both contribute to the mean time to repair and should be considered.

### ANALYZING THE RISKS

This same sort of analysis must be applied to all of the RT department's resources, with varying degrees of rigor, depending on the degree to which the particular resource provides a service that is critical to the enterprise.

A cluster that has a highly rated class C FM in a large city and a kilowatt daytimer AM in an outlying town will probably rate the reliability of the FM transmitter as more valuable. These relative values change over time and therefore must be reexamined from time to time. For example, right now, most groups do not consider their HD signal to be as important as their "analog" signal.

Risks can be managed somewhat by planning, by procedures, and by hardware. Work rules help keep both people and equipment safer. Surge suppressors and grounding help to protect equipment. Safety interlocks and properly inspected vehicle brakes help to protect people. First aid kits in the proper places help minimize minor emergencies. The right kinds of fire extinguishers, in good condition, help to protect both people and equipment.

There are outside risks to consider, also. Burglary, vandalism, and computer viruses are all common enough to be a concern. Each of these risks should be assessed, appropriate steps taken to mitigate the risks, and contingency plans laid to survive the events if they happen.

### PREPARING FOR THE UNEXPECTED

We have learned that more severe disasters should also be considered. If there were a major fire, or flood, or hurricane, that caused severe damage to the main studios and offices of the cluster, what would it take to return the enterprise to operation – both on an emergency and a permanent basis?

That question encompasses broadcast and business hardware, communications, software, business information, and broadcast information. Is the billing information backed up anywhere off premises? What about the music library? How long would it take to regenerate all of the cluster's IDs, imaging, promotional, and commercial inventory?

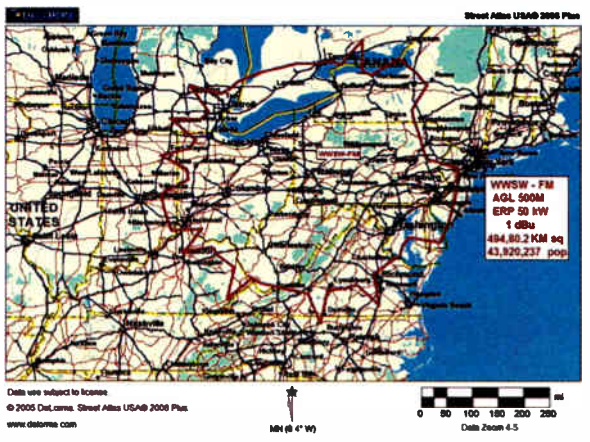
Planning is a good thing. Unless your career is very short, at some time some disaster of some magnitude or other that you did not foresee or plan for will sneak up and bite you somewhere. Perhaps, at that moment, neither your users nor your customer will offer you much comfort.

### COPING WITH CHANGE

Over time, there will be changes in the services requested by the customer of the RT department. There will also be changes in the resources used to provide RT's services.

Planning for any change should involve considering what other interconnected resources or services are affected by the change. It should also involve considering what major and minor effects the changes will have on the users. Note that users will hate any change, of any magnitude, for any reason, and without reagard for any benefit.

Move a jock from a hole in the wall to a palatial new studio and he will complain that he can no longer reach everything without moving. Furthermore, all customers (managers) will assume that any change they suggest or pay for will have huge benefits far out of proportion to either costs or reality. Few improvements to a class A in, for example, western Pennsylvania will really provide good coverage to Detroit, Philadelphia, and Washington, no matter what the 1 dBu coverage map shows.




**While computer software can generate a lot of things, some are best kept away from the sales department.**

Consider these facts in your planning, and how best to manage the resentment and disappointment. And do not ever let the Sales Manager see a 1 dBu coverage map!

### INTERFACING WITH THE USERS

Every RT department has an interface with its users, through which those users can request services and report problems. In order to please the customer, this interface has to provide satisfactory results, as determined by the customer.

The successful RT department will present a stable and secure set of services to all of its users. (A user will expect the telephone to work when he wants to call you to complain that the console stopped working shortly after he spilled a can of coke in it.)

If users are to be properly mollified, there must be some system for addressing user concerns and the problems that they report. The interface should include a means of reporting back to the users about the status and resolution of their concerns. There should also be a means of providing a summary of these transactions to the customer, by way of justifying the cost of dealing with these events.

In the days when every station was a stand alone operation with one console, one transmitter, and its own full time staff of engineers, the interface and its underlying systems for addressing concerns and reporting progress was all adequately handled informally around the water cooler or coffeepot. One could replace the noisy 12AX7 in the microphone channel and leave the empty box for the morning man to find, and everyone would be happy.

That mode of operation is probably no longer adequate in many stations. Replacement systems may be as sophisticated as the installation of elaborate Help Desk software. ***Radio Guide** September 2006.*

### EVALUATING REQUESTS FOR SERVICE

Users will request services and report problems. The services they request may fall within the normal range of services the RT department is expected by its customer to provide or they may require review with the customer. Problems may be large or small.

Different sorts of user contacts require different handling. The first step is triage. The user input must be evaluated for its nature and urgency. An appropriate response must be determined. Except in harmony with instruction from the customer, the users cannot simply be ignored.

Routine requests for services should have resources assigned. "Routine" requests, of course, can stretch from enough tape to seal a box for shipping to setting up remote broadcasts to cover a sports team for a season. Requests requiring significant resources should be entered in the database for that resource for later reporting. The user should be informed of progress and completion.

### SOLVE THE KEY PROBLEMS FIRST

Some user contacts will be to report problems. A "problem" at this stage is a condition with a significant impact and with a cause that may or may not be known.

To illustrate: a silent broadcast station may have a problem with a studio, a computer, a satellite receiver, an STL, a power company, a transmitter, or an antenna. This presents the RT department with two projects which are at least conceptually different.

The first priority is to return the service (program transmission) to a normal level with minimal impact to the enterprise. The second is to find the cause of the problem and resolve it in such a way as to reduce the likelihood of its recurrence. For example, if the problem turns out to be that a primary resource (a studio or a transmitter) has failed and there is an auxiliary resource (another studio or auxiliary transmitter), one normally turns on the auxiliary before tearing into the primary cause of the problem and finding the right solution.

### LESSONS OF A LIFETIME

I have proposed a work structure for the Radio Technology Department based on managing department resources in order to provide services to the users for the benefit of the enterprise and according to the specifications of the customer.

Such a work structure involves an interface with the customer, an interface with the users, and management of the department's resources. The proposed work structure scales to different size enterprises or to different levels within a larger enterprise.

If I had always paid attention to such an organized approach, rather than simply fighting alligators and chasing wild geese, several stages of my career would have gone much more smoothly. I hope the lessons I have learned during my career will help you make yours more productive and enjoyable.

*Bill Weeks started out to be an "Experimental Psychology" major at college. He was drafted to reactivate a dormant carrier-current radio station and began the slippery slope down into radio engineering. Weeks' Hungry Wolf Electronics in Milton, NY is active in project engineering, which he defines as "any sort of paying work that does not require a pager." Email him at Bill@Wolftron.com*

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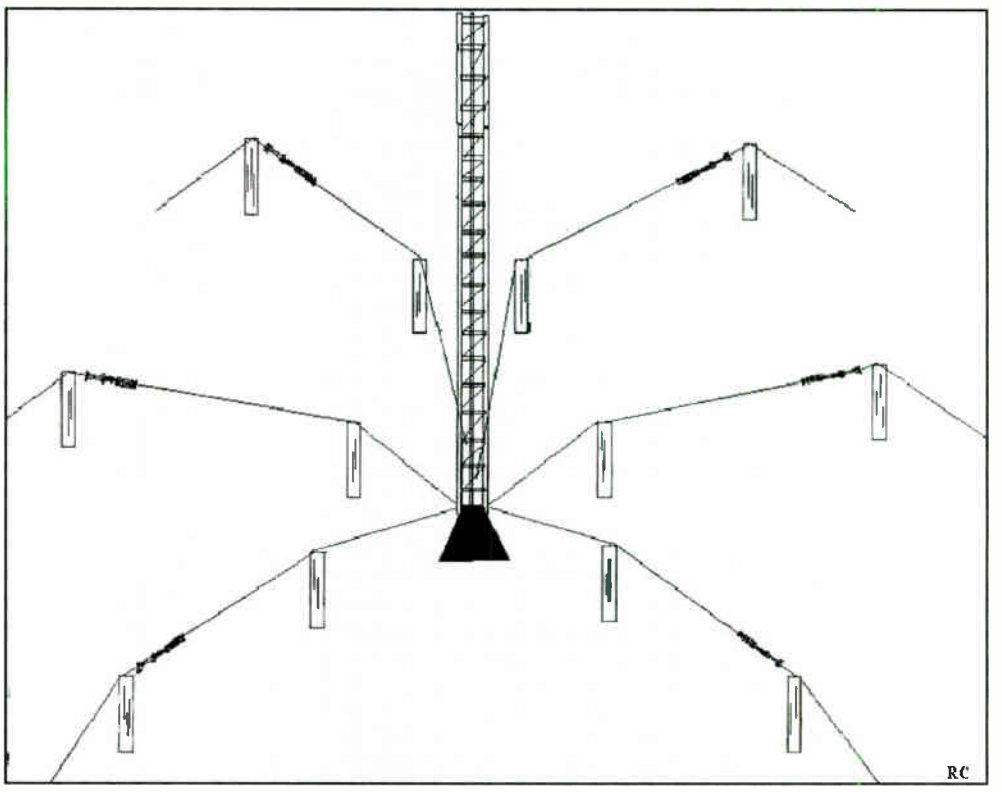


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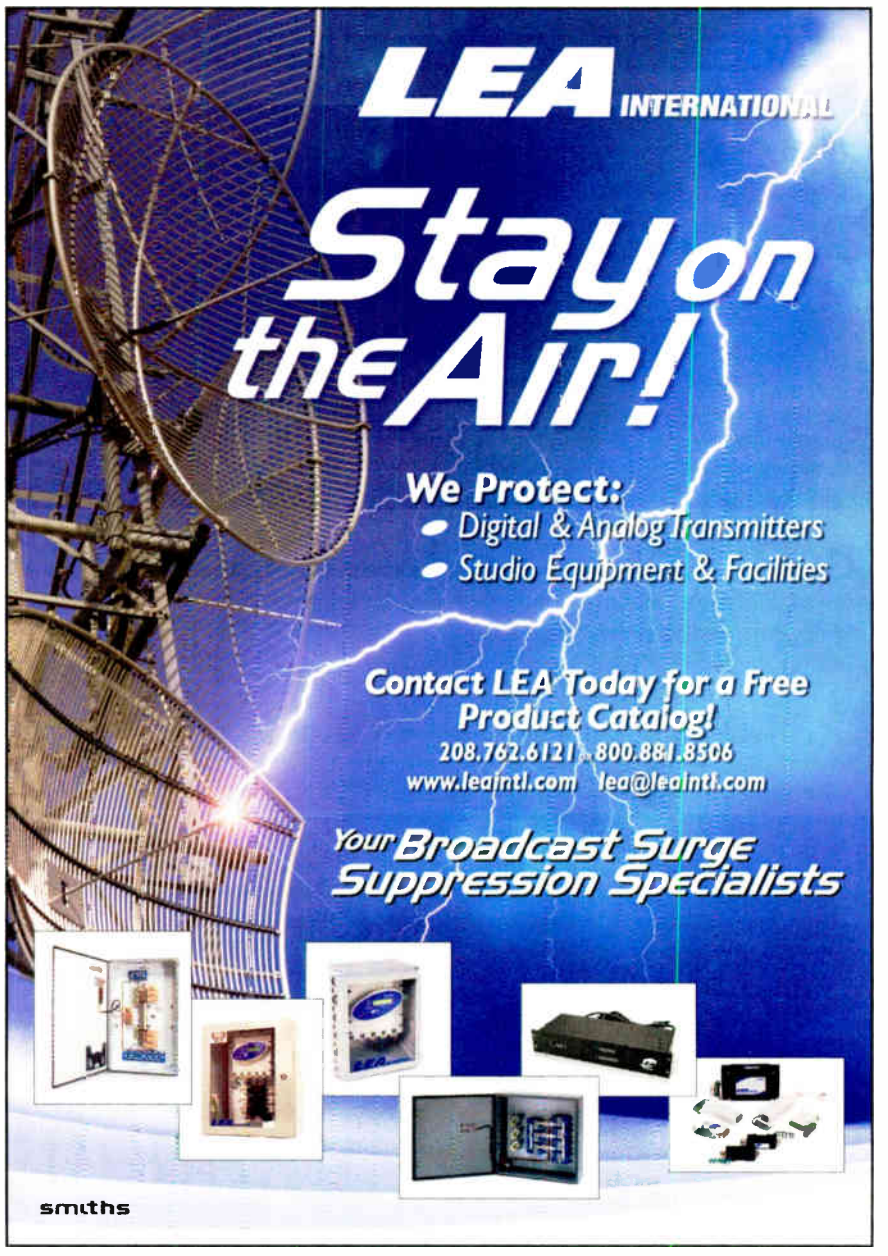

# Audio Guide

by Robert Orban

# Digital Audio – Myths and Realities

*More and more of the audio path in broadcast facilities is being handled in the digital domain. Thus it is important to understand what is going on – even when it seems counterintuitive. In this article, Robert Orban discusses the science behind six common myths about digital audio.*

It is clear that twenty years into the digital audio revolution there are still a lot of myths and misconceptions out there. In this article, we will consider some of these myths and explain the realities of digital audio that are behind them.

## MYTH 1 – THERE'S NOTHING BELOW THE DIGITAL LSB

The first myth is that there is no information stored below the level of the least significant bit (LSB) in digital audio. The reality is that this is only true if dither is not correctly used.

Dither is random noise that is added to the signal at approximately the level of the least significant bit. It should be added to the analog signal before the analog to digital (A/D) converter or to any digital signal before its word length is shortened. (The length of the digital "word" – the number of bits – determines the maximum dynamic range of the audio.)

The purpose of dither is to linearize the digital system by changing what is, in essence, "crossover distortion" into audibly innocuous random noise. Without dither, any signal falling below the level of the least significant bit would disappear altogether. Dither will randomly move this signal through the threshold of the LSB, rendering it audible (though noisy).

Mathematically, correct dithering de-correlates the first two statistical moments of the quantization noise from the signal and linearizes the system so that the digital signal path becomes equivalent to an analog signal path with the same noise floor.

## SHAPING AUDIO BY USING DITHER

Whenever any DSP operation is performed on the signal (particularly decreasing gain), the resulting signal must be re-dithered before the word length is truncated back to the length of the input words.

Ordinarily, correct dither is added in the A/D stage of any competent commercial product performing the conversion. However, some products allow the user to turn the dither on or off when truncating the length of a word in the digital domain. If the user chooses to omit adding dither, this should be because the signal in question already contained enough dither noise to make it unnecessary to add more.

It is possible to apply so-called "noise shaping" to dither. In the absence of "noise shaping," the spectrum of the usual "triangular-probability-function (TPF)" dither is white (that is, each arithmetic frequency increment contains the same energy). However, noise shaping can change this noise spectrum to concentrate most of the dither energy into the frequency range where the ear is least sensitive.

In practice, this means reducing the energy around 4 kHz and raising it above 9 kHz. Doing this can increase the effective resolution of a 16-bit system to almost 19 bits in the crucial midrange area and is very frequently used in CD mastering. There are many proprietary curves used by various manufacturers for noise shaping and each has a slightly different sound.

Noise shaping was first popularized by Sony's "Super Bit Mapping," although the principle as applied to high-quality audio was published by Michael Gerzon and Peter Craven in the late 80s.

## MYTH 2 – THE FREE LUNCH

Aggressive noise shaping can improve the signal to noise ratio in the midrange by as much as 18 dB. However, it is a myth that noise shaping *always* helps audio quality. The total noise energy in a noise-shaped dither is always larger than the total noise energy in garden-variety white, triangular-probability-function dither. In the case of aggressive noise shaping, it can be much larger by perhaps 20 dB.

It is very easy to destroy the noise shaping by downstream signal processing such as re-equalization, which uses multiplication and increases the word length. A digital to analog converter that is non-monotonic will destroy it as well. What happens is that the spectral dip around 4 kHz tends to get filled in, resulting in far higher noise than one would have gotten if one had used simple white dither in the first place.

Aggressively noise-shaped dither should only be used at the final mastering stage when the final deliverable recording is being created.

## WORD LENGTH AND SIGNAL DISTRIBUTION

In production, words with higher numbers of bits should be used for distribution throughout the plant and these signals should be dithered with white TPF dither. 20-bit words (120 dB dynamic range) are usually adequate to represent the signal accurately (20 bits can retain the full quality of a 16-bit source even after as much as 24 dB attenuation by a mixer).

It is important to realize that there are almost no A/D converters that can achieve more than 20 bits of real accuracy and many "24-bit" converters have accuracy considerably below the 20-bit level. "Marketing bits" in A/D converters are outrageously abused to deceive customers and, if these A/D converters were consumer products, the Federal Trade Commission would doubtless quickly forbid such bogus claims.

At the same time, in digital signal processing devices, the lowest number of bits per word necessary to achieve professional quality is 24 bits. Since this represents 144 dB dynamic range, one would think that this is overkill.

However, there are a number of common DSP operations (like infinite-impulse-response filtering) that substantially increase the digital noise floor and 24 bits allows enough headroom to accommodate this without audibly losing quality. This assumes that the designer is sophisticated enough to use appropriate measures to control noise when particularly difficult filters are used. The popular Motorola 56000-series DSPs have 24-bit signal paths and 56-bit accumulators – one reason why they are very popular in pro audio.

If floating point arithmetic is used, the lowest acceptable word length for professional quality is 32 bits. This word consists of a 24-bit mantissa and an 8-bit exponent, a format that is sometimes called "single-precision."

## MYTH 3 – RECONSTRUCTION FILTERS SMEAR AUDIO

A very pervasive myth is that long reconstruction filters smear the transient response of digital audio and that there is therefore an advantage to using a reconstruction filter with a short impulse response, even if this means rolling off frequencies above 10 kHz.

Several commercial high-end D-to-A converters operate on exactly this mistaken assumption. This is one area of digital audio where intuition is particularly deceptive. The sole purpose of a reconstruction filter is to fill in the missing pieces between the digital samples. Reconstruction filters *do not* "connect the dots" between samples by drawing straight lines between them. In essence reconstruction filters remove audio sidebands around harmonics of the sampling frequency.

These days, symmetrical finite-impulse-response filters are used for this task because they have no phase distortion. The output of such a filter is a weighted sum of the digital samples symmetrically surrounding the point being reconstructed. The more samples that are used, the better and more accurate the result, even if this means that the filter is very long.

## PAYING ATTENTION TO THE PASSBAND

It is easiest to justify this assertion in the frequency domain. If the frequencies in the passband and the transition region of the original anti-aliasing filter are entirely within the passband of the reconstruction filter, then the reconstruction filter will act only as a delay line and will pass the audio without distortion.

Of course, all practical reconstruction filters have slight frequency response ripples in their passbands and these can affect the sound by making the amplitude response (but not the phase response) of the "delay line" slightly imperfect. But typically, these ripples are in the order of a few thousandths of a dB in high-quality equipment and are very unlikely to be audible.

## ERROR TESTING THE FILTERS

I have proven this experimentally by simulating such a system and subtracting the output of the reconstruction filter from its input to determine what errors the reconstruction filter introduces. Of course, you have to add a time delay to the input to compensate for the reconstruction filters delay.

The source signal was random noise, applied to a very sharp filter that band-limited the white noise so that its energy was entirely within the passband of the reconstruction filter. I used a very high-quality linear-phase FIR reconstruction filter and ran the simulation in double-precision floating-point arithmetic. The resulting error signal was a minimum of 125 dB below full scale on a sample-by-sample basis, which was comparable to the stopband depth in the experimental reconstruction filter.

We therefore have the paradoxical result that, in a properly designed digital audio system, the frequency response of the system and its sound is determined by the anti-aliasing filter and not by the reconstruction filter. Provided that they are realized with high-precision arithmetic, longer reconstruction filters are always better.

## MYTH 4 - HIGHER SAMPLE RATES ARE ALWAYS BETTER

Because we know that the anti-aliasing filter determines the frequency response of an ideal digital signal path, a rigorous way to test the assumption that high sample rates sound better than low sample rates is to set up a high-sample rate system. Then, without changing any other variable, introduce a filter in the digital domain with the same frequency response as the high-quality anti-aliasing filter that would be required for the lower sample rate.

If you cannot detect the presence of this filter in a double-blind test, then you have just proved that the higher sample rate has no intrinsic audible advantage, because you can always make the reconstruction filter audibly transparent.

There is considerable disagreement about the audible benefits (if any) of raising the sample rate above 44.1 kHz. In 1999, *Stereophile Magazine* reported a blind test of several different 20 kHz lowpass filters applied to high sample-rate digital audio. Four experienced listeners first did blind A/B comparisons between

*(Continued on Page 14)*

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# Audio Guide

by Robert Orban

– Continued from Page 12 –

full-bandwidth audio sampled at 96 kHz and filtered audio, still at 96 kHz, using a digital audio workstation known to have very low jitter. None of them were able to identify the filtered audio; their results were equal to random guessing.

However, they then listened to a CD-R containing the same four selections, identified only as "1" through "4" with the order of the selections randomized. Under the conditions where they always knew which cut they were hearing (but not the processing used, if any), they ranked their preferences for the sound of the four different cuts.

It turned out that these preferences agreed exactly with the preferences they had earlier established in sighted tests, where they knew the processing applied to each cut. In the sighted tests, they preferred the unfiltered original.

An earlier 48/96 kHz test by well-known mastering engineer Bob Katz, using a somewhat higher-jitter workstation, resulted in Katz and his colleagues being unable to hear any difference between the filtered and unfiltered signals. The four subjects of *Stereophile's* test reproduced this result; they reported that even moderate jitter completely masks the difference between the filtered and unfiltered signals.

## A SUBTLE DIFFERENCE

This implies that 96 kHz sampling may provide a subtle audible advantage. However, the fact that experienced listeners in the pro audio industry were unable to identify the filtered cuts in an A/B test means that the advantage is very subtle indeed and is unlikely to be perceived by the average consumer. Moreover, four listeners and four cuts do not provide enough statistical data to rigorously prove anything, although the results are suggestive.

Regardless of whether further, more rigorous testing eventually proves that 96 kHz sampling is audibly beneficial, it has no benefit in BTSC stereo because the sampling rate of BTSC stereo is 31.47 kHz, so the signal must eventually be lowpass-filtered to 15.734 kHz or less to prevent aliasing. In the case of FM stereo, the effective sampling rate is 38 kHz and the same reasoning applies.

Sample rates of 48 kHz are beneficial in DTV, which uses this sample rate internally, but higher rates provide absolutely no further benefit.

In digital filters and equalizers, lower sample rates always reduce the noise and nonlinear distortion that these filters introduce when producing a given frequency response. This is an excellent argument for keeping the sample rate as low as possible in audio processors that include filters and equalizers.

I believe that 48 kHz is the ideal sample rate for audio processing designed for full-bandwidth transmission channels because it provides the best quality filtering without significantly compromising the basic audible integrity of the audio path. While I have also used 64 kHz as a base sample rate for some our FM processing products, this was to minimize input/output delay by eliminating as many internal sample rate conversions as possible.

## MYTH 5 – DIGITAL JITTER DEGRADES AUDIO

Digital jitter has been on many peoples' minds lately, so we ought to briefly discuss its effects on the audio chain.

One of the great benefits of the digitization of the signal path in broadcasting is this: once in digital form, the signal is far less subject to subtle degradation than it would be if it were in analog form. Short of becoming entirely un-decodable, the worst that can happen to the signal is deterioration of noise-shaped dither, and/or added jitter.

Jitter is a time-base error. The only jitter that cannot be removed from the signal is jitter that was added in the original analog-to-digital conversion process so that the original samples were not quite uniformly sampled in time. All jitter added downstream from the original conversion can be completely removed in a sort of "time-base correction" operation, accurately recovering the original signal.

The only limitation in signal recovery is the performance of the "time-base correction" circuitry, which requires sophisticated design to reduce any added jitter below audibility. This "time-base correction" usually occurs in the digital input receiver, although further stages can be used downstream.

It is hard to build digital hardware that is perfectly jitter-free, although the state of the art constantly advances. But always remember that the only place where jitter counts is right at the sample clocks of the A-to-D and D-to-A converters. In fact, provided that the digital words themselves can be recovered, an arbitrary amount of jitter can be introduced elsewhere in the digital signal path and be completely removed before D-to-A conversion, provided that your hardware is well enough designed.

## MYTH 6 – DIGITAL AUDIO DAMAGES THE STEREO IMAGE

Finally, we consider the myth that digital audio cannot resolve time differences smaller than one sample period, and therefore damages the stereo image. People who believe this like to imagine a step function moving between two sample points. They argue that there will be no change until the step crosses one sample point.

The problem with this argument is that there is no such thing as an infinite-risetime step function in the digital domain. To be properly represented, such a function has to first be applied to an anti-aliasing filter. This filter turns the step into an exponential ramp, typically having equal pre- and post-ringing. This ramp can be moved far less than one sample period in time and still cause the sample points to change value.

In fact, assuming no jitter and correct dithering, the time resolution of a digital system is the same as an analog system having the same bandwidth and noise floor.

Ultimately, the time resolution is determined by the sampling frequency and by the noise floor of the system. As you try to get finer and finer resolution, the measurements will become more and more uncertain due to dither noise. Finally, you will get to the point where noise obscures the signal and your measurement cannot get any finer. But this point is orders of magnitude smaller in time than one sample period.

## SUMMING UP

In conclusion, let us review the six common myths that confuse people trying to handle digital audio.

First is the myth that there is no information below the least significant bit in digital audio. With proper dither this is completely untrue – dither actually linearizes the signal path.

Second is the myth that noise-shaped dither gives you a free lunch. In fact, noise shaping is easy to destroy by downstream signal processing or imperfect conversion. So it should be used with considerable discretion.

Third is the myth that long reconstruction filters smear transient information and that short reconstruction filters therefore sound better. I have shown that this is completely incorrect, provided that all of the energy passed by the anti-aliasing filter falls in the passband of the reconstruction filter.

The jury may still be out on the fourth myth – the issue of needing sampling rates higher than 48 kHz. One small study suggests that 96 kHz provides very slight audible benefits to expert listeners using the finest equipment. But no one claims that the advantages are large, or even moderate.

Fifth is the myth that jitter matters everywhere in a digital audio system. In fact, the only places it matters are at the input and output converters. If it matters anywhere else, it means that your hardware is inadequate and has not completely removed the time base error.

The final myth is that the time resolution of the digital system is limited to one sample period. This ignores the fact that all data in a digital system have been band-limited by the anti-aliasing filter, so no sharp transitions occur between samples. The time resolution of a digital system is instead limited by the sample period and by the noise floor of the system, and can easily be nanoseconds, not microseconds.

All in all, modern techniques for handing audio allow great opportunities for manipulating audio without degrading effects merely by passing through the digital domain.

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*A pioneer in audio processing, Robert Orban is best known for the popular audio processors that bear his name. Contact Bob at rorban@orban.com*

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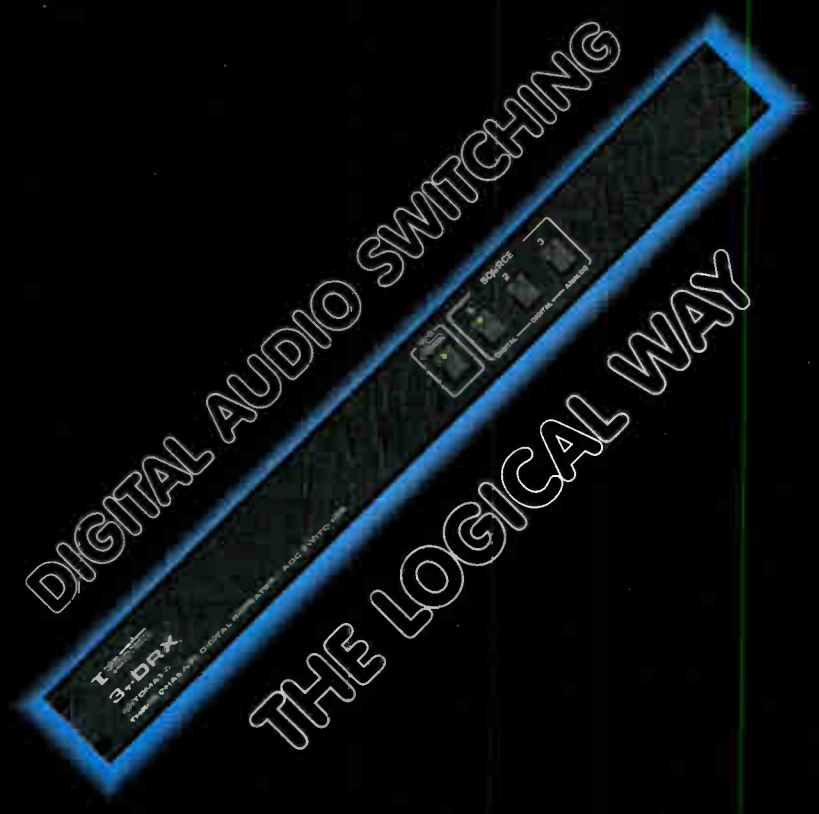

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# Studio Guide

by George Zahn

# When Good Microphone Placement Goes Bad

*Making the right choices as to what microphones are used in a studio, as well as what to do when more than one microphone is open at a time – whether dealing with a morning show with multiple guests or the challenges of live musicians playing in the studio – is more than just putting out a bunch of your favorite microphones and hoping for the best. George Zahn continues his series with this explanation:*

We all know someone in a broadcast decision-making position who might be quoted as saying "microphones are microphones are microphones." In our continuing effort to help you make better-informed microphone decisions, here are some more of the "ins and outs" of proper microphone choice and placement.

Last month we discussed the directional sensitivity of microphones and how to read a polar response graph. Now it is time to see why all those funky graphs are so important.

## OFF BASS REMARKS

Despite the name, no unidirectional microphone is truly unidirectional when it comes to picking up low bass frequencies.

The reason, quite simply, is that the wavelengths of bass frequencies are long enough that it is difficult to pick them up through the external slots or ports on the directional microphone. (These ports allow sound to enter the rear of the microphone, basically letting the same wave hit the front and back of the microphone element at the same time, in effect canceling the sound entering the microphone from behind.)

Since the bass sound waves generally do not enter the small ports, the bass sounds – even from behind the microphone – will be picked up.

Furthermore, because of the ports added to the body of the microphone, unidirectional microphones can be a bit more prone to handling noise if you have a fidgety announcer holding it and moving his hand along the body of the microphone. The vibrations of the fingers against the body are basically picked up as sound through the ports which are often in the handle of the microphone.

## LOST IN THE WIND

Wind noise also can be more problematic with unidirectional microphones.

This has been a problem for many a sports announcer doing spring training interviews in the stands with players. Normally player interviews are conducted in dugouts or locker rooms, far removed from natural wind. But many times major league baseball teams at spring training are in smaller facilities and interviews often are done in the stands or on the field with swirling Florida or Arizona winds.

A major wind blowing across the microphone element can obliterate a decent outdoor interview, even with a basic windscreen. As an example, I remember hearing a Spring Training pre-game interview done several years ago by Cincinnati Reds broadcaster Joe Nuxhall, one I am sure he recorded on the field with his trusty cassette recorder and microphone.

Unfortunately, as is often the case, Joe was not monitoring with headphones while recording and when went to play the interview on the air, the exchange sounded as if it were recorded not on a train but *under* a train. Amongst all the clichés in professional sports broadcasting, this interview lacked every one – of course it lacked any discernible speech at all in the rumbling audio.

The problem of wind in field recordings has become so ubiquitous that software titles such as Adobe Audition (formerly Cool Edit Pro) have spectral analyzers that can help isolate and attenuate wind noise from ill-recorded sessions. A sure way to ensure a better outside recording with any microphone is to monitor the audio while recording – or, at the very least, doing a test recording before starting the actual interview.

## THE NAKED TRUTH

Of the three major microphone families, unmodified condenser and dynamic microphone designs are naturally omnidirectional, meaning that the microphone is sensitive to sound from all directions around it. That works well if you are just using one microphone, as they used to do in very, very early musical recordings.

Back then, you would set up a microphone in the middle of a room and place the musicians around that single microphone based on each instrument's loudness. There was no "fixing it in the mix." Group dynamics in the mix were determined by simple distance from that single microphone.

Anyone who has mixed music in the modern era would cringe at such a thought, although Cowboy Junkies did record a marvelous CD by replicating the single microphone process using a very sophisticated microphone called a "soundfield" microphone, which actually has multiple microphone unidirectional (cardioid) elements in one capsule.

Whether you are recording or broadcasting individually-miked multiple instruments or a number of different voices, we now will explain why *multiple omnidirectional microphones will not work well* for your mix. Here is the enemy you will face when opting for multiple omnis: *phasing*

## PHASERS SET TO STUN

I am not talking about artistic phasing, something you may have heard before in the digitally or tape induced "wash out" effect in the drum break on Tears for Fears' "*Head Over Heels*" or other musical selections. As a carefully-controlled, well-planned effect, phasing is effective in moderate to small amounts.

On the other and, phasing *should not* be part of your audio when using multiple microphones.

Here is how phasing works. Microphone A is slightly (say about six inches) closer to you than Microphone B. Both microphones are picking up your voice. When your voice hits the two different microphones at slightly different time intervals and you mix the output of those two microphones together, you get a bizarre sound – what we call phasing.

What happens is two identical sound or audio waves which are mixed together just milliseconds apart will start to cancel each other. Because treble wavelengths are much shorter than bass wavelengths, the higher frequencies will "wash out" or cancel more. (Bass frequencies are virtually impervious to simple phasing.)

The result of multiple microphones picking up the same sound source at different time intervals is "comb filtering." Some frequencies are washed out while others remain. If you could graph the frequencies on a scale where the vertical intervals are volume and the horizontal intervals are frequency, you would see some frequencies at full volume, while other would be almost gone – looking just like the teeth of a comb, hence the name.

## UNINTENTIONAL LISPING

Moving between the microphones will affect what frequencies are being attenuated by the phasing. Distance is the key consideration here, so you will get a variable wash over the frequency spectrum.

This happens a lot on poorly miked podia where two microphones are placed at either of the front two corners and a speaker moves around between them, causing sibilance (from the higher frequencies) to disappear and making even the best speaker sound as if he or she is lisping. A future discussion will enlarge on the podium problem as we discuss coincident placement of microphones but, for the moment, we need to cover the very basic rules of avoiding phasing when using more than one microphone.

Here is the first rule you should try to follow: When using more than one microphone for mixing (voice or music), *do not* use an omnidirectional microphone of any type. Keep in mind that omnidirectional microphones pick up in all directions and cannot be "aimed," giving you no control on what you pick up with the microphone.

The ability to aim a microphone gives you a fighting chance to avoid unintentional phasing. So the most desirable pickup patterns for multiple microphone setups are cardioid (unidirectional) or supercardioid (much tighter directional). If you are picking up sound in a studio where headphones are being used, cardioid microphones are great. If you need the added isolation to avoid feedback from stage monitors or speakers in a studio or theater, you may want to try using supercardioid microphones.

## THE 3-TO-1 RULE

Using cardioids or supercardioids is the first step to a good recording. The second step is to try, at least loosely, to follow the "3-to-1 Rule." Simply put, choose the one instrument or voice you are miking that is farthest from its microphone, then try to place any other instrument and microphone at least three times that distance away from the other.

For example, suppose we have in our studio one guitarist and one vocalist. The vocalist is working four inches from her microphone, and the guitarist's microphone is about seven inches from the sound hole of the guitar.

The 3-to-1 Rule calls for us to keep the guitarist and vocalist and their respective microphones at least three times the seven inches (the larger of the two distances) away from each other. That is just 21 inches of physical separation between the two artists, which is very achievable unless they are both terribly agoraphobic.

The goal of the 3-to-1 Rule is to keep sound intended for one microphone from "leaking" into another microphone at the talk table or on the stage. In the real world, it is virtually impossible to eliminate leakage from multiple microphone set ups (unless everyone were given his or her own drummer-style sound-proof booth!), but the 3-to-1 Rule makes things manageable when you are mixing multiple sources.

Eyeballing the distance is fine; I have never known anyone to take a tape measure out to ensure the measurement. In fact, I once had to bend the rule slightly (OK, I broke it. But I did fix it with duct tape later!) on my first music mix. The challenge was to broadcast the 16-piece Blue Wisp Big Band from a stage slightly larger than a postage stamp; it all had to happen on a 12 foot by 16 foot area, including the live audience!

Next time we will share some of your comments as we discuss more about microphone technology and how the knowledge helps you do your job better.

*You are invited to share stories about your favorite microphone, horror remote story, or creative solutions. Send them to George Zahn, WMKV-FM Station Director, at GZahn@lifesphere.org*

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# Radio War Stories

by George Whitaker

## How to Steal a Radio Station

### *Part 3: Stealing the Whole Shootin' Match*

*It seems hard to believe – someone stealing an entire radio station. But as George Whitaker shows, this is not as impossible as you might think. All it takes is an honest person trying to deal above-board with someone who has set out with the intention of taking advantage of the seller.*

In the first two installments, I explained how certain people arranged to steal an antenna and a roll of 3-1/2 inch coax. Now that we have an understanding of their methods, I will show you how to steal a complete radio station. (Actually, the bad guys did have to spend some money, but they got it for about ten cents on the dollar.)

The idea is that by knowing how the scams were accomplished, hopefully you will not allow yourself to become a victim. Personally, I would like to give real names and call letters – I can prove every word if I had to do so. However, to protect the guilty, all of the names or call letters are fictitious.

#### THE KEY ASSET

First, we need to look at how the Federal Communications Commission views a station license during a sale. Although I am not a lawyer, I am relating this the way I see it from having been an observer over the years.

At any rate, the way I understand it is that the Commission will not allow a lien on the license itself. Therefore, you write the contract to cover the physical assets and then the license is transferred by the FCC to the new owner, if they approve.

The license, of course, is what actually constitutes the station. The physical assets have very little value without a license to use them. Normally, in the case of default in payment, the license and the assets are transferred back to the original owner. In a legal sense, however, they do not necessarily go together.

#### THE PLAYERS

Here is the cast of characters for our dastardly plot:

***Angel:*** he is the original owner of the station – and a very nice guy. When he got ready to sell his station he just wanted to help our next character realize his dream of running his own station.

***N. Y. Mann:*** this is a naïve young man (hereafter referred to as the NYM). He always wanted to have his own station and Angel made him a real good deal. Unfortunately, as time passed, it became sadly evident that the NYM was not turning out to be a very good owner/manager and the station never was able to bill enough to carry itself.

***Ed and Fred:*** these two fellows owned a station about fifty miles away (I do not know by what means they acquired it). On the surface they appeared to be pretty good guys; Fred was quite wealthy and a deacon in one of the larger Baptist churches in the area. Overall, they had a show of respectability.

I was doing contract work for Ed and Fred at their station and that is how I came to be involved and have first-hand knowledge in this scam.

#### THE SCAM

Now here is the story on how the deal was worked:

The NYM had been struggling, trying for a couple of years to get his station in the black but, instead, had run up a considerable debt. The biggest item was a pile of money owed to the IRS for unfiled 941's. The IRS was beginning to put pressure on the NYM to file and pay, as were some of his other creditors.

One day Ed and Fred showed up and told the NYM that, since the license was in his name, they would buy the license from him for the amount owed to the IRS and other creditors. The NYM would not come out with anything but he also would not owe anything. As you can imagine, the NYM jumped at the chance to be relieved of his creditors and they proceeded to file for a transfer of the station license from the NYM to Ed and Fred.

During the time it took for the Commission to process and approve the transfer of the station license Ed and Fred gave the NYM just enough money to keep the station operating – they reassured him that they would pay off all his debts just as soon as the transfer was approved.

*(Continued on Page 20)*

# Radio War Stories

by George Whitaker

## How to Steal a Radio Station

*Continued from Page 18*

The NYM could hardly wait as the IRS and other creditors were hounding him constantly. By now you probably have already guessed what happened next.

### THE SWITCH

Anyone who has worked with me or done business with me knows that I am a stickler for honesty and fairness. It was during the wait for the license transfer to be finalized that I figured out what was going on and told Ed and Fred they would have to find another engineer.

However, I continued to observe from a distance, just to see if I was correct in my assessment of the situation. If I had been wrong, I would have cut off a good monthly income for nothing. As it turned out, I was 100% correct.

Of course, as soon as the FCC license was transferred and Ed and Fred had solid, legal possession of the document that actually constitutes the station, they informed our NYM that they had decided not to pay the IRS or his other creditors – he would just have to deal with them himself, they said.

### THE STING

At this point Ed and Fred had complete control of the station – and the NYM was standing out in the cold with a pile of bills. His only option would have been to sue Ed and Fred for "specific performance" or, in other words, to fulfill the contract and pay off his debts. The NYM, of course, had no money to fight this kind of legal battle.

What about the physical assets? Yes, before the ink was dry on the new license, Ed and Fred found a new victim; the scheme was constructed so Ed and Fred would manage to get them, too. Here is how it worked:

Because the NYM had defaulted on the contract of sale, Angel now had legal possession of the physical assets again. But since Ed and Fred had the license, those assets turned out to have less value than just a few days before.

### A DOUBLE SCAM

Ed and Fred quickly got quotes on new studio and transmitting equipment and filed for a new transmitter site just down the road from Angel's site. Angel would be stuck with a tower, tower site lease, transmitter – and all the other used equipment from the station.

Just the cost of paying off the lease and dismantling the tower would have been horrendous. Plus, Angel would have had to store all the old equipment and try to sell it on the used market. It would have taken thousands of dollars just to dispose of everything and, at best, he might have broken even. More likely it would have cost more to dispose of the equipment than he could get for it.

But, guess who just happened to stop by and make an offer? Good old Ed and Fred were willing to take everything off Angel's hands for $20,000 (I do not know the exact figure, but I am sure it was a fairly small amount).

Two unpalatable options were left for Angel. He could have taken the $20,000 and forgotten about the whole matter. Or, he could have paid off the studio and transmitter site leases and tried to store and then sell the equipment. (The time and money here would have been considerable.)

Angel naturally chose to take the small amount of money and his lumps. Instead of the $200,000 he was to have gotten for his station, he wound up with $20,000.

I hope this series of articles has enlightened you to some of the things that can happen to the unwary station owner with legal impunity. Unfortunately, small stations will always be vulnerable because the legal system definitely favors the big guys.

*George Whitaker is a long-time broadcaster, based in Arlington, Texas. Contact George at boss@mikeflags.com*

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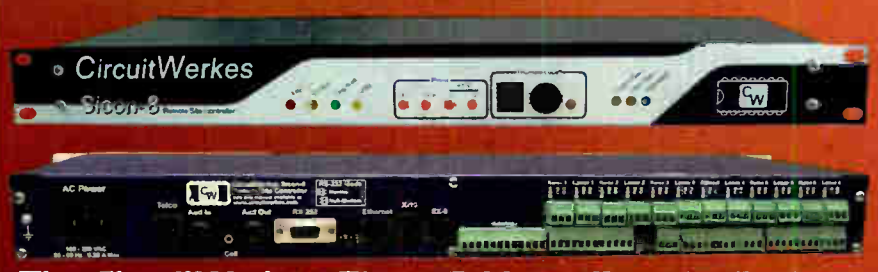


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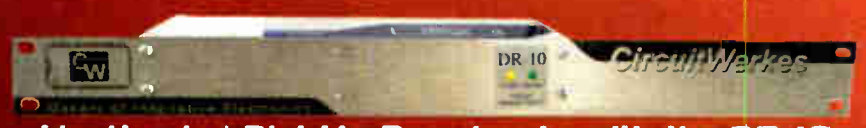


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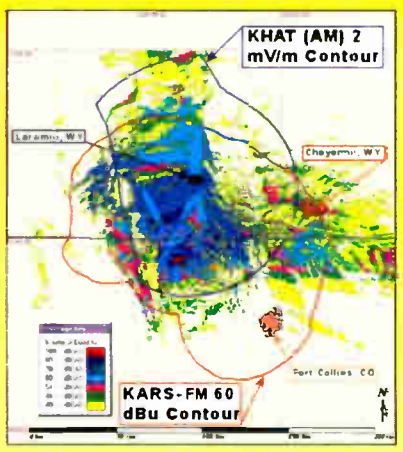


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# FCC Focus

## Quarterly Transmitter Site inspections

by Ken Benner, NCE

*Stations that have towers with lights are familiar with the Quarterly Tower Lighting System Inspection. Ken Benner suggests that as long as you are there, it is a good time to schedule a full station inspection. Even stations without tower lights can benefit from such a regular inspection.*

The Self Inspection Checklist includes verifying that a timely Quarterly Tower Lighting System Inspection was conducted as specified in Section 17.47(b) of the FCC Rules and Regulations.

In addition to meeting the FCC requirements, such an inspection is something that could easily become critical in the defense of a station whose tower is involved with a plane crash. It is absolutely essential in the interest of air traffic safety, our preventative maintenance programs and, most importantly, the licensee's legal protection and peace of mind that we review and log these inspections as suggested.

### DOING MORE THAN THE MINIMUM

For those of you who have suffered through one of my Alternative FCC Certification Inspections I am sure you recall my mantra: "Keep it cool, keep it clean, keep those voltage spikes under control, keep your maintenance reviewed, and you will prevent more than 95% of your maintenance headaches!"

Since most station engineers are busier than ever these days, visits to the transmitter sites sometimes are put off unless the remote control sets off alarms. Nevertheless, regular maintenance inspections are more important than ever before so you can see any deterioration at the site and initiate repairs before any major damage is caused.

In other words, it is important that you not stop at doing the minimum. Any and all extra time spent with your system will result in better, more stable operation.

### A USEFUL CHECKLIST

My good friend, Dave Malley, at Kirkwood Community College in Cedar Rapids, Iowa is one of the most dedicated broadcast engineers I have ever met. He has shared his "Quarterly Site Inspections Checklist" with me for this column, to which I have added a few additional comments.

I suggest the following list be laminated and reviewed quarterly with a record of such maintenance done as part of your station's technical log. (The list is also available as a .doc file at www.radioguide.com/QuarterlyInspection.doc) Of course, you may already have your own routine that you use when visiting your transmitter sites. You may even some key points in mind that Dave and I have missed. Be sure to incorporate them on your list.

### SPECIAL TESTS AS APPROPRIATE

Depending upon whether you experience very cold or very hot temperatures, you may have additional items that relate to your specific site.

For example, one thing you might add to the list is to turn on the antenna heaters and use a clamp-on meter to determine if any of them have opened since your last inspections. Several stations have found this to be a helpful diagnostic.

If this is the first time you have been at this particular site, determine from the manufacturer the current for each heater and post this value near the point at which you make the current measurement. Obviously, the proportion of reduced current demand will indicate if one or more heaters have opened. For example, if there are ten heaters and you find heater current down 30% – you have three heaters that have opened and have found the reason for your high VSWR during periods of snow or sleet.

### ONGOING BENEFITS

Feel free to duplicate this list, check it off each quarter – it should not take you more than twenty minutes unless there is a problem. Show it as part of your logs to any FCC Inspector, Manager or Licensee and you can be assured you will be commended for your professional dedication.

*Ken Benner is an Alternate FCC Inspector under the ABIP. His email is bennerassoc@comcast.net*

## Quarterly Site Inspections Checklist

### SITE INSPECTION

- The site fence is in good repair and secure.
- All the fence gates are securely locked.
- All the fence padlocks are easy to operate (or sprayed with a Best Lock Co. approved lubricant.)
- The fences around building and anchor points are in good condition.
- The warning signs on the fence are in place and in good condition.
- Check area within fence area for new vegetation growing and pull if necessary.
- Pick up other debris that may have gotten inside the fenced area.
- Spread herbicide in the spring of the year and repeat later if regrowth develops.
- Proper posting of tower registration number, if required.

### BUILDING INSPECTION

- Ensure the door lock is secure and latched properly.
- Ensure the door padlock is easy to operate. (If not, use approved lubricant.)
- Exterior of building appears sound, no punctures from bullets, hardware not rusted, etc.
- Ensure the interior of the building is free of any apparent roof leaks.
- Inspect top of building for ice punctures, dried seam sealer, any apparent leaking.
- Building appears to be level and not stressed by foundation settling.
- Change any light bulbs that have gone out.
- Interior of building clean and free of dirt, mouse droppings and debris.
- Building temperature control OK.
- Make sure the air filters are clean, with good air flow.
- Ensure all cable entrances are tight and leak-proofed.
- Make a list of supplies you need to buy and bring on your next trip.

### TRANSMISSION SYSTEM

- Check and log each transmitter reading. Note any that are unusual.
- Check the PA temperature rise, especially on FM transmitters.
- Check the auxiliary transmitter and dummy load, if available.
- Check any RF filters for proper operating temperature.
- Check any RPU or other gear for normal operation.

### TOWER STRUCTURE

- Check to see the tower(s) straight in appearance, no twisting, sway, etc.
- Check to see if all guy wires appear properly tensioned with respect to each other.
- Check to see the grounding connections in place, clean and tight.
- Check to see if the tower paint condition appears to be good with a good color contrast between bands.

### ANCHOR POINTS

- Check to see the anchor sites are free of vegetation and debris.
- Check to see the turnbuckles are cabled to prevent turning.
- Check to see the all the bolts and nuts are secure.
- Check to see that all the hardware is free of rust. (If not, clean and spray with cold galvanizing.)
- Check to see the ground connection is in place and tight.
- Check to see if the anchor is starting to corrode or rust just below ground level.
- Check to see that the antennas and radomes appear OK.
- Check to see that all cables, coax and waveguides are fastened tightly to the tower.

### TOWER LIGHTS

- Ensure the tower lights come on when photocell detector is covered.
- Check to see that all sidelights are on.
- Check to see that both lamps of the top beacon are flashing.
- Check that the flash rate and duration is within specifications.
- Ensure all lamps are free of any white light (indicating no cracked glass or filters).
- Ensure the conduit breather is in place and free of obstructions.
- Check the lighting controller:
- Check door operation (and spray WD-40 to loosen as necessary).
- Ensure the controller is free of dirt, moisture & corrosion.
- Check to see that all connections are tight to the touch.
- Check to see that the photocell is pointing to the North and correctly positioned vertically.
- Check the remote control system calibration for a low reading of 40 and the high reading;
- Document remote control readings for future reference. (Note: Calibrate only when all lamps are working.).

### UPON LEAVING SITE

- Place all equipment back to its normal operating condition.
- Place the transmitter in "remote" mode.
- Place the remote control in "remote" mode.
- Ensure the Fax machine cabling (if you have one) is in its normal state.
- Ensure the air conditioner is on.
- Place all other switches you may have used during testing back to the normal position.
- Leave log entries and/or copies for future reference.
- Securely latch the door.
- Lock the door padlock and check to make sure it is closed.
- Lock the fence padlocks and check to make sure they are closed.
- Lock the main gate padlock and check to make sure it is closed.

# Walking the Floor at CES 2007

## Observations from the January Consumers Electronics Show

For forty years now, the Consumer Electronics Association has been producing one of the premier trade shows. The only way to describe the 2007 Consumer Electronics Show (CES) in Las Vegas last month is big, crowded, big, filled with tech toys galore, big, visually exciting, big, and noisy. Did I mention that it was big?

With 140,000 attendees swarming over 1.8 million square feet of exhibits, parceled out to 2,700 exhibitors and spread all over the Strip from the Las Vegas Hilton to the Convention Center to the Sands Expo and Venetian Hotel, there was almost nothing electronic that was not displayed somewhere – including much of interest to broadcasters.

**The Las Vegas Convention Center is back there somewhere, among the tents and other activities. At least the monorail was easier than finding parking.**

### MANDATORY STOPS

Of course, for broadcasters, the displays of digital radios were of primary interest.

A couple of years ago, it almost seemed like there were more pictures in the iBiquity booth than actual radios. This year, however, there has been progress in bringing radios to the market. At least 18 tuners and tabletop radios, as well as a number of car radios, were on display. Truly portable HD radios? No, not yet.

**More and more choices are coming on line; prices are starting to drop.**

Car radio makers took several different directions. Delphi showed a prototype HD radio capable of recording programs for replay; the capacity depends upon the size of the removable memory card used and the bit rate set. Delphi was a bit reluctant to give exact numbers, but it was more than a few hours, even on the smaller flash cards.

Over in the Visteon tent, the new "HD Jump" radio was on display. Designed to be dockable both in cars and on tables, the user carries it with them. Connection to the Jump includes an input jack for MP3 players.

Both Delphi and Visteon seem interested in making the radios "user friendly " and featuring more direct access to some of the most used functions – in contrast to the multiple levels of menus one must navigate on many other car radios to adjust some features. Capabilities for receiving RDS, PAD (even program schedule "grids"), and traffic data were demonstrated in the models.

### THOSE FM MODULATORS

The way the Jump radio connects to the car system brings up another issue of great concern to broadcasters – an FM modulator. So, I specifically asked at each booth if the FM modulators were FCC approved and am happy to report that virtually every manufacturer with whom I spoke has gotten on-board with products that radiate properly – the majority were happy to show me their FCC labels.

I spoke with Larry Sharp at Roadmaster USA. A former radio chief engineer, Sharp told me that sometimes it takes a little time and effort to communicate with the factory, but he (and others) were committed to doing things correctly, so that any potential interference was reduced below FCC limits or entirely eliminated.

Before leaving the North Hall (somehow I just seem "pulled" in there), I just had to take a moment to look at all the tricked out cars, each trying to outdo the others with bigger and better audio and video systems.

**Perhaps the ultimate low-rider?**

### MORE AUDIO AND VIDEO

The CES show floor was filled with video screens, speaker systems, and computer controlled "Media

*(Continued on Page 26)*

# Walking the Floor at CES 2007

*Continued from page 24*

Centers" to control everything from movies in one room to a musical concert in another to Internet content in a third. Wireless picture frames could be changed to match the media content. Remote control and alarms filled out the more complex packages.

If your computer is in a different room than your new HDTV, products now can provide streaming of HDTV, music and picture files for well under $200. Several products, including D-Link's MediaLounge will do the job.

**D-Link MediaLounge**

Another good product is the ZyXEL PL-100, which provides Ethernet networking using your power lines. From there, prices move upward, depending upon capability, internal storage, and connectivity. Several products even allow you to forward your music and videos to where you are, if connected to the Internet.

Speaking of video, it was dazzling. The "We have the Biggest TV" contest continued this year. This year's "winner" is, would you believe ... wait for it ... 120 inches (ten feet)! They surely would dominate most living rooms.

As befits any electronic show, there were myriads of iPods and other MP3 players, cameras, flash memory cards and thumb drives. There were also all sorts of accessories to carry, power, amplify (with speakers) and connect them with your computer and other storage. With flash memory becoming standard, multi-gigabyte storage in tiny cases is making it easier and easier to carry an entire library, plus back up your data files.

## LISTEN TO THE MUSIC

While the debate continues as to whether MP3 files should be permitted to exist in an audiophile world or sent to disco-heaven, various companies were showing off speakers and earphones to fit every taste.

In the wired world, Shure brought their new line of "in the ear" Sound Isolating earphones. No, not ear buds. You cannot use that term to describe these $150 to $500 devices, which contain as many as three speakers in a tiny capsule. Designed for musicians, they sound sweet.

If you need a wireless set of earphones, either for convenience in a studio or by necessity out at a remote, Bluetooth products were in evidence from several makers. Another interesting product is the Kleer wireless technology. Now being marketed by RCA (Jet Stream), for example, a Kleer wireless system can simultaneously transmit the same program to four sets of earphones for up to ten hours on one charge.

## COMPUTER CITY

Since COMDEX' demise a few years ago, CES attracts a large number of the computer folks. From small startup hardware companies to software giant Microsoft (with special focus on Office 2007 and the Windows Vista operating system), there was no lack of computers or ideas on how to use them.

A couple of screen extenders caught my eye. As control rooms fill up with CPUs, one way to reduce the noise and heat load is the Matrox TripleHead2Go. This extends the desktop to three screens, making it easy to display multiple applications. Triton showed a small USB boxes that doubles a desktop's workspace.

Engineers running RF proofs certainly are benefiting from the latest GPS products. Having good street level maps to go with that is important, and DeLorme – a favorite of many users – showed their new product, Earthmate GPS, a Bluetooth-connected GPS setup that connects to a laptop or even a PDA.


**WildCharge can power a laptop and cell phone simultaneously. Tesla would be proud.**

Being in the field can mean that power may be a problem with many pieces of gear fighting for the "power spigot." Solutions include multiple output converters, battery assist packages (using regular batteries, hand cranks, or a combination), and of course, solar cell products. One company, WildCharge, even showed a pad that transfers power wirelessly.

## ... AND STILL MORE

How about putting it all together and build, perhaps, the ultimate remote vehicle? How about a rolling WiFi hotspot? Autonet Mobile showed a vehicle with an Always-On Broadband Network. Just pull up to a remote (or tailgate party) and the hotspot serves everyone – audio, video, Internet, IP streaming, VOIP, everything.

A final note: after four days of walking, I sure wish I had thought of bringing an extra pair of legs.

# First Person

by Marvin Collins, W6OQI

# CW, RTTY, Radio News, and a Long-Standing Friendship

*It was a different age. Long before computers and satellite transmissions, radio stations got the news and weather from one or more teletype machines which were constantly banging away in the newsroom (or news closet). But before that, news was sent via Morse code (also known as CW) on shortwave and received at stations like KNX, Los Angeles. Marvin Collins sheds light on this history.*

Recently, while looking through my old ham radio log books, I noticed that, on 1/26/1955, I called my first Radio Teletype (RTTY) CQ, with no results. This first CQ was on 40 meters. Ten minutes later I tried again on 80 meters, also with no results. On 2/26/1956 I had success with my first RTTY QSO with Forrest A. "Bart" Bartlett, W6OWP.

Little did I know this was the first contact in a series of almost weekly contacts that was going to last for the next fifty plus years. Nor had I an inkling of the amazing history Bart had lived through, a history that touched both ham radio and the broadcast industry.

## MOVING THE NEWS TO RADIO

A very interesting piece of information I learned about Bart was that, in the early thirties, he worked for several radio stations, including KNX, Los Angeles. His job was to receive Morse code (CW) shortwave transmissions of the news and, using a typewriter, type out the news for the newscasters. This was before the news began being transmitted to broadcasters via teletype machines.

**Forrest "Bart" Bartlett copying CW in the KGER Newsroom, 1938.**

In the 1930's the call letters WCX (7850 kHz, 10 kW) and WJS (15700 kHz, 10 kW) became known around the world for daily news CW transmissions. While domestic users subscribed to Transradio Press Service, dozens of shipboard operators surreptitiously copied the CW transmission to keep on-board personnel current with the latest news.

Among the messages we exchanged over the years, Bart explained some of the history of radio news: *"As strange as it must seem today, seventy-some years ago radio stations seeking to augment local news with national and international events were unable to get access to the news agencies of the day. United Press, Associated Press and International News Service all had contracts with their newspaper clients forbidding the sale of their services to broadcast stations.*

*"It was in this environment that Transradio Press was organized to fill the gap. Rather than using leased wires and teletype machines, news dispatches were delivered by shortwave Morse code transmissions from the high-powered commercial transmitters in New York operated by Press Wireless, Inc.*

*"The transmissions were at 39 words per minute at scheduled times throughout the day. Clients would install a shortwave receiver and if one of their engineers did not have high-speed code copying ability, they would hire a radio operator who did. Among the perhaps 150 broadcast stations using Transradio Press was KNX, Los Angeles."*

## THE "INTERCEPT OPERATOR"

During the 1930's Forrest A. "Bart" Bartlett had worked as a Transradio Press Service CW intercept operator at KFEL in Denver, KIUJ in Santa Fe, KOOS in Marshfield (now Coos Bay City), and KNX and KGER in Los Angeles. We "spoke" a number of times about his work at the KNX Hollywood studios, at 5939 Sunset Blvd.

Bart recalled: *"In keeping with their strong policy on news coverage KNX had become one of the prime western stations using Transradio Press Service. With delivery to radio stations via 39 wpm CW, obviously a radio operator was needed and I was hired to replace an assistant who handled the press copy work.*


**The KNX studios in the 1930s.**

*"The receiver was a Hammarlund Comet Pro and its antenna was on the roof of the Sunset Blvd. building. The studio newsroom was too small to accommodate the 'operating position,' so I worked in a section where program material was mimeographed. One of the girls in this department was Eddie Cantor's daughter, Natalie.*

*"This was before CBS took over KNX. The transmitter was located at Sherman Oaks. Ken Ormiston (of Aimee Semple MacPherson fame) was chief engineer. At the studio, Leo Sheperd was the technician I knew best. After Leo's untimely death, his ham call, W6LS, later became the call of the Lockheed Radio Club."*

## PRODUCING THE COPY

Over the years, Bart told me some of the activity that went on to get the news from Morse Code to the KNX listeners. It took the efforts of a team, starting with the radio operator.

*"There were four news writers who prepared the broadcasts: Les Mawhinney, Pete Pringle, Kelly Woolpert and a sports writer named Carter. There were two newsmen that delivered these broadcasts. The one I remember was Glen Hardy. Many years later (after WW2), I heard him again doing news on a small valley radio station.*

*"A big account for the news broadcasts was Alka Selzer. This was touted as the "Alka Seltzer Newspaper of the Air." I still remember the "plop, plop, fizz, fizz" bit as part of the commercial! During the time I worked at KNX, aside from the news broadcasts, I also remember Fletcher Wiley and his Housewives Protective League as one of the most popular of the KNX programs.*

*"The use of the Transradio Press Service was discontinued after KNX became part of the CBS family. However, the news department still needed the services of a CW radio operator on a part-time basis. I filled this need, which was to provide copy of marine weather broadcasts.*

*"This information was incorporated in news bulletins primarily of interest to yachtsmen plying the waters off the Southern California coast. Errol Flynn was given as an example of one of the many who depended on the KNX reports."*

## FROM CW TO RTTY

Changes were coming and Bart's life was to take an interesting turn. Initially, it did not seem like it was going to be good. Bart remarked: *"My first experience with teletype might have "turned me off" of any further interest.*

*"I still was working for KNX in their Hollywood news department, copying the shortwave dispatches provided by Transradio Press Service. Then, one day in the fall of 1936, something new appeared in the newsroom: a Model 15 RO (Receive Only) Teletype, tied to the newswire of one of the major press services. I could see myself being replaced by this mechanical contraption. And this is just what did happen about Thanksgiving of that year."*

Fortunately for Bart, *"Transradio Press was opening a bureau in Los Angeles So I wasn't out of work very long, and strangely enough, a Model 15 (later a 19) replaced the typewriter on which the shortwave transmissions were copied.*

*"Transradio sent me to a class operated by the telephone company where I received instruction. During the next few years I became very adept at the use of Model 15 and Model 19 Teletypes as well as the Model 14 machines on a Postal Telegraph circuit that came into the office."*

## A HUMAN INTERFACE

From 1937 to 1942 Bart worked either full or part-time for Transradio Press Service at their Los Angeles bureau. He also built and maintained the bureau's equipment. Remote receivers located at Bart's residence at 1269 Montecito Drive, Los Angeles were used for the Transradio Press operation.

**Transradio intercept facilities at KGER studios In the Clark Hotel, Los Angeles, 1938. Personnel: Evelyn Marshall, Forrest Bartlett and Kelly Woolpert. Remote receiver controls were in the rack.**

After Bart told me about this in 2003, I made it a point to drive to the address. I found the house he lived in - and where the remote Transradio Press receivers were located - to still be there. The location is very close to what used to be the KRKD transmitter site (it is still maintained as a backup site for 1150 kHz.)

**Bartlett's home where the Transradio Press CW reception point was set up in the back room (drawn shades). The pole was for the beam antenna.**

It was a busy life, being an operator and repairman. *"I've often thought of the thousands of words of news leading up to WW2 for which I was the "interface," copying CW at 39 words per minute directly to the Teletype circuit which distributed the news to clients around southern California.*

*"Meanwhile, when the shortwave circuit was idle, I was busy with technical problems involving a remote receiving site and designing a siphon tape recording system. The latter was to ease the developing difficulty of finding high-speed CW personnel - non-radio persons could be trained in a much shorter time to read the inked tape."*

(Continued on Page 30)

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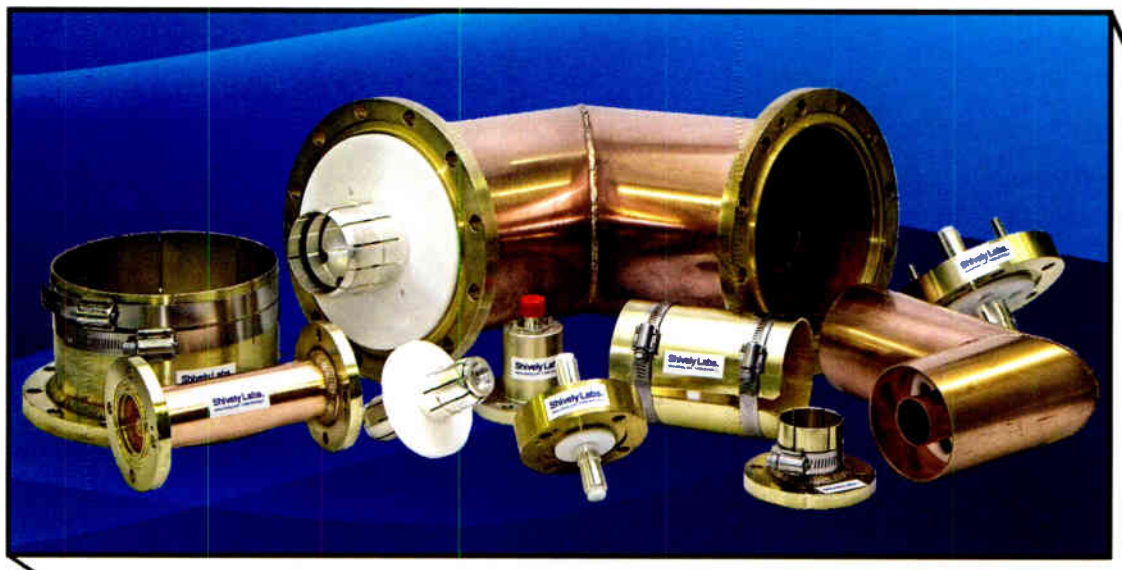

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# First Person

Continued from Page 28

## CW, RTTY, Radio News, and a Long-Standing Friendship

### CW AND FSK IN WWII

Transradio Press Service had broken the major wire service monopoly on news distribution to the national media. By the 1940's the leading wire services recognized broadcasting as a significant business and no longer were exclusive contracts signed with newspaper clients.

**A siphon tape printer and sample tape, which reproduced the "undulations" of the incoming CW signal.**

Unfortunately, as the Teletype printer service became available in radio station newsrooms, the Transradio Press Service share dwindled. But there still was work for folks like Bart.

*"The United States entry into WW2 is another chapter. I had been turned down by the Navy. I went to work for Press Wireless and this is a good place to mention that they were pioneers in the HF development of FSK.*

*"Initially, it was used on CW point-to-point circuits with a significant improvement in thru-put. A notable achievement attributed to the use of FSK involved two Press Wireless units that accompanied advancing allied forces in Europe and the Philippines during WW2.*

**Los Angeles teletype operators in the early 1940s.**

*"I was with the Philippines unit. The transmitters operated at only 400 watts but, using FSK, they were able to maintain high-speed circuits bringing reports from war correspondents to agency and newspaper editors in the U.S. only minutes after dispatches had been released by the censors."*

### MEETING THE SOURCE

At the time I met him, Bart was working for Press Wireless in Belmont, California, where he operated their high power shortwave transmitters. I was still going to school but working part time at KCBH(FM), licensed at 98.7 MHz in Beverly Hills, California.

**Marvin Collins, W6OQI, with a Model 26 Teletype machine about 1955. This was the Teletype machine used for the first RTTY conversation with Bart Bartlett, W6OWP, on February 26, 1956.**

I also was in the United States Navy Reserve. One of my annual two week training duties in the Navy Reserve took me to the San Francisco area. I believe it was on one of these trips that I had the opportunity to meet Bart for the first time at his home in Belmont, California.

### A WELL PRACTICED HAND

Bart's commercial experience in using teletype machines certainly showed during our weekly RTTY conversations. His typing on RTTY was so good, I thought he must have been sending his text via punched tape during our weekly ham radio RTTY conversations.

I was very surprised to see that he was using just a simple Model 15 Teletype machine, which meant he was simply typing on the keyboard with some very fast fingers.

During this visit I was able to see Bart's CW (Morse code) setup he used for the American Radio Relay League (ARRL) West Coast code practice

(Continued on Page 32)

# "My Number One Codec Rental is Zephyr Xstream"

-Steve Kirsch, President Silver Lake Audio

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# First Person

by Marvin Collins, W6OQI

– Continued from Page 30 –

transmissions and CW qualifying tests. I remember seeing a Bohme CW keyer for the first time in Bart's ham shack.

Some years later, on another trip to the Bay area, I was able to visit Bart at the impressive Press Wireless transmitter facility in Belmont, California. I was lost in the San Francisco fog, trying to find the KGEI shortwave transmitter site. The only building I could see in the poor visibility turned out to be the Press Wireless building I had visited before, but initially, I did not recognize it in the fog.

**Bart Bartlett at his Model 26 teletype machine and Bohme CE keyer in the early fifties.**

The man who answered the door told me I had the wrong building for KGEI. But then, when he said I was at the Press Wireless facility, I asked if he knew Bart, W6OWP. He laughed and said "Come on in; Bart is on duty." Bart and I had another good face-to-face meeting before I finally found KGEI.

## STAYING IN CONTACT

Later, when Press Wireless closed down at the end of October 1969, Bart went to work for Aeronautical Mobile Inc. (ARINC). I moved from working at KCBH to KPOL-AM in Los Angeles and felt like I had moved to the "Big Time" going from the then unknown medium of FM radio to AM broadcast radio in 1957.

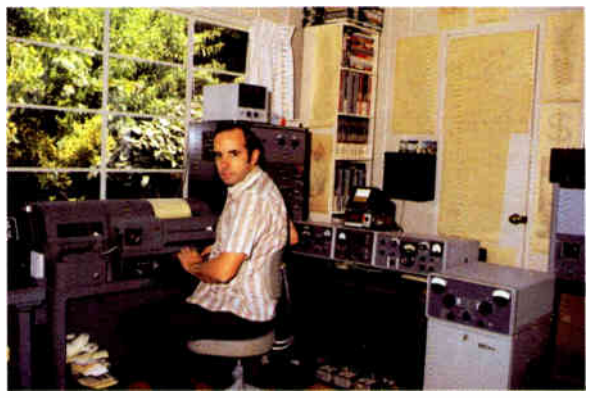
**The Press Wireless shortwave transmitters at Belmont, California about 1960.**

During these job changes for both of us, Bart and I continued our RTTY weekly conversations. Sometimes when I worked the all-night shift at KPOL Bart and I would have a conversation on 40 meter RTTY before I went to bed and before he went to work.

In more recent years, after Bart retired and I became Chief Engineer of KFI and KOST FM in Los Angeles, our weekly RTTY conversations remained on 80 meters on Tuesday evenings. We found that 80 meters was still like a pipeline between us.

## THE LONGEST RUNNING RTTY CONVERSATION IN THE HISTORY OF HAM RADIO

After more than fifty years of weekly RTTY conversations, Bart and I believed we must have had the longest running RTTY conversations in the history of ham radio.



**Years change; models change. This is 1972 – and a Model 28 ASR teletype.**

In time, Bart and his wife Peggy moved to Paradise, California. During our conversations, Bart would often tell me that he had just finished clearing the brush on his three acres of property or that he had cleared out the brush in the creek on his property. He continued to do this into his nineties. This amazed me. I said to Bart that the hard manual labor must be what keeps him going at his age.

There were a few exceptions to our weekly RTTY conversations when Bart and his wife Peggy would be traveling in their motor home. We managed to keep our conversations via CW. I would use my computer to generate and receive CW.

When I would ask Bart, "How fast should I send this evening?" He would reply, "About 45 wpm would be fine." He would have no problem copying me at that speed. He would send back to me at about the same speed but all I could do was let my computer decode the high-speed CW from Bart. *(Continued on Page 34)*

# Feature packed.

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**Who are these guys?** • Why buy a console from Axia? Element was designed by Mike Dosch and his team of ex-PR&E renegades (who know a bit about consoles). And Axia is a division of Telos, the DSP experts.

**Perfect timing** • You can't have too much time. That's why Element's control display contains **four different chronometers**: a digital time-of-day readout that you can slave to an NTP (Network Time Protocol) server, an elapsed-time event timer, an adjustable count-down timer... and there's also that big, honkin' analog clock in the center of the screen (Big Ben chimes not included).

**Screen play** • Use any display screen you choose, to suit your space and décor. Get a space-saving 12" LCD, or go for a big 21" monster. (This is Dave Ramsey's favorite Element feature, by the way. Anyone want to bet he bought his monitors on sale?)

**Lovely Rita** • LED program meters? How 1990's. SVGA display has lots of room for timers, meters, annunciators and more — enough to show meters for all four main buses at once. Reboot to 5.1 surround mode and the light show is even cooler, with surround audio and associated stereo mixes all going at once.

**Memory enhancer** • We know how forgetful jocks can be. That's why Element remembers their favorite settings for them. Element's Show Profiles are like a "snapshot" that saves sources, voice processing settings, monitor assignments and more for **instant recall**. Profiles are easy to make, too: just have talent set up the board the way they like it, then capture their preferences with a single click for later use. (Hey, make *them* do some work for a change.)

**Black velvet** • Some things **just feel right**. Like our premium, silky-smooth conductive plastic faders and aircraft quality switches. We build Element consoles with the most durable, reliable components in the industry — then we add special touches, like custom-molded plastic bezels that protect on/off switches from accidental activation and impact. Because we know how rough jocks can be on equipment. And nothing's more embarrassing than a sudden case of *broadcastus interruptus*.

**Split decision** • No, you're not seeing double: Element gives you the choice of single-frame or split-frame configurations of **up to 40 faders.** Perfect for complicated talk or morning shows where the producer wants his own mini-mixer, or to give talent space for copy, newspapers and such. Solomon would be proud.

**Swap meet** • Element modules hot-swap easily. In fact, the **entire console** hot-swaps — unplug it and audio keeps going; an external Studio Engine does all the mixing.

**Stage hook** • This button activates the emergency ejector seat. OK, not really. It's the Record Mode key; when you press it, Element is instantly ready to record off-air phone bits, interviews with guest callers, or remote talent drop-ins. One button press starts your record device, configures an off-air mix-minus and sends a split feed (host on one side, guest on the other) to the record bus. Like nearly everything about Element, Record Mode is **completely configurable** — its behavior can even be customized for individual jocks. Sweeeet.

**How many?** •
How many engineers does it take to change these light bulbs? None... they're LEDs.

**Talk to me** • Need some one-on-one time with your talent? Talk to studio guests, remote talent, phone callers — **talk back to anyone** just by pushing a button.

**Missing features** • Did we forget something? Program these **custom button panels** with any macro you want, from recorder start/stop to one touch activation of complex routing and scene changes using PathfinderPC™ software. You could probably even program one to start the coffee machine (black, no sugar, thanks).

**Great Phones** • With Element, jocks never have to take their eyes or hands off the board to use the phones. Element works with any phone system, but really clicks with the Telos Series 2101, TWOx12, and new NX-12 that connects four hybrids plus control with a **single Ethernet cable.** Status Symbols™ (cool little information icons) tell talent at a glance whether a line is in use, busy, pre-screened, locked on air, etc. Even dial out with the built-in keypad.

**The Busy Box for jocks** • Element comes standard with a lot of cool production room goodies you'd pay extra for with other consoles: like per-fader EQ, aux sends and returns and custom voice processing by Omnia™ enabling you to quickly build and capture compression, noise gating and de-essing combinations for **each and every jock** that load automatically when they recall their personal Show Profiles. Context-sensitive SoftKnobs let production gurus easily tweak these settings, while simultaneously satisfying their tactile fixations. (Don't worry, for on-air use, you can turn off access to all that EQ stuff.)

**Mix-plus** • If constructing a complicated mix-minus on the fly brings a big grin to your face, you're excused. But if you're like us, you'll love the fact that Element does mix-minus **automagically**. Forget using all your buses for a four-person call-in, or scrambling to set up last-minute interviews. When you put remote codecs or phone calls on air, Element figures out who should hear what and gives it to 'em — as many custom mix-minuses as you have faders.

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Element

# First Person

by Marvin Collins, W6OQI

– Continued from Page 32 –

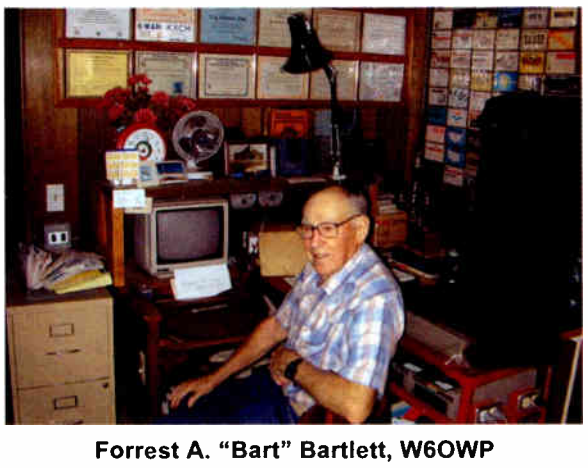
**Marvin Collins, W6OQI with his "glass Teletype" in the year 2006. It is interesting to see what fifty years will do to a person.**

## PIONEERING WORK

During the course of our conversations I learned that Bart was a real pioneer in ham radio RTTY. When Bart started on ham RTTY in 1952, FSK (frequency shift keying) was not yet permitted. RTTY was sent using Make and Break (MAB) keying until FSK was made legal by the FCC on February 20, 1953.

Bart's interest in CW caused him to develop an automatic CW keyer. He applied for a patent in the early 1940's but a patent was not granted until March 9, 1948. (The patent number for his automatic CW keyer is 2,437,497.)

When I started writing about our 50-year-plus conversations via ham radio RTTY, it was my intention to have Bart write part of this story, but it was not to be. I did not know Bart was going to become a silent key before I finished. Fortunately, the messages I received from him over the years were enough that we could indeed read portions of his story in his own words.



**Forrest A. "Bart" Bartlett, W6OWP**
**March 25, 1914 - July 3, 2006.**

I was deeply saddened to learn that Bart became a silent key on the evening of July 3, 2006. Bart was 92 years old. There is going to be a large void in my Tuesday evenings from now on. 73 Bart.

*Working in and watching the Los Angeles broadcast industry for over fifty years, Marvin Collins (W6OQI) can be reached at KFIam640@aol.com*

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# Transmitter Shack

by Don Mussell

## Be Prepared for Earthquakes

It was busy early that morning; I was checking e-mail and preparing to head out for the day. We were going to be installing a new STL link up on Mauna Loa on the Big Island of Hawaii.

Then I heard a few rattles in the walls of my room and felt my chair start to move. Ah, an earthquake.

### GREAT SHAKES

OK, I have been through these before, being a native Californian. But whoa, "this is a Big One!" I thought to myself. I was hanging onto the desk, trying to stay in my chair, wondering when it would stop and if everything around me was going to fall. It got stronger and stronger, and seemed to last for nearly thirty seconds.

Then it suddenly stopped. All was quiet again. I checked the radio – and my radio station was still up and running. Cool, I thought.

Most of us think we do not have to worry about earthquakes. Floods, fires, lightning – those are the things that are most likely what you think about when planning for disaster (you do plan, right?). Surprisingly, many of us who take care of broadcast facilities should be concerned about earthquakes.

Besides the West Coast and Mountain West of the continental US, the state of Alaska, portions of Hawaii, a big part of the Midwest, Southeast Coast and the Upper Northeast are all vulnerable to a fairly major earthquake in the future.


**USGS map of earthquake potential.**

### EARTHQUAKE PLANNING

What can you do to plan? To start: if you have equipment simply stacked up on top of other equipment in a permanent installation, put it in racks and tie it down.

A simple cross-brace made of uni-strut, tied to the walls or ceiling, really solidifies your installation. Out here on the west coast, it is standard procedure to install floor bolts or angle brackets to the bottom of transmitters, combiners and racks. Otherwise, they may walk out the door (literally) during the next major shaker.

Feed lines should be attached to solid surfaces and cable chases. And, please, do not place heavy, portable objects up high in an unsecured manner. It also is a good idea to store chemicals and other volatile liquids down low *and* in a protected case or shelf.

It also would be wise to see how well the transmitter (and the studio for that matter) buildings are constructed overall. If you are living with un-reinforced masonry or cinderblock that has no internal steel, you may well be vulnerable to damage.

### DANCING GENERATORS

So you assume that the nice 4,000 pound 70 kW generator you have outside will stay put during an earthquake? It might be time to re-think that assumption. The ground moves faster than that big weight can, and it will slide back and forth, breaking electrical connections and possibly fuel lines.

If you have an external fuel supply, you have to assume that it will move as well. Tie it down. Most fuel tanks have provisions for just this kind of thing. Size the hardware so it will not break during high stress movements. Most steel hardware has ratings for stress and breaking moments.

Finally, after all the equipment is in place, mark your exit routes; try to plan the pathways so nothing big falling over will be able to block your escape.

Oh – my radio site in Hilo? I had just finished a retrofit of the site and installed earthquake bracing a month before the Big One hit. Timing is everything – is it not? Be prepared, even if you think it is just a remote possibility.

*Don Mussell has been doing broadcast engineering since 1968. Based in Bonny Doon, CA, Don can be reached at dmsml@well.com, or via his web site: www.well.com/user.dmsml*

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## A Non-Comm View

## Public Radio's Content Depot: Ready for Prime Time?

by John Hingsbergen

*Content Depot is about to bring about a major change in program distribution among Public Radio member stations. What is Content Depot and how will it change your life? John Hingsbergen explains.*

Public Radio's long-awaited Content Depot continues to meet delays in its rollout. The new satellite system has been in development and testing for a number of years with an original goal of coming on-line in 2005.

The system, intended to replace the legacy Public Radio Satellite System (PRSS), moved from the testing phase to "dual mode operations" on November 1, 2006. NPR Distribution had hopes of ending the transition phase as early as the end of January but extended the planned date, first to the end of February and most recently to the end of April, 2007.

### EXTENDED TESTING

In a December 21st notice to stations, Peter J. Loewenstein, Vice President of the Distribution Division at NPR said, "We need more time to solve the various operational issues and for users to gain experience and comfort with using the system successfully."

Lowenstein told ***Radio Guide*** that the target date was never intended as a definite cutover. He is quick to point out, "We're not going to turn the old system off until we know that the new system can stand on its own and give us the kind of reliable service that we all need."

The November 1st system start-up opened the Content Depot's web portal to over 400 stations following a one month "beta test" in October. However, as early as six weeks into the originally-planned 90-day transition, skeptics such as Vermont Public Radio's Rich Parker remained uncertain about the advisability of a cutover. Some posters on tech-oriented e-mail lists were continuing to refer to the current mode as an ongoing "beta test."

### MAJOR HARDWARE CHANGE

Officials at NPR Distribution had been preparing for the rollout of Content Depot for the last number of years.

Among the steps was the Earth Terminal Refurbishment Project, in which many stations received new satellite dishes and associated electronics. All of these new dishes are moveable, for relatively easy relocation in case of another "situation" such as the 1998 loss of Galaxy IV. The new systems were also required to provide L-Band outputs to feed the new satellite receivers.

The previous Public Radio Satellite Operating Support System, activated in the 1990's, was innovative for its day – a single-carrier-per-channel (SCPC) network with control software built on the Microsoft/IBM OS-2 operating system. The SOSS allowed stations to set up templates of programming received as real-time audio to be routed to air or recorded for later broadcast.


**A satellite receiver installation for Content Depot.**

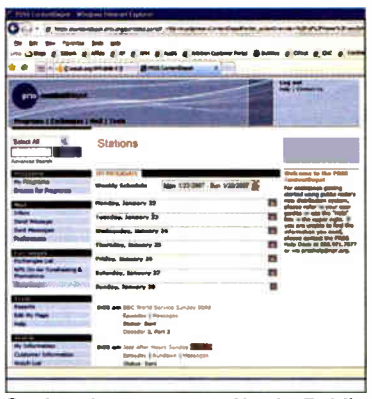
With the SOSS system, one-way program data contained an eight-day "System View" of available programs plus messaging. The SOSS also included time sync and the ability to send commands to outboard recording devices.

### SATELLITE DELIVERED USING IP

Station installation of the Content Depot includes streaming decoders and file storage receivers.

Content Depot is an Internet Protocol (IP)-based system providing both real-time and store-and-forward audio in the form of MP2 files. The unit at the top of the picture to the left is the International Datacasting SFX2100 file receiver. The SR2000pro units provide two audio streams each for real-time audio delivery. Stations select their programming through an Internet web interface.

Messaging, including episode information, rundowns and promotional materials can then be integrated into each station's home page. Station administrators are able to grant users their own level of access to the Depot, ranging from the ability to subscribe to merely viewing program information.




**Stations interconnected by the Public Radio Satellite System make Content Depot programming selections through a web-based "portal."**

Other features include direct usage feedback to producers and more accurate billing. In addition, producers can add file-based programs in non-real-time, doing away with the need for expensive ISDN circuits or satellite uploads.

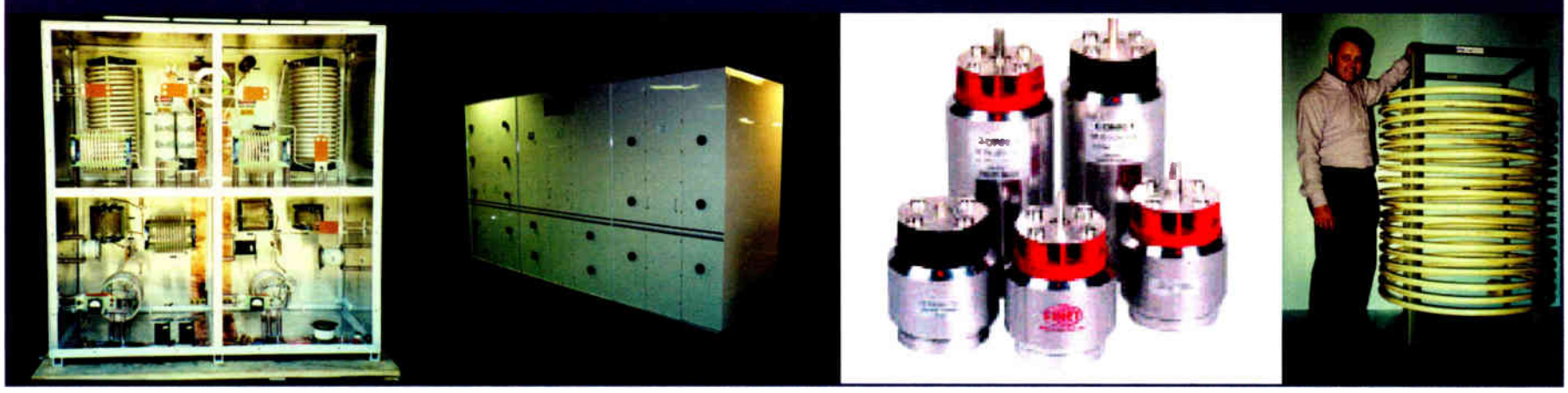
The system includes built-in cueing for four discreet commands to indicate, "start," "stop," and internal program breaks in live streamed programs.

### TESTING THE SYSTEM

One station engineer has said he "couldn't be happier with how all this is working." John Holt is Director of

*(Continued on Page 40)*





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# Radio.edu

*Continued from Page 48*

Engineering and Operations at WAMU at American University in Washington, one of two major public radio stations serving the Nation's Capitol.

In December, while others were expressing concerns, Holt commended the system in a post to the PUBTECH e-mail list. Holt explained to ***Radio Guide*** that his DAVID automation system is receiving episodes of *Car Talk, Wait, Wait Don't Tell Me, This American Life* and other programs reliably and with minimal operator intervention.

Holt admits that his board operators do find it necessary to cut up and perform other minimal tasks on some of the audio files. However, he is willing to accept this as part of routine operations.

## SMOOTHING THE SYSTEM OPERATION

Comparing the system to a three-legged stool, Loewenstein says there are three "metrics" that must be met to complete the Content Depot transition, "Program producers must have learned how to adapt content to the new formats and procedures used in the system; all stations must have gained experience with the system in their local operations; and the system itself must be stable, consistently reliable, and otherwise performing acceptably."

At WMUB, a service of Miami University in Oxford, Ohio, our experience has been consistent with what many others are reporting. We were among a group of a dozen stations that served as "beta test" sites, getting access to the Content Depot's file delivery and live streams a month earlier than hundreds of others.

By November, Chief Engineer Jim Keen had successfully routed the new audio streams to our Logitek audio engines and to two station consoles. He configured BE's Content Depot Import program for delivery of audio from the new system's file storage receivers into the station Audio Vault. Both delivery systems have performed essentially as promised.

## GROWING PAINS

Vermont Public Radio's Parker is Director of Engineering for a six-station, two-service statewide network. His facility was among the first to test the basic functionality of the Content Depot in 2005 and he was pleased with the possibilities of what he saw.

Nevertheless, after nearly two months of "dual mode" operation, Parker has been outspoken in his concerns about the system upon which his station and its 160,000 listeners rely. His primary concern has been with the file-delivery system although the live streaming has not been without problems.

Among those problems have been a number of "portal outages" that left receivers without programming when the system was unable to execute tuning commands. Parker and other station-based engineers say problems of this type are the reason for a concern about the way the live streaming decoders are programmed, requiring intervention from the Network Operations Center once a program is in progress.

## STANDARDS IN TRANSITION

Parker's issues with the file delivery system are what he describes as a need for "sanity checking" to assure consistency in the naming conventions of programs and program segments. As a Public Radio veteran, he recalls earlier times when the distribution folks would insist on quality and consistency.

Parker says, in the new system "There has to be a set of standards that are well understood, that are consistent, and that are enforced." He blames the file ingestion problems on, "a combination of producer metadata tagging, automation vendor choices and a lack of an enforcement quality control arm at the PRSS."

NPR Distribution's Loewenstein agrees that a "sanity check" is essential as well as the creation and enforcement of standards. Yet he says, "We don't have a monolithic system here. It's not like one person at one place sets this up and everybody toes the line.

"We're trying, as we have been for all these years, to find the right place to create standards and the right place to monitor standards and quality assurance."

## A WORK IN PROGRESS

We have experienced problems at WMUB that are similar to those identified by Vermont's Parker, namely consistency of file names, program segmentation and metadata such as start and kill dates. We have held back from cutting over to the Depot's streams for live programming on our main channel but we have used the new system for providing the BBC World Service to our HD-3 channel.

**WMUB Operations Coordinator Ben James examines the station's Content Depot receivers.**

WMUB Operations Coordinator Ben James has been very happy with the delivery of seven weekly episodes of Garrison Keillor's *Writers' Almanac* as well as the advance segments of *Car Talk* and the *Tavis Smiley Show*. He has been using the Content Depot-delivered versions of these programs since December.

With our colleagues we have been baffled by the inconsistency in the naming of promos and the illogical kill dates on NPR program credits. Despite the delays and drawbacks, we join many other users of the Public Radio Satellite System in practicing patience, knowing we will eventually enjoy all the benefits of what promises to be one of the world's most advanced and complex audio delivery networks.

*During his nearly 40 year career John Hingsbergen has been a DJ, a program host, News Director and producer. Since 2000 he has been Program Director at WMUB-FM at Miami University in Oxford, Ohio. Contact him at: hings@fuse.net*

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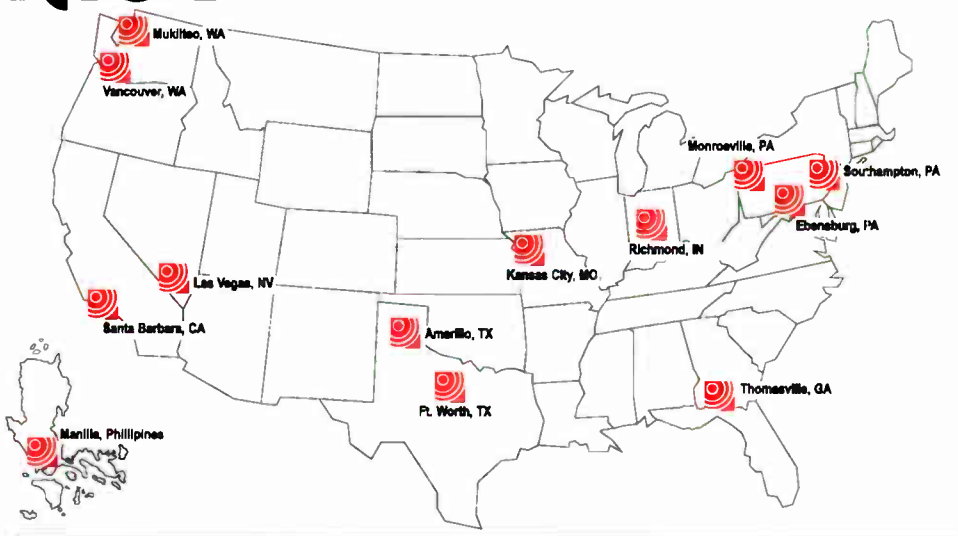


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# Gear Guide

Automation • Logging

Digital Audio • Delay

## February-2007 Buyers Guide

## Axia

### IP-Audio Driver

www.axiaaudio.com • 216-241-7225

Axia Audio points to the Axia IP-Audio Driver as a sophisticated solution to computer sound card hassles. "As you already know, Axia uses the Livewire protocol to transport high-priority, real-time, low-latency audio over Ethernet. The Axia IP-Audio Driver lets any Windows PC feed audio to and record from the Axia network without the need for an expensive broadcast-quality sound card," said Clark Novak of Axia Audio. "Instead, the Driver software is loaded onto a PC, and its audio (from automation software, Audition, wave editors, etc.) is routed to the network through the PC's NIC (Network Interface Card). No soundcards are involved, and no D-to-A conversions."

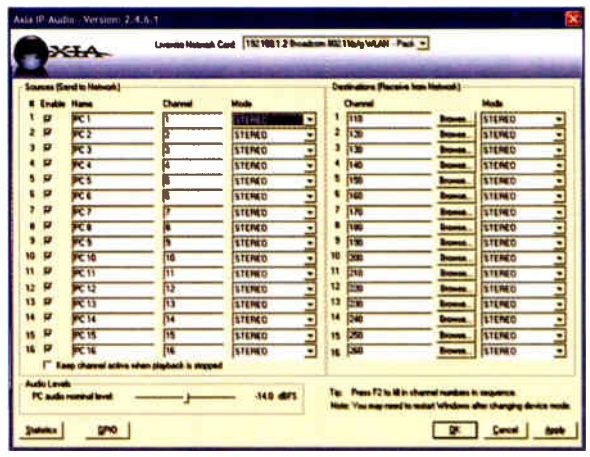
There are two "flavors" of the Driver. One is a single-I/O version (one stereo play stream, one stereo record stream) meant for use on editing workstations. This version is sold through Axia dealers.

The 2nd flavor of the Driver is the Multi-I/O version. This one has 16 stereo play channels and 16 stereo records. It is meant for use with audio delivery systems like ENCO, Prophet, AudioVAULT, etc. and is not sold by Axia dealers, but as OEM software through Axia's delivery system partners (a complete list may be found on-line at www.AxiaAudio.com/partners/).

PC noise, inconvenient output connectors, poor headroom, and other gremlins compromise even the best sound cards. With Axia, you eliminate sound cards by connecting your PC directly to the Axia audio network using ordinary Ethernet ports. Your PC audio stays pristine, and not only do you eliminate the expense of sound cards, but also the audio inputs (router or console) normally fed by the sound cards. For highly computerized environments, the cost savings can be significant.

Using the Axia IP-Audio Driver driver, your PC becomes an Axia "node" and its Ethernet port connects directly to the Livewire network, and the Axia driver handles all the necessary audio conversions. The PC can then send its audio to any network destination, and can record or audition any other network source as well.

"Clients have been reminding us that fewer new PCs include the PCI slots necessary to host sound cards," said Axia VP Marty Sacks. "Our clients also tell about the substantial amounts of money saved by not having to buy



**Axia IP-Audio Screen**

sound cards. Additionally there is the savings realized by eliminating the cost of a router switcher port (or console input module)." If you need to send audio outside the network, i.e., convert it to analog audio, simply send the stream to the outputs of an Axia Audio Node, which supplies pro-grade, rack-mount audio I/O with outputs capable of +24dBm.

## BSI

### Simian Automation

www.bsiusa.com • 888-274-8721

For some of the world's largest and smallest broadcasters the process of a move to BSI's Simian radio playout and automation software starts with a simple download of the full-version from BSI's website.

Prominent components of the interface are three main players with intuitive controls and indicators. These will play Linear PCM, .wav, ADPCM, MP3 and TMC audio files. Simian also supports MPEG Layer 2 and Content Depot media. A compatible audio card or a low-cost audio codec available from the company is required.

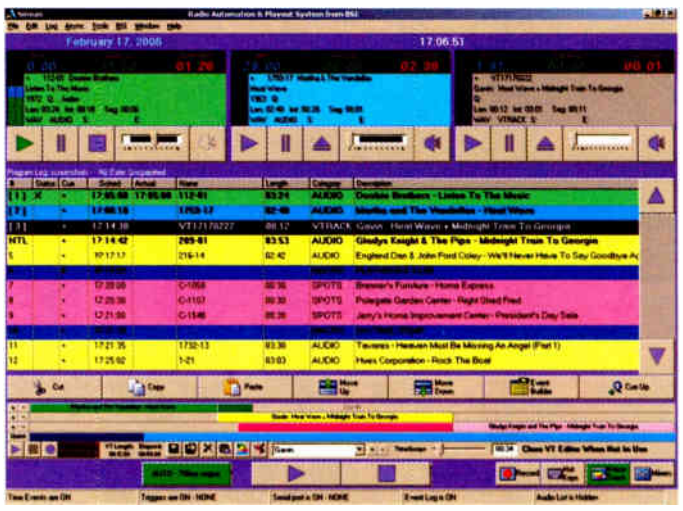
Simian supports Content Depot by means of its automatically updated dynamic database. "The 'SoundHound' utility monitors folders and adds new content to the audio database preventing the common headache of a scrambled database or the need for frequent file backups," explained Chris Kehoe of BSI.

Below the players is the Program Log. Here virtually any music or traffic schedule can be imported. There is additionally a third import module which can be configured to import a Windows Notepad or Microsoft Excel file for those last minute log additions or station promos. Multiple imported logs are merged and sorted into chronological order ensuring that spot breaks are in the proper location.

While the log is playing, Simian will create a dynamic web page. It is easy to configure the page to dynamically provide artist and track information or act as an e-commerce gateway. Simian can liven up an otherwise static web site. The data can also be fed to RDS / RBDS / PAD generators.

The bottom portion of the screen is dedicated to extra features that are often needed. In addition to a HotKey palette played through a fourth invisible player, there are two background recorders that can automatically trim silence from the front and back of the files. The user will find a Voice-Track editor able to automatically position the tracks and ramp a duck during playback.

For stations fed by satellite networks, Simian supports 16 external inputs any of which can be potted up or down from within the program. This makes running local spot breaks and adding magic call idents a simple process across multiple satellite network feeds. If your local breaks are not running exactly to time, Simian is



**BSI Simian Screen**

able to adjust them dynamically with the in-built Time Stretch & Squeeze. No more coming back from breaks a second or so early!

To learn Simian, BSI recommends their training programs, boot camps, remote login support, and user forum. The user forum also serves as a tech support resource with a 60-minute maximum response time for customers.

## Henry

### USB Matchbox

www.henryeng.com • 626-355-3656

The USB Matchbox is a professional USB-to-XLR bi-directional stereo audio codec. It provides ease of USB connectivity in any application where digital audio from a computer needs to interface with a professional analog audio system. The USB Matchbox is USB powered, and solves the myriad of problems caused by using common sound cards in broadcast and professional audio environments.

"It eliminates the hum and buzz caused by unbalanced grounding, and it operates at levels that are compatible with the rest of the studio. We recently added THAT Corp. InGenius™ ICs to the balanced inputs, which yields exceptional CMRR performance even if the source is asymmetrical. The USB Matchbox complies with the new "AES-48" grounding standard, making it an ideal choice in high RF environments," said Hank Landsberg of Henry Engineering.

Adding to the problem of using conventional computer sound cards, the inputs and outputs are often at the wrong levels. The unbalanced interface creates ground loops that cause hum and buzz. The "EMI hurricane" within the PC case creates even more noise, and the sound card audio quality is usually sub-par, (despite exaggerated claims) with pedestrian design and poor component quality.

The USB Matchbox provides the quality that professional users require. Its dual-PLL asynchronous design permits simultaneous record and playback. Front panel controls allow precise adjustment of input Level and L/R Balance trim. Output levels are calibrated with recessed trimmers. Rear panel connections include XLRs for balanced analog I/O, Auxiliary unbalanced line inputs, and outputs for amplified speakers. The speaker output can be muted with an external contact closure via the Mute jack. The steel chassis provides effective RF shielding. All ICs that connect to the "outside world" are mounted in sockets.

The heart of the USB Matchbox is Burr Brown's Delta Sigma 8X Oversampled codec. The codec's performance is further enhanced with Henry Engineering's proprietary L/C pre-filtering and edge-of-the-art analog circuitry pains-


**USB Matchbox**

takingly designed by Bill Sacks, founder of Straight Wire Audio. This carefully tuned design eliminates the transient intermodulation products caused by inadequate reconstruction filters found in even high-end sound cards. Careful attention to component selection and circuit board layout yields smooth open and transparent "un-digital" audio with rock-solid bass and crystal-clear highs.

The unit's internal switch-mode power system virtually eliminates ground loops through the PC, and allows operation at professional levels with liberal headroom. The USB Matchbox will operate with virtually any audio editing, recording, or broadcast automation software at sample rates up to 48 kHz and up to 16-bit resolution.

# Gear Guide

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## February-2007 Buyers Guide

www.RadioGearGuide.com

# Pristine

### CDS Version 4.0

www.pristinesys.com • 800-795-7234

Pristine Systems announces CDS (Content Delivery System) version 4.0 pioneering the first of a new generation of broadcast automation systems incorporating elements of artificial intelligence in order to enhance a station's on-air product.

This new "Smart Promo" feature automatically produces professional sounding "coming up next" style promos. A sample recording may be found on the Pristine website at www.pristinesys.com/temp/promo.mp3

CDS Satellite Automation Systems incorporates extended features, comprehensive control, and over-built capacity to handle demanding satellite automation challenges while providing timely & smooth transitions for local spot insertions, news, sports, liners, and jingles. CDS supports all satellite formats, including PRSS Content Depot.

CDS is compatible with an array of third party music schedulers, traffic and billing systems, and multi-track digital editors. Additional compatibility is found with Audio Science's CobraNet and Axia's Livewire Ethernet audio. CDS also supports HD metadata for on-air and web-site presence, BlackBox digital audio logger and alert software, plus the new Informant audio monitor with electronic mail alerts.

Among the many features of CDS may be found:

- **One** button on the console switching between automation and manual modes.
- **RDS** Song Title & Artist generation.
- **Log** changes made in real time as necessary.
- **Music** log editing automatic recalculation of start times.
- **Simultaneous** play and record allowing for recording of phone calls, spots, satellite programs, and creating in-context "wet" voice tracks.
- **Quick** viewing and editing of the entire day's log or use of the Audition Tool for easy off air monitoring.
- **Automatic** live website content generation.
- **Production** workstation may be configured with your favorite editing software and serve as a standby on-air workstation.
- **Searcher** key to find quickly any audio-file by title, artist, or phrase.
- **Delivery** of song titles, artist names, photos, sponsor logos, etc. to the station's website in real time.


- **Link** adding for various sources of artist bios for your site to become more interactive for the visitor.
- **Use** of your favorite music scheduler or Pristine's Music Plus.
- **Playing** and recording in virtually any format including PCM, MP2, and MP3.
- **24-hour** clock sync to satellite or other known closures.
- **Color-coded** audio channel usage.
- **CDS** SAT configuration of a separate pot on the console for HotKeys.

# Prophet

### NexGen Digital 2006

www.prophetsys.com • 877-774-1047

Recently released, Prophet Systems' NexGen Digital 2006 is the latest version of Prophet's popular automation software. Every NexGen workstation can do the basics – things like manipulating station logs, adding and editing production, viewing overall system status, and even running any control room.

Emphasizing scalability, Prophet points to extra capabilities that may be added as needed.

The Audio Server is the heart of NexGen's playout system. It is responsible for playing out your log, keeping your station on time, and exporting title and artist data just to name a few important jobs. As NexGen is a fully networked system, an Audio Server can be controlled from anywhere on the network.

Capture satellite feeds or any other audio with NexGen's fully integrated DRR module. Twenty seconds after recording starts, the audio is available in the NexGen library for playback by any machine on-air – a feature that makes DRR perfect for time shifting.

With advanced features like fade up/down of audio, automatic ducking, and fully adjustable timelines, liners, breaks, and intros for an entire shift can be recorded – all without ever leaving the VoiceTRAC recorder.

"We continue to deliver the features users ask for, said Diana Stokey, Manager of Marketing. "We are dedicated to making NexGen Digital the choice people turn to for content management."

NexGen 2006 makes it easier to identify VoiceTRACs. Titles now include station, date, hour and even position within the hour. If stations have to do re-takes on VoiceTRACs, NexGen 2006 now lets users undo and redo them, making it easier to try out multiple takes.

NexGen 2006 offers better sounding and easier to produce podcasting content. Users will be able to burn podcasts straight to audio or data CD using the Podcast Wizard and Podcast XLR8R. Also, users will be able to pre-schedule podcasts to be automatically created and transmitted.

Any NexGen machine can do any job on the network without reconfiguration. If a machine fails for any reason, another machine takes on its role by simply changing an IP address in the database. All configuration data is stored in the database, so there's nothing unique about any single machine.

**NexGen Digital 2006**

"Enhancements that are coming this spring include Pooled Hot Sparing and the addition of Album Field, Text/Memo information tied to VoiceTRACs, Local viewer enhancements and the ability to hide drives on a per CPU basis," added Stokey.

From a MINIMAL stand alone Audio Server with the database/file server on the same computer to an ADVANCED networked configuration with no single point of failure, Prophet Systems' NexGen Digital 2006 will meet the needs of any broadcaster large or small.

# Vox Pro

### VoxPro PC Version 4

www.audionlabs.com • 206-842-5202

VoxPro PC, seen in many air studios and production rooms, has added features to its familiar easy to use interface. Already optimized for two-channel recording and rapid digital audio editing, "Version 4 introduces new functions including AGC on both or separate channels, plus noise reduction. Zoom, automatic networking, advanced effects, normalizing, post recording volume control, a robust RSS wizard to publish to the web, and file search by name have been added," said Charlie Brown of Audion Laboratories.

For those unfamiliar with VoxPro PC software, it is easy-to-learn and optimized for radio station control and production studios. It is sold with an optional hardware control panel and digitally records and edits voice, sound effects, and music clips on two tracks or one (mono). All popular file formats, including MP3, MP2, WAV, AIFF and WMA files can be imported and exported individually or in groups. Unlimited undo and redo, remote start, one-button insert record, and file sort are basic features.

Additional features include MARKERS. Pressing the "M" key on the computer keyboard leaves a marker in the timeline above the waveform window. At the same time a note window pops up where you type info regarding the point you are marking. This allows you later to easily find important points in the sound clip.

Press the ZOOM button on the VoxPro control panel or the "Q" key on your computer keyboard and you are zoomed in 100 times to accurately view difficult edit points. You can playback in the zoom mode or use the jog wheel to audibly scroll through a file while in zoom mode. Version 4.1 adds a headroom slider. This slider functions as a "vertical zoom", allowing very low level signals to be clearly seen and edited.

AGC is now part of the VoxPro package. In addition to the ability to expand the caller's channel you can compress or expand either the caller's channel or the talent's, or both. VoxPro's AGC, simply put, "boosts the timid and limits the loud."

Networking VoxPro workstations is now totally automatic. Put two or more computers running VoxPro on your station's LAN and they automatically find each other, swap information, and connect.


**VoxPro PC**

A new feature is a publication wizard that allows users to podcast recordings. It can be used to generate RSS files, compress audio to MP3 format and upload files to a web site.

"VoxPro has become the replacement of choice for high maintenance, all-in-one box editors and continues to win over air staffs who demand simplicity and speed," concluded Brown.

# Service Guide Radio Equipment Products and Services

# Service Guide Radio Equipment Products and Services

# First Look
# First Listen

## The Sangean HDT-1 Component Tuner

The release of new models of radio receivers, especially those that are designed to handle the IBOC digital signals, are always eagerly anticipated. With each introduction, engineers from all over acquire one and set about listening to the audio, assessing the ability of the receivers to "hear" the signal, and investigate the various "features" that are included.

Are the receivers "half full" or "half empty?" Some folks focus on features that seem important to them but are lacking in the radios. Others have applauded the efforts of the manufacturers to develop and bring to market a product for a service that has not, as yet, shown to have "critical mass" among listeners.

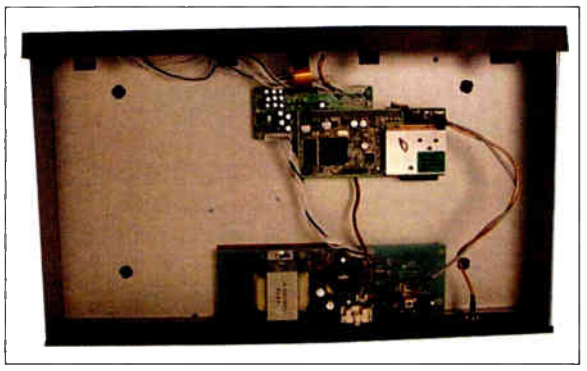
Late last year, the Sangean HDT-1 and HDR-1 radios made it into the consumer channel. The HDT-1 is a tuner, the HDR-1 is a tabletop radio with speakers.


**The Sangean HDT-1**

While not having every feature a broadcaster would desire, at a list price of about $200 (another $50 for the HDR-1), the Sangean seems to operate well, featuring good selectivity and sensitivity, at least on the FM side.

### PEEKING INSIDE

Since we are curious sorts, we just *had* to open the case to see what is inside. In the picture, we are looking inside the Sangean HDT-1 receiver. Designed to fit a standard rack mount opening, the view inside was a bit surprising.



**Inside the Sangean HDT-1 receiver.**

The PC cards inside the case include a power supply and amplifier card, a controller and display card, and the HD radio tuner. As with a number of manufacturers, the Sangean HDT-1 and HDR-1 are using a DSP module produced by LG Innotek, using the Texas Instruments chipset.

All together, the cards take up something like 10% or so of the space inside the case. But size is not the real measure of the product.

### MORE THAN MEETS THE EYE

Staring at these parts is interesting; you almost come away thinking "there must be more to this radio than that!" However, the cards are really one of the benefits of the large scale integration of microprocessors and parts – and the miniaturization that they foster. (Unfortunately, we still have not quite reached the point where portable radios are feasible.)

A very sensitive and selective FM tuner provides clean, crisp audio with full display of RDS and PAD streams on a screen that can be ready easily from across the room. Features include presets, direct frequency entry, and an infra-red (IR) control remote.

Golden ears might quibble about the audio, but when compared to what is being transmitted, the receiver does more than a credible job. Voices on AM sound a bit rougher than one might like, but again, that is no surprise.

### DIAGNOSTICS

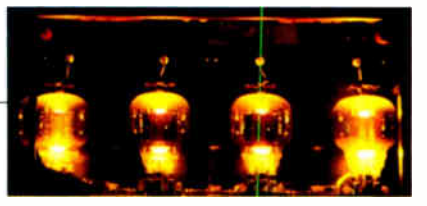
One of the things broadcasters want to know is what sort of diagnostics are built into the radio. The Sangean has several: a Signal Strength Indicator that can be used to adjust the antenna, a Carrier to Noise reading to ascertain the quality of the signal, an audio spectrum display to give you an idea of the decoded signal's spectrum.

The diagnostic screens also show a bit rate error number, the IP address of the digital exciter, and a couple of other informational screens.

Oddly though, this first iteration does not allow forcing the receiver to an analog or "split" (one side analog, one side digital) mode. That, a digital output, and faster display speeds are being considered for an HDT-2 model. Curiously, the HDT-1 has been reported to receive AM Stereo in locations where it is still operating.

In the months to come, more receivers will come to market and consumers will no doubt benefit from the improvements driven by the lessons learned from the performance of the first generation units. – *Radio Guide* –

# Final Stage



## RADIO ROUNDUP

### The Radio Guide Event Register

*Email your dates and info to:* ***radio@rconnect.com***

**2007 Annual AM Transmission Seminar**
February 14-16, 2007
Orlando, Florida
www.radio-guide.com/amseminar.htm

**National Assoc. of Tower Erectors (NATE)**
February 12-15, 2007
Nashville, Tennessee
www.natehome.com

**National Religious Broadcasters NRB2007**
February 16-20, 2007
Orlando, Florida
www.nrb.org

**Great Lakes Broadcasting Conference & Expo**
March 13-14, 2007
Lansing, Michigan
www.michmab.com

**National Federation of Community Broadcasters**
April 11-14, 2007
New Orleans, Louisiana
www.nfcb.org

**NAB 2007**
April 14-19, 2007
Las Vegas, Nevada
www.nabshow.com

**OAB Annual Convention and Engineering Conf.**
March 16-17, 2007
Tulsa, Oklahoma
www.oabok.org

**SBE22 Broadcast & Technology Expo**
October 16-17, 2007
Verona, New York
www.www.sbe22expo.org

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|---|---|---|---|
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