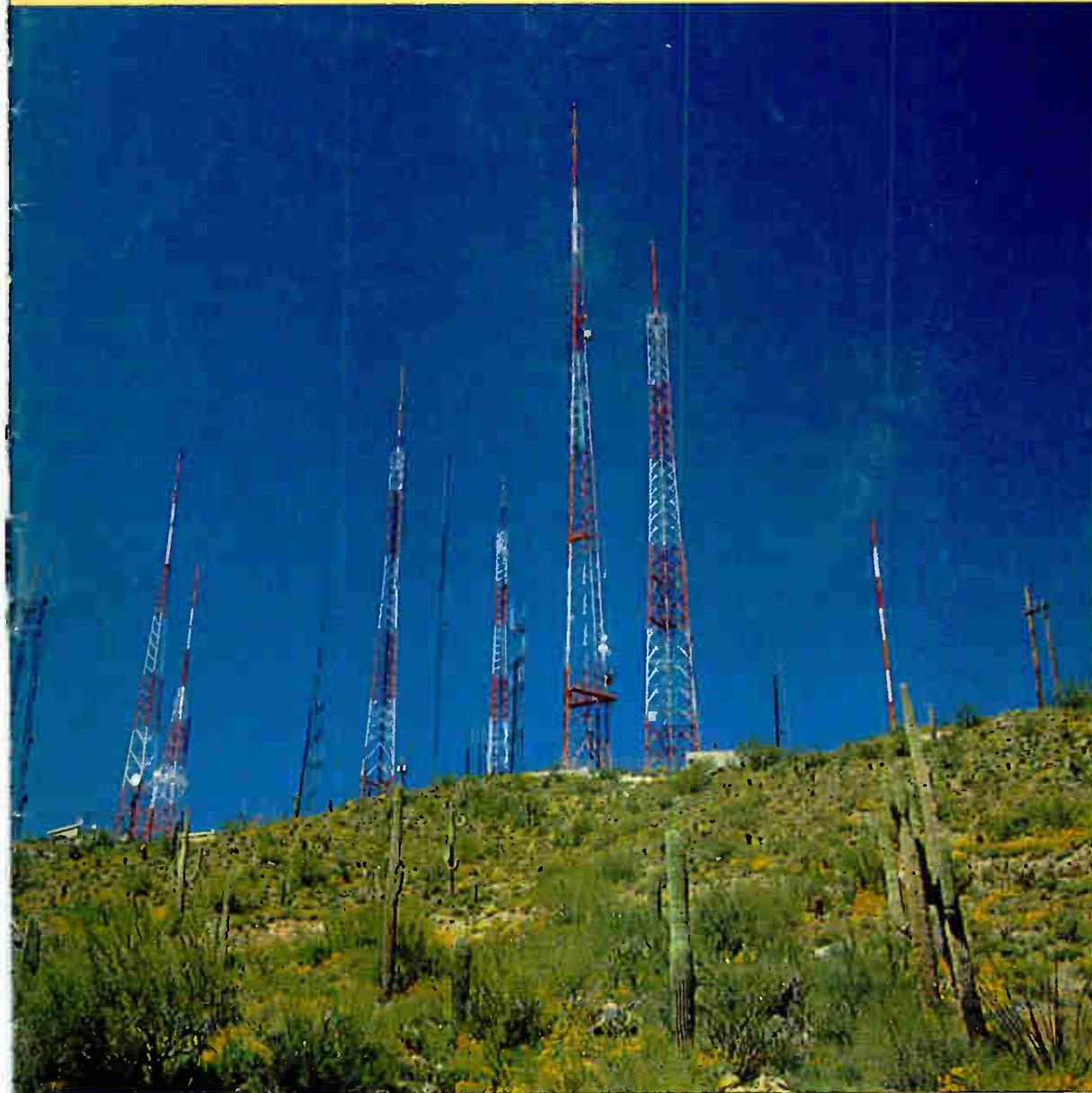


# Radio Guide

Radio's Technology Magazine

June 1992



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## Station Stories

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### South Mountain Transmitter Site

Photographs by  
Bill Ammons, CRL

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*Picky Picks and Post Mortem*

**Tips From the Field** – Pg. 17  
*Telco Tips, Tower Lights (more)*

**Equipment Reports** – Pg. 27  
*Audio Consoles*

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Reader Service #091

## Inside This Issue

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*With a brutal climate, rattlesnakes and intermod, South Mountain transmitter site is home to 14 Class C FMs.*

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Radio Guide Page 4

## Everyday Heroes

By Ray Topp, publisher



You've spent a few years doing what you do best, and everything is working smoothly. The old tube gear has been replaced, the transmitter plant has had a thorough tune-up, and the rat's nest in the studio racks (you inherited from your predecessor) has been replaced with neat punch blocks. You even took the time to label and document it all (well ... most of it).

The old auxiliary transmitter, after a new set of finals, a good tweaking and a well-placed kick, is ready for emergency, stand-by service. An old E.F Johnson relay (now you know why you've been saving them for 20 years) between the two AM transmitters and the tower, a home-brew interface with the remote control ... and you may actually be able to relax.

Everything's great until the tower takes a lightning hit on Friday night. The ATU is history, the telco box has blown off the side of the building, and the pole pig is dead.

You go out to the site, fire up the standby generator and rig up the Marti for an emergency audio feed. But what about the ATU? You know that the old auxiliary transmitter can work into just about any load it sees, so using a combination of jumpers and odd-sized capacitors for a VSWR of something less than infinite, ... you're on the air! Your coverage isn't great but at least the metro area can hear you.

Hey, you're a hero ... right? You're feeling pretty smug as you walk into the station on Monday morning. That is until the GM asks you why you didn't get the station back on the air sooner, the PD asks you why he couldn't hear the station 30 miles out of town, and the sales manager won-

ders why you had to "steal" the Marti that they were going to use for the remote on Saturday morning!?!?

You're ready to let them have it, but instead you just smile. This is radio ... and you love it!

### Reader Service Cards

By now you've probably noticed the colored Reader Service Card reply card. Each month you will find this dual-purpose reply card inserted between the pages of your **Radio Guide**.

If your copy of **Radio Guide** is reaching you at the appropriate address, then you needn't do anything. We'll keep sending your copy of the Guide to you at that address as long as you like, so you don't need to keep sending a new card in every month just to stay on the mailing list. Of course if you do change your address or station affiliation (or are just tired reading a second-hand copy of the Guide), then fill out the card with new or updated information and mail it back to us. We'll make the changes right away.

The Reader Service Card is also there to provide you with a way to obtain additional information from manufactures and suppliers. Every ad and every Equipment Report in **Radio Guide** has been given a Reader Service number. If you'd like more information from a particular advertiser or more facts regarding a piece of gear found in our Equipment Report section, then just circle the proper numbers on the card.

**Note:** Our *Equipment Guide Fax service is in full swing. Poly-bagged with this month's issue is a menu of options for the Equipment Guide. Keep it available for easy reference.* R.T.

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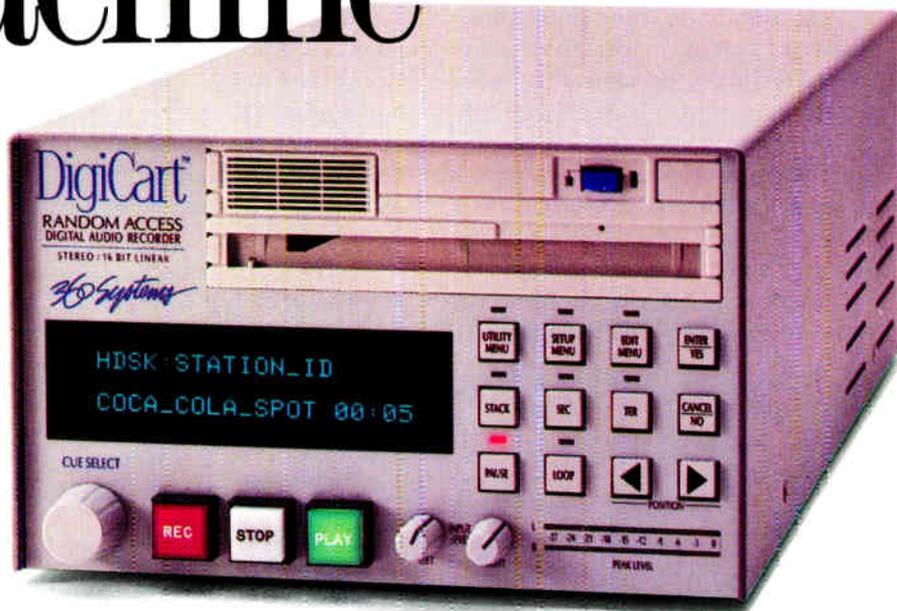
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**Reader Service #093**



# Picky Picks and Post Mortem Peculiarities

by Judith Gross

Is it me, or do these **trade shows** just keep getting longer and longer? We have the **pre-preview**, the predictions, the preview, the early reports, the late reports, the **full reports**, the **post-mortem** (like any dead patient deserves) and finally, the loose strings, followed by the **next show's** pre-previews and so on until nausea.

By now you know all about the **must-sees** and the **can't live withouts**.



High-tech wedding, Vegas-style

We have a **product highlight wrap** (or maybe "rap") for you, this issue. I won't drone on with a "**best of**" or even a "**rest of**" here. But here's my own **Particularly Picky Picks** of the one essential product which debuted in each of a unique set of categories.

For **Best Cost Cutter**: The CD recording system from **Harris Allied** which slashed the price of a CD recorder in half.

For **Biggest** (scope-wise, not necessarily in size): The **Pioneer** CD changing system which handles 300 CDs or can be strung together for access to 9600 CDs. Can almost handle my own CD collection.

**Most Elegant**: The **Wheatstone** A-6000 console, call it the Caddy of Consoles, or BSW or Mercedes Benz.

**Least Expensive Toy**: The Card, from **Digital Audio Arts** shown at the **BSW** booth. Full fidelity audio editing on your own PC.

**Most Ambitious Marriage of New & Existing Technology**: **Pacific Recorders' ADX**, a digital workstation and automated console mixstation.

**Best of Two Good Ideas in One**: **Broadcast Electronics' new line of solid state AM transmitters with AM stereo built in.**

**Most Convenient Device to Handle Irritating Jobs**: **ITC's Digital Audio Repeater.**

**Best Resurrection From The Dead**: **AM stereo, in AMAX radios, at the Motorola booth and in Japanese daily life.**

And finally, **Most Unusual Concept**: **QEI's liquid-cooled solid state FM transmitter. Is it true that the propylene glycol used in the cooling system is edible, or rather, drinkable? Well I don't want**

to find out first-hand, but if you find any **happy rodents** at your transmitter site you'll know why.

OK, so much for that. If you think I left anything out of the **Particular Picks**, fax me your pick, with a **product category** of your choice, and I'll mention it down the road.

The **bride** wore white, the **groom** boasted of feedback suppression and full duplex capability and the ceremony was held, complete with **sushi and champagne**, at a sufficiently tacky, neon-bedecked **Vegas wedding chapel.**

It was **Telos' way** of announcing the **100 Delta hybrid**, by "marrying" the new product – the "groom" – to a telephone – the "bride."

A lovely trill of liting acceptance from the bride, and with her "**ring**" the two were joined together "in long distance and local calls, **call-in segments** and morning zoos."

**Ma Bell** was seen to shed a tear, and of course, the bride was a **little wired** while the groom became adamant at the rumor he had a **screw loose**. But the sushi was tasty.

And speaking of **Telos**, multi-city success **Howard Stern** was doing just that, or rather yelling for one the other day on the air. Somebody, please, give that boy **his Telos hybrid** and calm him down, for heaven sakes. How else are we going to hear those **graphic confessions** from his all too eager soft-porn callers?

Oh yes. Glad to see this year's **NAB Engineering Conference** kicked off with a jump start from, Mr. Compression himself: **Larry Hinderks**, from **Corporate Computer Systems**. Dr. Larry was in rare form, with some new jokes, yes! All about how we're in an advanced stage of **analog audio**: "We've distorted it as much as we can,



Hardware sales dance ...

now let's see how much damage we can do **digitally.**"

But I always learn something new from your talks, Lar. This time it was that those **iridescent chartreuse lines** on your slides clash mightily with those **hot magenta graph grids.**

## JG's Earwaves

Just one footnote on **DAB** at the show. After wowing most visitors with a chip that successfully extracted a **digital signal** from FM, **USA Digital** engineers had to face one of the skeptics who had said, "It couldn't be done." He was practically dragged **kicking and screaming** over to have a look-see too. His reaction? "Well, I never said you couldn't **extract** the signal. I just don't think you can do **AM**."

It's always **something**. First it's "You can't extract a **digital signal**." Then it's "Yeah, but you won't solve **multipath**." Next it's "Yeah, but you can't do **AM**." Before you know it, it'll be, "Yeah, but it can't do **windows**." Never satisfied.

Kudos to **Bob Hammet** and **Ed Edison** who won the **Radio Engineering Achievement Award**. It was at the Engineering Luncheon and I, as much as anyone else, was grateful that **Panasonic** decided to shell out to sponsor the luncheon.

But, frankly, I could have done without that **20 minute commercial** for their products at ear-splitting volume while we were eating.

A high point of the luncheon, indeed, the convention itself, just had to be **Tom Lewis'** speech, "On the Shoulders of Giants."

Tom, who you will remember wrote "**Empire of the Air**," that terrific book on de Forest, Armstrong and Sarnoff, admitted that before researching the **three radio pioneers**, he was ignorant of their contributions.

But he also said he was amazed that those of us right here in the **radio business** are sometimes just as **ignorant**. "Sadly," he said, "there are those who live in a world of **organized amnesia** ... who don't **want** to know." Amen to that, Tommy my friend, on **many** different fronts.

Tom urged broadcasters to **preserve their heritage** by uncovering and treasuring the archives of their past, including the **memoirs** and **notes** of past **radio greats**. Good suggestion, Tom. My scribbles are being **hermetically sealed** even as you read this.

Oh yes, and **post-show**, I had a real blast in my adopted state of **Arizona**. The occasion was a **CRL dealer meeting** and western hoedown in the Phoenix-Tempe area, where the cactus aren't shy and the shenanigans are as plentiful as the **gila monsters**.

Best of all was the moment two **mean outlaws** fired six-guns and kidnapped two from the party, including **Northeast Broadcast's Bill Bingham**. Later on, the two were told to "Dance, pardner" to the sound of gunfire, until the local sheriff came and put a damper on the violence.

So exactly **what dance** was that, Bill – the fox-trot or the **Tempe two-step**? And with that I think I'll just **waltz** outta here myself for the time being. Music, maestro...

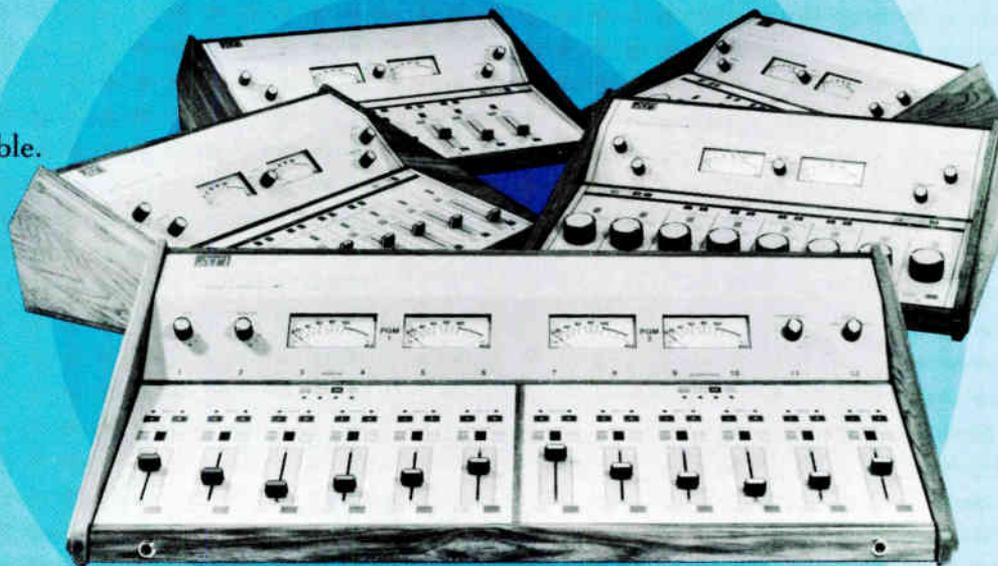
*Something wacky going on in your neck of the woods? Let's gossip together. Call 703-370-7943; fax 703-212-0838 or MCI mail me at #507-3038. Or write 511 18th St. SE, Rochester, MN 55904. I'm scouting for some nifty doo-dads for you to covet so keep 'em comin'.*

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# EBS Action, New RFR Guidelines and SBE Directorship Changes

By Judith Gross

## Tough Questions on EBS Still Loom

It's anybody's guess what will happen with the FCC EBS Advisory Group. The committee is scheduled to terminate as of July 25. But a working group has been tasked with developing a new set of technical standards.

The FCC has completed its Notice of Inquiry on EBS, fielding comments to a complete revamp of the system. But there are too many conflicting proposals to make it a clear cut outcome.

Some broadcasters maintain that there's no need for an overhaul of the system at all. But new technology and the input of several regional groups which have come up with their own alerting systems contradict that stand.

Among the proposals is one to use the RDS system as a new emergency warning technology. One of the chief benefits is the ability of the system to test itself off-air, with no need for those infamous tones to air during prime schedules. The RDS system has been used successfully in some localities as a private warning system in case of chemical spills.

Adding to the confusion is an earlier FCC docket suggesting a shorter tone for the on-air tests, from the 25 seconds it now runs to only eight seconds. The NAB has supported that proposal. It also has the support of TFT, which makes EBS gear.

"We did a small survey and found that 90% of the stations we talked to said they favor the shorter EBS tones," explained Darryl Parker of TFT.

Parker says the company has suggested that one way to lessen stations' dislike of the on-air tests would be to run the eight second test at the same time every week.

"If listeners got used to hearing the EBS test at the same time, they would certainly sit up and take notice if it were sounded during a different time in the case of an actual emergency," said Parker.

He acknowledged, however, that problems could arise if the actual emergency occurred at the same time the test was usually run. He also noted that stations would probably schedule the tests during times of low listening, perhaps overnight or weekend shifts, when the least experienced personnel were in charge.

"That could make it more difficult to know if the equipment were working properly or to give the regular employees the experience in dealing with the EBS system," he said.

In addition, the shorter tone docket is facing another snag. While the NAB supports it, the association has now suggested that the Commission wait and tie the short tone docket to the question of a complete system revamp, which were originally separate items before the Commission.

Now that comments on both dockets are completed, the FCC can adopt proposals on report and order, delay action, tie the two items together, or do nothing.

Working groups on technical standards and on education and public safety are still active, but there's no word on whether the advisory committee's work will be extended past its deadline or terminate toward the end of July.

## New RFR Guidelines Expected

While controversy over the harmful effects of RF radiation has never been settled, some new ANSI levels on exposure are scheduled to be approved sometime this year.

The FCC has been using ANSI standards for time/strength exposures, but the most recent standards are ten years old. They take into account body mass and have set up a table based on signal strength measures in mW/square cm. For example, for 1 mW/square cm, the maximum exposure time has been six minutes, and so on.

Now, based on new studies, the IEEE has developed a revised set of guidelines which is expected to gain ANSI approval as a replacement for its previous guidelines. The new levels were developed by IEEE Standards Coordinating Committee 28 and have already been approved by the IEEE.

The FCC will probably not unilaterally adopt the new guidelines, according to the Commission's Dr. Robert Cleveland. He said the guidelines could be adopted in a rulemaking, however.

The new guidelines relax the standards somewhat for public exposure, but tighten them up for station workers, who face longer exposure times.

For testing RFR levels, two types of meters are available from Holiday Industries (612-934-4920). The RF Broadband Survey Meter measures the strength of electric and magnetic fields, and the Body Current Meter measures induced and contact RF current going into a human body.

But just because there are official ANSI levels does not necessarily clear up the public's confusion about RFR, Cleveland noted. He explained that the FCC, which does not even own its own measuring gear, and the EPA were close to a joint RFR policy with a draft report in 1990.

But either through budget shortfalls, a reordering of priorities or inter-agency disagreement, the EPA pulled the report and work on it was halted.

(continued on page 10)

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Reader Service #095

continued from page 8

The result now, Cleveland noted, is that there is no clear cut way to handle RFR complaints. There is not even agreement about harmful effects of exposure. He observed that the public sometimes takes advantage of the confusion by curtailing a station's right to build or relocate a tower, or worse, by filing lawsuits.

Would the ANSI guidelines hold up in court? "There's no telling what a

jury might do," said Cleveland. He said most RFR lawsuits are settled out of court.

There have been several instances of RFR problems, some which have gained national attention. A widow of an engineer who was exposed to RFR and died sued his employer, AT&T, and won.

Not so clear cut was a Washington, DC-area case where a complaint

was filed with the Commission by a tower company whose workers were exposed to RFR. A tower with multiple antennas was the site, and the problem occurred when one station failed to turn down its power during the work period.

The tower company asked for a policy statement from the FCC's Mass Media Bureau but never received an answer. "Stations seem to be saying to tower climbers, 'If you won't do it we'll get somebody else' and they get away with this," said one tower climber.

In a more severe incident a worker at an antenna farm looked into the open aperture of an illegal uplink and has sustained retina damage. The owner of the illegal uplink was only fined \$2000 but a lawsuit has been filed against the company.

One FCC insider suggested that complaining through a local Congressional representative could bring more immediate action than working through the institutions involved.

Cleveland said that while the policies remain mired in confusion, there are at least two FCC bulletins which could help stations deal with potential RFR problems. OST #65 outlines the current ANSI guidelines. And OET #56 is written to answer the public's questions about RFR dangers.

But until and unless the FCC adopts the new IEEE guidelines once they are approved by ANSI, station workers may not fare any better than they have in the past.

### **SBE Looking For A National Director**

Steve Ingram, the National Director of the SBE, is leaving that position. Ingram's contract expired at the end of May and was not renewed.

The expiration came on the heels of infighting among the SBE ranks over a dues increase and the future of its national convention.

The convention is slated for this year in San Jose, CA, the second week in October and Ingram has said he will stay on to help with convention duties.

In the meantime, the SBE has said it will be searching for a new national director, but there is also apparently some sentiment for abolishing the position altogether.

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# On The Road

## Circuit Research Labs Tempe, Arizona

By Judith Gross

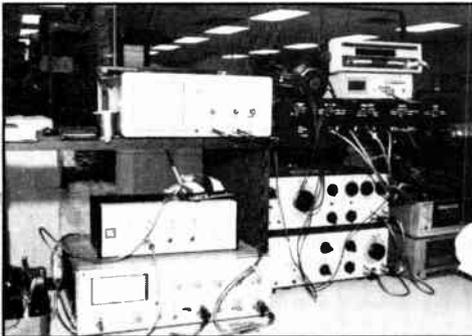


International dealers gathered for a tour of the work area, where pre-assembled boards are put together to become new processing products.



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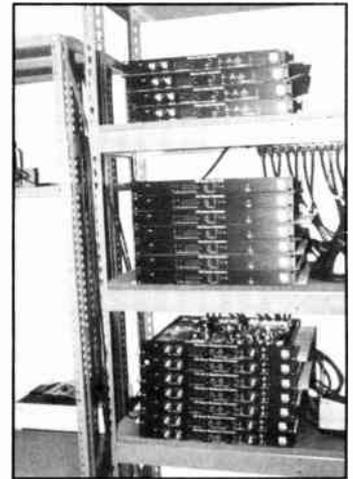
*Circuit Research Labs -- CRL -- started out as a broadcast consulting company back in 1974. The Tempe, AZ based company started manufacturing audio processing as a way of helping low power AM stations improve coverage and has grown to marketing 22 products for AM and FM. The company has taken the lead on industry technical issues and helped champion AM improvement when the NRSC standard was first introduced.*



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Sheriff Black Bart rescues Northeast Broadcast's Bill Bingham & BWPS' Willie Torres from some bad outlaws.



All ends with a Cowboy Serenade.

## A Sampling of Allocations Plotters

By Steve Shrader

"Return to the thrilling days of yesteryear... The Lone Ranger Rides Again!" If you remember that intro, either from the first run in the mid '50s or from Nick at Night, then you are probably aware of the Heath Company.

Before there were computers, integrated circuits, TVs and modems, there were Heathkits. But now, after 45 years, they are no more! The Heath Company recently announced that they were ending the kit business to concentrate on other faster selling products. Some of the reasons given for the decline of the kit business was lack of leisure time, price competition and the lure of personal computers.

Many of us had our first introduction to electronics through the "World of Heathkit" and it's a shame this resource is gone. Over the years, this company produced kits ranging from simple AM radios to computers. Not only did these kits provide valuable training but also allowed the novice the opportunity to actually assemble

his or her own "masterpiece." If you are asking yourself what this has to do with the BBS, the answer is "Not Much," except that if it were not for the Heath Company, many of us may not be where we are today!

### For Broadcasters Only

And now...back to the future. With last month's article, I introduced you to the world of CD-ROM and its ever-expanding universe of software. This month we'll explore software written specifically for the broadcast industry.

For those of you who have used the terrain retrieval program on the BBS, you can thank Peter Moncure of RadioSoft. Peter has written a series of programs that deal with allocations, terrain, coverage, and STL paths that are really outstanding!

The first program is MapFM. This program will do a complete allocation study for any Commercial FM frequency or range of frequencies. All you have to do is enter the coordinates and

the class of station and the program does the rest. If you want to base your search on an existing station, the program finds the station in the FCC database and uses those coordinates for your proposed station location.

The program provides the user with a listing of all stations involved in the allocation search and includes call, city, state, channel number, class, FCC status, distance, separation, bearing, clearance, and whether a short space is created. After this information is displayed, a contour map of the study is drawn on the screen showing acceptable stations in green and short spaced stations in red. If you want to see the location of other stations' towers, the program will also draw this on a map for reference.

### Topographical Help

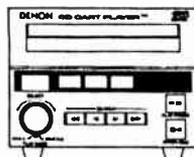
The next program is HT3D (Height in 3D) and simply put, this program consists of all of the U.S. Topo maps on a computer. The user of this program picks a set of coordinates anywhere in the U.S. and gets terrain displayed in 3D and in various shades of color depending on the height.

Additionally, you can add your tower to the display and see how your antenna height compares to the surrounding terrain. The graphic displays of the terrain are really dazzling!

Another program, HAAT (Height Above Average Terrain), does just what is indicated: it calculates the HAAT for a given location. After you have plugged in the chosen coordinates, the program chugs away at scanning all those points that we use to have to plot manually. The program will calculate the HAAT for the eight cardinal radials around your point or will calculate as many radials as you request.



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# Bits, Bytes and BBS

... continued

After you have been given the HAAT info in text form, the program asks if you want a polar display of your signal. If you answer yes, you are prompted for the power and antenna HAAT (or height AMSL). At that point your calculated pattern is drawn on the screen.

## Point-To-Point

The next program, STL, calculates signal path clearance, not only for STLs but for any two points. After you enter your points, either manually or from a reference station, you are asked for the antenna heights and if you want to take earth curvature into account. You are also asked if you want Fresnel zone clearance displayed.

After you answer all the questions, a display of the signal path is shown on the screen. "No line of sight" is highlighted in red. You can tell immediately if you have a path or not. Instead of

drawing those FCC terrain profiles, capture the screen and print it and you're finished. Total time: about five minutes!

The last program of Peter's is called CHARTFM and is fantastic! Peter has surely made his wife a "Computer Widow" with this one. This program retrieves station information and calculates average terrain height, service and interfering contours and distances. All of this data can then be displayed on a 3-D map in color with cities. The map shows the (F50,50) 60, 57, and 54 dBu contours and the (F50,10) 80, 54, and 40 dBu contours.

## For A Sampling

If these programs fit your needs, you can demo all of Peter's programs except CHARTFM on the BBS. The demo file name is TRN.ZIP. If you have any questions, give Peter a call at 914-246-4912.

Before I go dark this month, I would like to mention one other program which is excellent. After searching for a program that would print good polar graphs and being disappointed many times, I finally found DATA-PLOT.

This program is an all-purpose graphing tool which will display and print rectilinear and polar graphs. All you have to do is choose the graph type and enter the scale you want. Your data can be entered manually or can be retrieved from a table that you create with your word processor. When it comes to making professional looking contour graphs, this is the program!

This is a shareware program and you can download it from the BBS. The name is DATAPLOT.ZIP. If you need graphs, give it a try! Until next time...keep up the good work, and stay safe at that transmitter.

Steve Shrader operates the Radio Guide BBS and keeps himself very busy running AVS Broadcast Services. Call the BBS at 804-468-4957. You can reach Steve at 804-468-4344.



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# Good Business For Your Clients ... And Yourself

by Mike Patton

This month begins the first in a series of several columns about the business aspects of being a contract engineer. The issues will be wide and varied. Some of them were obvious to me at the outset; others have come clear only after much grief.

First and foremost, I will tackle that Damocles Sword of client relations: how to keep from being taken advantage of without becoming known as a piker.

First, a caveat: I recently returned from the spring NAB show, where I saw many old friends, made some new ones, avoided the houses of ill repute and had a pretty lady buy me a beer (alas, she turned out to be my editor).

Even though, being a contract guy, I usually have to pay most or all of my expenses (except the occasional beer), I always find the conventions to be invaluable for my business. There is some magic to being face-to-face with clients and vendors.

### Phantom Purchase Order

One of the acquaintances I ran into is a field service engineer for a major manufacturer. He told me that his firm has a growing problem with contract engineers and their clients. It seems there are entirely too many cases where an engineer will order a part to be sent to the station, which has an account with this manufacturer.

But when the bill comes due, the station doesn't pay, claiming no knowledge of the order. This manufacturer had to "eat" some \$46,000 last year due to snags of this type, and that amounted to almost 15% of their total parts sales. This company now requires faxed or mailed purchase orders, on station letterhead, for ALL orders.

Now for me, this becomes a hassle. Many of my clients are in other towns, and some don't even own fax

machines. Often, the only person at the station who cares anything about engineering or the equipment needed is the owner, who has better things to do than type purchase orders.

I spoke to several other field engineers at other firms and it seems this problem is not yet widespread, but it sends a clear warning to me: Make sure you have your client's permission before ordering anything.

### Bully or Wimp?

Back to general principles. I've found it's difficult to maintain a reputation as a good engineer without being known as either a "taker" or a push-over. Sure, there are owners and managers out there who will take advantage of you if you let them. But in my experience, the great majority of GMs are good and decent people.

Even the good managers will drive as hard a bargain as they can; that's just part of being in business. But a large part of your being in business (yes, you are, just as much as the station owner or manager is) is not letting anyone run over you. This is hard work with most GMs who have backgrounds in sales and could sell ice to the Eskimos.

But it's a delicate balance for you as well, since it is easy to be seen as taking advantage of a client. If you charge someone for something you were not very up-front about in the first place; if you bill them for more hours than they expected; if you buy parts without their approval; it can kill their opinion of you real fast.

But on the other hand, if you agree to do too much for too little money; if you allow yourself to be pressured into doing extra work without extra pay, you can get to be known as an engineer a client can take advantage of. Don't get the impression that GMs cackle with glee at cocktail parties, hatching schemes to defraud you (at least I hope

they don't), but word does get around, either way.

### Playing Fair

Here are some suggestions on how to be fair to your clients:

1. Don't order or purchase parts, supplies or equipment without authority.
2. Don't do work without permission ... this burns me; I see broken equipment, I naturally want to fix it. A fellow engineer taught me to ask instead: "What do you want me to do about this?"
3. Don't play games with billing.
4. Don't forget to include mileage, meals, lodging and other road-related expenses.

It's a cliché that it's easier to obtain forgiveness than permission. This is usually true for isolated incidents, or with someone like a family member who is obligated to put up with your bull. But it can be the kiss of death for the contract engineer. Most stations have several alternatives to your services. You may be surprised to find how irreplaceable you aren't.

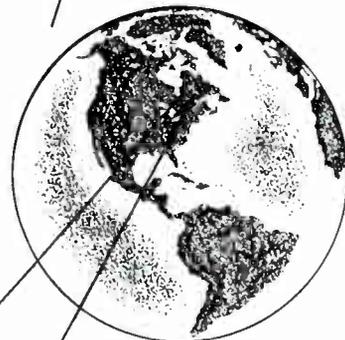
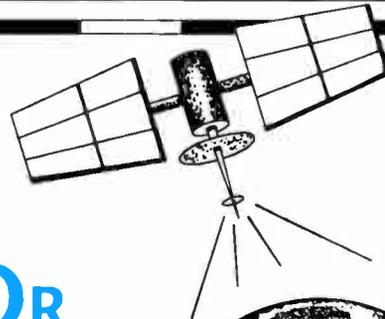
Now, some suggestions for making sure your client is fair to you:

1. Be assertive when asked to do something for nothing.
2. If you agree to do a job for a set price, make sure to allow for cost overruns.
3. If you give an estimate, build in what I refer to as the "FUBAR Factor" -- leave yourself some slack in case the equipment you have to work on is FUBAR: *Fouled Up Beyond All Recognition* (to give you the PG rated version).

Clearly, the line between doing the most you can for a client without leaving yourself out in the cold is a fine one to walk, but it's worth the double reward of smooth client relationships and money in the bank for you.

Mike Patton owns and operates Mike Patton Associates and is a pleasure to buy a beer for. He can be reached at: 504-292-4189.

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# Tech-Tips From the Field

*Practical Solutions to Practical Problems*

## 1. TTC Translator Fix

## 2. Telco Wiring Tips

## 3. Tower Light Reminder

## 4. Interfering Infrared

by George Whitaker

I love this job. Unabashedly, unashamedly, I admit it. I love working with Tech Tips.

Getting to read all of the interesting ideas and occasionally visiting on the telephone with readers is so much fun I almost (I said almost), feel guilty about getting paid for it. Just keep sending in your Tech Tips and let everyone share in your nifty discoveries.

Once again, each Tech Tipster will receive a pocket calculator identifying them as a Radio Guide Tech-Tipster.

And, receiving one for his help with translator problems is John A. Bredesen, P. E., director of engineering for KLCC-FM in Eugene, Oregon. John, by the way, will become a regular Radio Guide columnist next month, with the debut of his "Transmitter Site" column. This month, John tells us about solving:

### **TTC Translator Problems**

KLCC-FM has a total of eight translators in various communities to relay our signal to listeners who otherwise would be shielded by mountainous terrain present in Oregon. We have been using units manufactured by Television Technology, Corp (TTC) of Colorado. Excellent translators, they have given us reliable service for, in some cases, close to a decade.

Recently, however, we had failures in two units in less than two weeks, both related to the same cause. If you have early TTC translators in the field, you might want to consider our "fix." And thinking radically, you might want to do it before trouble develops. At least inspect the PC board where the trouble occurred as described below.

The problem in our case was one where a connector on the power supply board overheated, due, I assume, to an increase in contact resistance

over time. It's the connector (P704) which brings the power transformer leads to the power supply PC board, and specifically involves the pins (6 & 7) carrying the AC from which the 24 V is derived. In both cases the pins got hot enough to melt the solder on the PC board, and in one case, destroy the connector.

Later models of the translator also have the four bridge diodes removed from the PC board and replaced by a bridge diode assembly like the Motorola MDA 2506 or an NTE 5326 (25 A, 600V) which is on the rear panel of the main chassis, not on the PC board. The PC mounted diodes produced enough heat to discolor the laminate. In our case we made a modification to take care of both problems as follows:

1. Mount the appropriate diode assembly in a convenient place on the rear of the translator. Be sure to use heat sink compound.

2. Cut the red and orange leads off of connector P704 (pins 6 & 7), and add enough wire, if necessary, to reach the AC terminals of the diode assembly. Use at least #18 AWG. Crimp on a couple 1/4" slip-on connectors and press onto the two diode terminals labeled "AC."

3. On the power supply PC board, remove the four diodes (D702, 3, 4, 5) which comprised the original bridge.

4. Prepare two wires (choose two different colors) about 4" long. Place 1/4" slip-on connectors on one end of each wire. At the other end attach some kind of a two-pole polarized connector capable of carrying several amps, such as a Molex 03-09 series. (The 03-09 connector is the heavier duty of the two common types found in most electronic stores.) From the mating connector run two leads to, and solder them directly on, the traces on the PC board. (Do not reuse the existing PC board connector.)

The lead carrying the "+" voltage from the bridge rectifier is soldered to the trace which goes to the positive connection of C702, the main filter cap. The negative lead is soldered to a trace near the other capacitor terminal. The purpose of the connector between the diode and the PC board is to allow removal of the board without having to worry about polarity when reconnecting.

That's all there is to it. This modification totally removes the higher current of the 24 V circuit from the small diameter pins on the original connector, as well as the heat-producing diodes from the PC board. A word of warning, however. While I believe that references to specific TTC pin numbers, wire colors, etc., are correct, please check your own translator manual for accuracy. And do check your work before applying power.

One other tip for these units. If you run into a situation where it appears that you have lost regulation of the 24 V supply or there is hum and other garbage on the air from the translator, check the main filter capacitor mentioned above (C702). We have had enough fail that I carry several spares with me in my "Translator Repair Suitcase!" The exact replacement isn't easy to find, but last time I checked, Newark Electronics had them available.

Many times, those of us who have dabbled in the black magic of radio for a number of years forget that the things we learned years ago are the same things that we need to share with the generation coming behind. With this in mind, I am going to try each month to include at least one Tech Tip that would be very basic to the old-timer but very necessary to the newcomer.

**(continued on page 18)**

**Radio Guide Page 17**

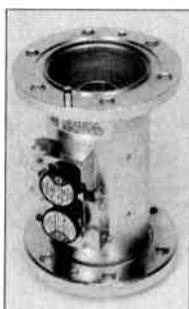
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## Tips From the Field

*continued from page 17*

This month, let's take a look at telephone wiring codes. First of all, in a two-wire system utilizing standard "I" wire, (I for indoor), there are four conductors. Red and green constitute a pair, and black and yellow constitute a pair.

Line #1 will always be on the red and green pair and line #2 will always be on the black and yellow pair. In the event you have a single line with something like an old style speakerphone or a light arrangement in the phone that requires an external power supply, the black and yellow pair will always be the power-carrying pair.

Sometimes it is necessary to make conversions between six-conductor phone wire and standard red, green, black, yellow; or in rare cases red, green, black, yellow, blue, white. The latter is rare and I have personally only seen it a couple of times. The first conversion is quite often necessary to wire phone jacks or extend older wiring with new.

**The conversion table is as follows:**

*Red = blue with white trace*  
*Green = white with blue trace*  
*Yellow = orange with white trace*  
*Black = white with orange trace*  
*Blue = green with white trace*  
*White = white with green trace*

One of the hardest things for me to remember, besides my anniversary, is the quarterly tower inspection. This may be kept as a separate log, or entered in the "station log" (whatever that is). I keep mine as a separate log, just as I do my EBS and transmitter maintenance. At any rate, something that comes once every three months is darned hard to remember. If I write it on a calendar on the shop wall, somewhere, someone will say, "You don't have a calendar? Go get the one out of engineering. And, while you're there, see if they have a better chair than this one. If they do, bring it, too".

So, what I have done is program my Gentner VRC 2000s to give a status closure on the appropriate days at about 9:30 in the morning. This gives

me an alarm that says, "tower maintenance."

I go do my tower inspection, reset the command relay to open the status, clear the alarm (not necessarily in that order) and then I am set until three months later when my pager will again go off to remind me.

Although assuredly not a common problem, our next Tech Tip deals with a situation that, if you had it, would certainly make you want to jump off the top of the tower. From WGHQ-WBPM, Kingston, NY (914-331-8200), Lee A. Waller gives us:

### **The Case Of The Interfering Infrared**

For a period of several months our entire stable of CD players in the control room would do strange random things. They would skip, halt, jump tracks, open drawer, close drawer and cue up when there was no disc in the machine. I checked the machines completely and even sent one back to the factory but nothing was ever found wrong.

Finally, the overnight jock noticed that these events seemed to occur most often as he was moving about the room. "Maybe," he said, "stray commands are getting into the remote sensor on the front of the units." Well, not likely, I thought. But, to humor him, I placed black tape over the remote control windows. We have not had the problem since.

I still do not know where the stray infrared was coming from, but it sure eliminated a problem that was driving the entire air staff to violence.

I find that Tech Tips generally fall into one of two categories, "scratches" and "slappers." A scratcher is one where I scratch my head and say, "How in the world did he ever figure that one out?" A slapper is where I slap my forehead and say, "Why didn't I think of that?"

So our next Tech Tip is a slapper I learned from Paul Demaree a number of years ago when he was in Ft. Smith, AR. Paul is now the owner of KTLQ-KEOK in Tahlaquah, OK.

Paul built a relay interface to allow the station to carry a satellite format

## Tips From the Field

... continued

using a Radio Shack 12 V AC-to-DC adaptor to power the relays. The \$6.95 unit is capable of 500 mA and will carry several smaller relays. You can't begin to build a supply for that money and all you have to do is plug it in. I have since used these on several small projects and it sure saves time as well.

### A Few Quick Shorties

From Bill Jones, Broadcast Engineering, N. Charleston, SC (803-767-7880):

The little plastic spools that Solder-Wik comes wrapped on are great for carrying solder in your tool kit. Just fold the outside back, wind the inner spool full of solder and fold the outside back up to its original position.

From Robin Cross, WNIU, Northern Illinois University, DeKalb, IL:

The bat handle switch on Moseley STLs and other equipment will oxidize over a period of time if the switch is not "exercised." This oxidation can cause unnecessary down time. It would behoove every engineer with these, or other gear with switches that are almost never used, to exercise them during a time period when their function is not critical to the station operation.

From Pete Deets, WFHR/WWRW, Wisconsin Rapids, WI (715-424-1300):

The 12 V high current supply in our automation recently failed, but when disconnected from the brain,

showed no problems. For a dummy load, I substituted an automotive headlight and a couple of side lights to total the 9 A normal load. It looked rather silly but it worked.

And, finally, from Rich Egan, WIZM-Z93, La Crosse, WI (608-782-1230):

I recently encountered an interesting problem with our Marti BR-10 RPU receivers. We were having trouble with a lot of static and noise in some of our broadcasts, even though the signal strength should have been quite strong.

Our receivers are co-located in a rack with an older RPT-40-L transmitter, which contains a small cooling fan. Over time, the vibration from this fan caused some of the hold-down screws on the receiver circuit boards to work themselves loose. These screws not only hold the boards in place, but also serve as a connection to ground. I snugged down all these screws and our signal problems disappeared.

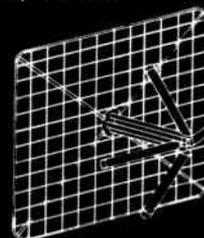
The other day, while attempting to bolster my ego, I was comparing myself to Indiana Jones. I finally decided that the only thing we have in common is the fact that we both hate snakes. This leads me to ask the question, "Does anyone have any ideas for keeping them away from your transmitter site?"

I have been told that you can put mothballs around the building, but, I have never tried it. I would like to find out if it really works, or maybe you have another sure-fire remedy. Let me know and I'll pass it along as well as use it myself.

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# A Book Review on a Circuit Guide

by Eric Small

### The Art of Electronics

Paul Horowitz & Winfield Hill  
Cambridge University Press

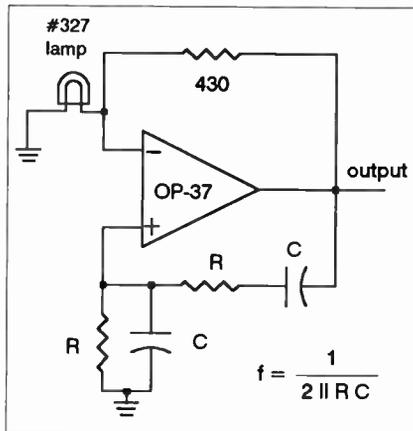
Broadcast engineering covers a wide range of technology – from RF systems design, to telephony, to air conditioning. And while most broadcast technical types have an electronics background, few of us are circuit designers.

In theory, a broadcast engineer working at a station should not need to do any circuit design. The idea is to create larger systems from building blocks that others have designed. It doesn't always work that way, however. Maybe no one makes a box with the exact function that you need.

In my days as a chief engineer I designed and built several transmitter room control systems, as well as a bunch of special purpose remote control sensors. I just could not buy the circuits needed to do the job. Another reason for designing your own is the urge to improve on equipment that is supposed to do the job, but often could do it better.

### No Advanced Degree

Some broadcasters feel that they can't design circuits without an engineering degree in electronics. Nonsense! Unless you want something really complicated, or need to optimize the design because you're going



Wien-bridge low-distortion oscillator

to build a thousand copies, you can design what you need with a little help from some books. Finding the right book can be a problem, though.

Engineering texts look nice on your book shelf, but are not much help

when that op-amp that's supposed to be an amplifier is oscillating instead. Most textbooks concentrate on teaching "first principles" and generally use a lot of math in the process.

The idea is to teach the student the basics, so whatever technology comes along during the next 50 years or so, the engineer is equipped to understand it. That's fine, but it's also the reason engineering texts are not a lot of help when you're trying to design an equalizer using off-the-shelf ICs.

### High Brow Approach

Circuit collection books are the other extreme. These books, often thick, expensive, and with high class names like, "Encyclopedia of Circuit Design," are usually nothing more than collections of circuits taken from various electronics magazines. They include few design details and rarely have the circuits been tested. Unless a circuit does exactly what you need and it actually works, these books are a waste.

(continued on page 22)

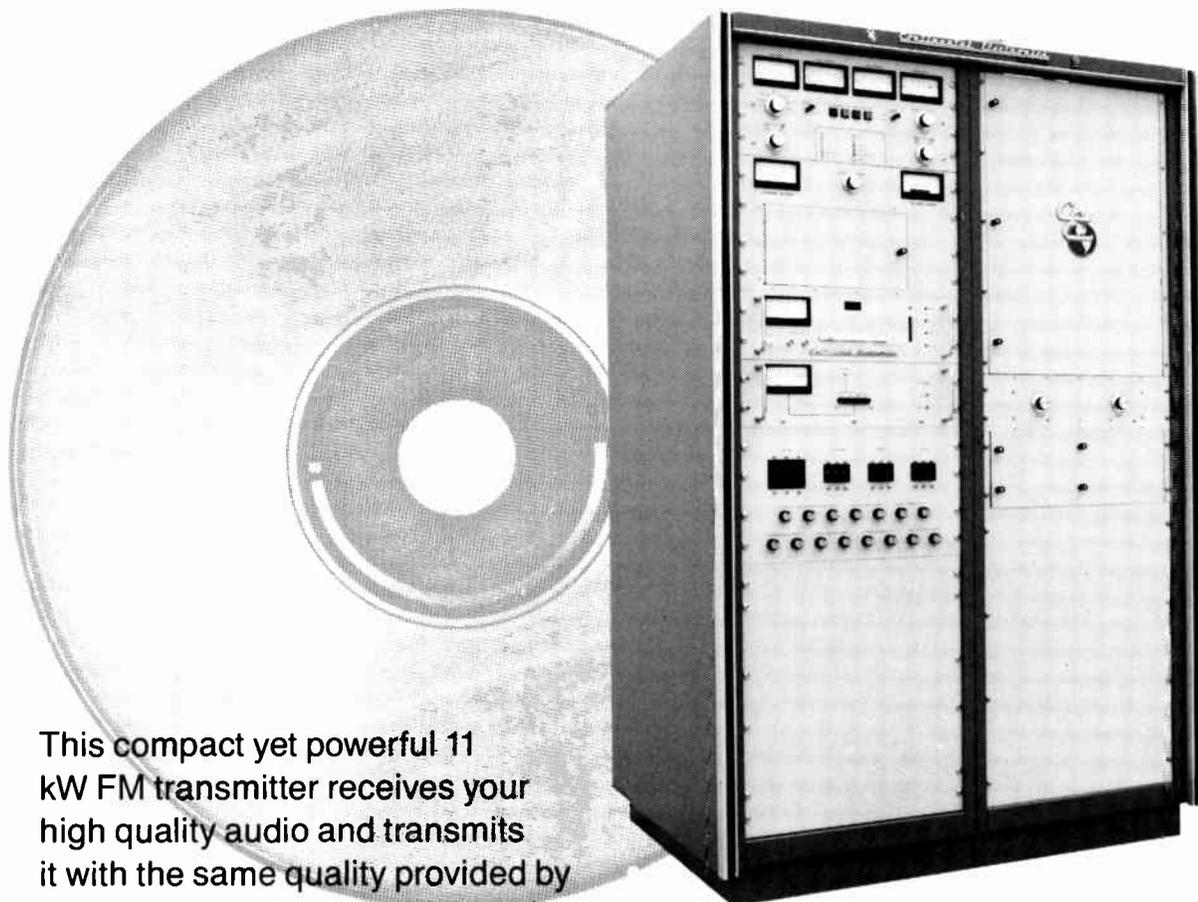


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Reader Service #106

## A Book Review On A Circuit Guide

Occupying the middle ground are books that show how to design with current technology. Some of these books are aimed at the advanced electronic hobbyist. Among the best known are the "Cookbook" series published by Sams. The "TTL Cookbook" by Don Lancaster probably helped more engineers make the transition into digital logic than any other book.

Ten years ago, I worked for an aerospace company and knew at least one engineering manager who had all kinds of weighty text books on his shelf, but kept a copy of the "TTL Cookbook" hidden in his desk to refer to when he actually had to understand a digital circuit.

### Wide Applications

Then, several years ago, another type of book emerged. Its intended audience is technical people in fields other than electronics who need to design and build special purpose electronic gear.

Electronics has revolutionized science from astronomy to medicine to zoology. Often researchers in these areas need some electronic function, but don't have access to engineers and technicians to design and build it for them. It is such technical professionals that these books are written for.

The nice thing about this class of books is that they are written for intelligent, technically competent people but make no assumption of electronic design knowledge.

By far, the best book for doing design work is "The Art of Electronics." It offers 1000 pages of down-to-earth, real design information.

The chapter titles give a feel for the vast coverage of the book: Foundations, Transistors, FET's, Feedback and Op Amps, Active Filters and Oscillators, Voltage Regulators and Power Circuits, Precision Circuits and Low-Noise Techniques, Digital Electronics, Digital Meets Analog, Microcomputers, Microprocessors, High-Frequency and High-Speed Techniques, Low-Power Design, Measurements and Signal Processing.

To give you an idea of just how practical the book is, the following are topics from the chapter "Digital Meets Analog:" CMOS and TTL logic interfacing, Digital signals and long wires, A/D conversion, Phase-locked loops, and Pseudo-random bit sequences and noise generation.

The book uses no heavy math — just simple "plug in the numbers" formulas as needed to select components

and values. Wherever possible, graphs and tables make even simple formulas unnecessary.

### Bad Circuits

My favorite parts of the book are the sections on how *not* to design certain types of circuits. They are called "Bad circuits" and illustrate common pitfalls in designing a particular type of circuit.

The digital chapter has a wonderful section titled "Logic pathology," with subsections called: DC problems, Switching problems, and Congenital weakness of TTL and CMOS. Another section in the "Low-Noise Techniques" chapter deals with "Interference: shielding and grounding." The book includes over 1,000 figures and 78 tables. The tables proved so useful that they were published as a book.

I've designed several circuits using this book, including a pink noise generator, a low noise composite stereo amplifier and an active filter. All worked as designed with a minimum of tinkering and no unpleasant surprises.

I strongly recommend "The Art of Electronics" by Horowitz and Hill to anyone who even occasionally needs to design an electronic circuit.

The book is published by Cambridge University Press and costs about \$50. The current version is the second edition. You may find the first edition around at a bargain price. Avoid the temptation. A lot in electronics has changed between 1980 and 1990. The added chapters and the revisions make it worth the extra cost.

*Eric Small is president of Modulation Sciences and can be reached at 800-826-2603.*

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# Outlining Your Needs

by Gordon Carter

We're still going step-by-step through a major studio move, and the trick now is to get the capabilities of the firms you hire to meet the needs you communicate to them.

When you have assembled your moving team (real estate agent, architect, studio consultant and key staff members), you are ready to get to work. However, this may not be the type of work you expect. Most people would say the next step is to go looking for suitable spaces. But how do you know what space is really suitable?

Before looking at any space, your team needs to sit down and determine your specific needs. Many questions need to be answered as part of this process, and doing so now will save

lots of time and hassle later. The goal of this process is to find out how much space you really need and what special needs should be considered with your new space.

### How Visible?

An old adage is that the three most important items when looking at real estate are location, location, and location. This is especially true of a radio station. The very nature of broadcasting puts a radio station in the public eye.

Some stations may want to increase their visibility to their public. Others may need a location that is more out of the way. Still others may need a site that is convenient for frequent guests to drop in.

Considering on- and off-air needs will help you pick out a general location for your building search. And while you are looking at various areas, be sure to consider accessibility and security for your staff and visitors.

During the process of evaluating your needs, you need to take a good look at the way your station works from the inside. Consider office space as well as control room and studio space. The architect can be a big help here in de-

termining the appropriate amount of office space for various people and their jobs.

### Space Study

A good starting point is the space your people are currently using. Watch them work and see if they are working efficiently, without a lot of wasted motion. Too large an area can be as much of a culprit here as too small a space. If the work space is too large, they may have to move around too much in the course of their normal work. If the space is too small, you may find them constantly moving things to change from one task to another.

After you have evaluated how everyone works, be sure to allow for adequate common areas. You may need a conference room in which your sales people can make an effective sales pitch. Of course, a comfortable reception area that conveys the image your station wants is a must.

Another vital area in many radio stations is a kitchen or lounge area. Your night and weekend people will find this space absolutely essential, while your 9-to-5 staff will enjoy the convenience of not having to leave the premises, especially if you are a bit off the beaten track.

One often overlooked area is storage space. Be sure to allow room for technical equipment storage, office supplies, and long-term records storage (remember, you want to keep those logs and tax documents for at least seven years).

If your station owns a remote van or other vehicles, a garage or parking area is essential. Of course, don't forget to allow for staff parking in areas where such considerations are feasible.

*(continued on page 26)*

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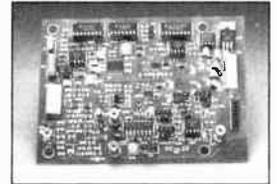
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## Studio Site

continued from page 24

# Outlining Needs

### The Technical Side

Once you have evaluated your office needs, it is time to start looking at your technical facility requirements. Of course, you need a control room for broadcast. But what else do you need? A lot will depend on the way your station operates.

If you take most of your programming from a satellite-delivered service, you will need space for a satellite dish, but maybe not much more than a master control room.

If you do a lot of local news, a newsroom with space for people to edit and write copy, as well as production facilities for actualities and drop-ins will be necessary. On the other hand, if you are a rip-and-read news operation, you need little more than a space for a printer or computer.

Likewise, your local spot production needs will determine the size and

number of production rooms, as well as the equipment in them (more on this in a later installment). If you do any recording work you may want to consider a studio or two. Again, the exact nature of your work will determine the size and equipment.

While you are evaluating your technical facilities, be sure to give some consideration to the acoustical needs. A room that is too small will never sound right, either when you listen on speakers or talk on a mic.

Also, a room with the wrong proportions may sound thin or boomy, depending on many other factors. No amount of acoustical treatment can totally compensate for an improperly designed room. You may need more ceiling height in the space you are using for your studios to allow for ductwork and wiring, or maybe even a floating floor. Also, be sure to allow for extra space for isolation between rooms. Your studio consultant should be able to assist you with these considerations.

Another part of your technical facility that you should consider is a room that houses your common technical equipment, such as telephone interfaces, routing switchers, satellite equipment, and the like. If you are also moving your transmitter, be sure to allow space for it and your antenna.

Also, be sure to allow adequate space for a workshop. How many cluttered work spaces have you seen crammed into corners? It is much easier to maintain equipment when you have a well-designed shop that allows for efficient use of your time.

### Other Considerations

You may also need to allow extra space for 24 hour air conditioning or heating, depending on your geographical location and the services available in your new building.

Janitorial space may also be necessary, especially if you are in your own building. Finally, be sure to allow for adequate washrooms for your staff. You may even want to consider shower facilities to help clean up.

These are just an outline of items for consideration in determining your space needs. Don't be afraid to bring up any ideas or questions to your moving team, no matter how insignificant or silly it may seem. If it hasn't been discussed, discuss it openly so that everyone is aware of the concern.

And, be sure to allow room for possible future expansion in all areas. Remember that you are looking at a space you will probably need to live with for at least ten years, and possibly even longer. From these discussions, your team can put together a minimum usable square footage, and from there you can start looking at buildings and sites.

Gordon Carter is Studio facilities manager at WFMT-FM in Chicago. He can be reached at Professional Audio Services, by calling 708-482-4142.

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# Equipment Report:

# Audio Consoles

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## Equipment Report:

## Auditronics

Reader Service #113

### First Try is Best Buy

by Richard Douglas, KBPI-FM

KBPI completed installation of our first new Auditronics 800-24 audio console in our main control room in late 1991 and is now beginning installation of a second 800-series console (the 850-24) in a new production studio.

For two years, plans for these new studios had been on the drawing board, with the search for our ideal console at the center of the project. At the May, 1991 NAB, we did a double-take as Auditronics unveiled their new 800-series console.

This new console met our requirements: the Telephone Interface Module (TEL2), fed by the Auxiliary mixing buss provided the flexibility required by our air staff and would interface easily with the two Telos 100 hybrids we were using; there were lots of audio inputs and outputs provided; the console's logic scheme was basic and adaptable and many expansion possibilities were included in its design.

I liked the Auditronics 800 because all the analog signals I'd always wished access to were immediately available right on the connectors, including VCA control voltages. There are lots of inputs and outputs, sensible control logic and control interface requirements, even an equalizer on the headphones. Almost all audio signals are active-balanced at a high level.

This full-size, modular console has lots of flexibility. The 800's power, audio and logic busses run the entire length of the console and are available at every input or output module slot. Each module's double-

sided printed circuit board is laden with personality-determining DIP-switches, powerful high slew rate audio ICs and a varying number of hybrid modules dedicated to various audio and logic functions. These densely-packed hybrids use surface-mount technology, assuring accurate, quiet and highly dependable performance, a feature demanded in a good VCA system.

The basic console consists of up to 24 mono or stereo input modules, two line output modules and a monitor module. Other full-size modules are available for telephone interfacing, studio monitors, talkback and intercom. Input modules are available with an optional pan-pot for stereo imaging if desired.

This console boasts two independent monophonic mixing busses plus stereo program, audition and utility busses and a unique stereo auxiliary mixing bus with separate assigns and mixing level controls.

Three gold-plated circuit board edge connectors carry signals to and from each module. One of these (a 100-pin connector) plugs into the motherboard and handles power, analog and logic busses. Two others (one for audio, another for logic) are user-connected at the time of installation.

Separate "A" and "B" audio and logic circuits is a luxury our last console didn't provide. Each "A" and "B" audio input has its own logic signals for device control and an "External Logic Disable" input has been provided on each module.

The main console bi-polar power supply is +/- 20 volts. Each module has 15 V regulators on the card. We were initially concerned because this scheme always

generates some heat, but it hasn't been a problem, possibly because there are two low-speed fans just beneath the meter bridge.

After six months operation on-air, our first Auditronics 800 console performs very well. A few minor difficulties were overcome with ease. The cue speaker mounted inside the console on the right hand side was difficult to hear; our solution involved adding an external cue speaker and a more powerful cue amplifier.

The headphone jacks, mounted on the console front apron, were inaccessible in our installation. They were disconnected and external headphone amplifiers were connected and mounted at each microphone position.

The Auditronics staff has been friendly and helpful. Together, we've come up with ways to increase the console's flexibility and add value to an already smart buying decision.

Richard Douglas is CE at KBPI-FM, Denver. For more information on Auditronics consoles circle number 113 on the reader service card or call 901-362-1350.



Radio Guide Page 27

# Equipment Report:

## Broadcast Devices

Reader Service #114

### Digital Quality With Yesterday's Hardware

by Robert C. Tarsio, Broadcast Devices

In today's world of digital audio, console makers are pressed to "push the envelope" to produce better analog specifications. We at Broadcast Devices, Inc. have been making direct replacement amplifiers for existing consoles in the same quest.

There are three audio specs to consider: dynamic range, headroom, and signal-to-noise ratio, or SNR. Dynamic range is the difference between the maximum output level before clipping distortion and the noise floor of the device with levels adjusted for nominal output. Headroom is the maximum level above nominal that the device can be driven before clipping occurs. The SNR is the difference from nominal level to that which noise and hum can be measured when the nominal signal is removed.

If you add the absolute values of the SNR and headroom you can determine the dynamic range of the console under investigation. For example, a console with a +8 dBm nominal output specification that clips at +28 dBm would have 20 dB of headroom, that is, 20 dB above the nominal output level.

If the noise is specified to be 70 dB below the nominal +8 dBm level, the console has a signal-to-noise ratio of 70 dB. To find the dynamic range, add these two figures together. For example: 70 dB SNR + 20 dB Headroom = 90 dB Dynamic Range.

This kind of performance is typical of much of today's equipment. Let's compare this to that of a console designed a few years back.

One of our first retrofit products was a set of replacement microphone preamps and program amps for the Gates Executive Series consoles which includes the Diplomat, President and Ambassador. Many are still in use today and so we continue to offer the HPR-100 Microphone Preamplifier and HLR-100 Program Amplifier for them.

The Executive, as supplied from the factory, had a dynamic range of about 64 dB. This means that a console of this type will clip sooner and will have a higher noise floor than a modern IC console.

According to the original technical manual, the Executive was rated for +8 dBm nominal and had a maximum output of +18 dBm, producing 10 dB of headroom. In 1962 this was standard design and considered adequate. Today, 20 dB is considered good.

The Executive's noise floor was specified at 64 dB below a +18 dBm output. Note that this means that the SNR was only 54 dB below the +8 dBm nominal level. Once again: 54 dB SNR + 10 dB Headroom = 64 dB Dynamic Range.

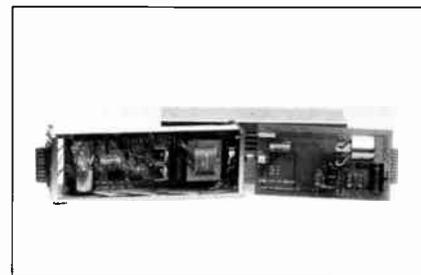
The FCC requires that system noise be at least 60 dB below 100% modulation. In order to pass a proof, you have to run the console at +18 dBm for all of the measurements. The real SNR is only 54 dB because under normal operating conditions you will run your console at +8 dBm and not at the threshold of clipping.

Our B.D.I. retrofit mic preamps and program amps can actually make an Executive produce a 90 dB dynamic range. When retrofit with B.D.I. electronics, we spec the Executive's noise at least 70 dB below +8 dBm nominal level. The headroom is 20 dB to produce a maximum output of +28 dBm.

The key to low noise in this type of console is the ability to build a low impedance input, high gain program amplifier stage. The mixer bus design used in the Executive and many other consoles of that era is the traditional 150 ohm, high loss, constant impedance type. That loss requires a program amplifier with 62 dB of gain.

In developing the HLR-100, we created a mic-to-line level stage. We have actually measured 75 dB in the lab but as a conservative measure spec the HLR-100 at 70 dB. Once again: 70 dB SNR + 20 dB Headroom = 90 dB Dynamic Range. Now you're digital-ready.

Bob Tarsio is co-founder and CE of Broadcast Devices, Inc. He can be reached at 914-737-5032. Or for more information, circle reader service card number 114.



# Equipment Report:

## Radio Systems

Reader Service #115

### Big Board At a Small Price

by Dan Braverman, Radio Systems

When WTEM, the new all-sports station in the nation's capital, and the voice of the Washington Redskins, was ready to make its console selection, station management chose two new Radio Systems RS-24 consoles for on-air.

These consoles are brand new, having just made their debut at the NAB spring convention. They are Radio Systems' largest, providing 48 stereo or mono inputs and available in four models: 6, 12, 18 and 24 channels.

With the number of audio sources in a typical air studio expanding to include DAT, CD players, more networks and multiple phone feeds, it's not surprising that there is a greater demand for larger consoles in an affordable price range. With our RS series, stations no longer have to spend top dollar for these "big" boards.

But the RS series is more than just a bigger version of our other consoles. We've added a mix buss extender board to allow users to create up to four additional mix-minus foldbacks or network splits. We've also designed in greater flexibility to create special output feeds using some, but not all, of the console inputs.

In many markets, with new operating agreements, this is critical. For example, one station wanted to feed two transmitters with different feeds from the same board. Our new console makes that possible. It can also accommodate users who would like to feed multi-line phone hybrids.

The RS-24 console includes all standard features of the other models in the line, including digital event timer; Penny & Giles faders; dbx VCAs; fully flexible inputs that can accept mics, cart machines and consumer sources easily; talkback circuitry and more.

For more information, circle reader service card number 115 or call Radio Systems at 800-523-2133.



# Equipment Report:

Arrakis Systems

Reader Service #116

## Console Series For the 90s

by Jon Young, Arrakis Systems

The 12,000 Series consoles from Arrakis have proven themselves to be a versatile and reliable console line that can address the needs of a variety of markets.

The 12,000 Series has three mainframe configurations: 8, 18 and 28 input channels. The mainframes are actually 10, 20 and 30 channels but a TOB1 output module and TCRM1 monitor module are required and use two mainframe positions.

The mainframe is a "universal" buss design and can be placed in any position on the console. All module positions in the mainframe must be filled, and an input module, option module or blank module fits this purpose. Standard color is Arrakis tan.

Standard mainframes are tabletop mounted. The deluxe mainframe features thru-table mounting, 1/4" milled aluminum side panels, lighted VU meters and deluxe oak trim system. The deluxe mainframe is available in either Arrakis platinum or tan colors.

The VU meter housing hinges at the back to expose three internal connectors per module with the cabling exiting at the rear of the console. The connectors are AMP ML series, a major upgrade from the Molex connectors common in the industry.

The 12,000 supports a large standard complement of modules. There are four types of input modules: two mic and two line. These have basic and advanced modules. The advanced feature "Pan" for mic modules and "Mode Select" for line modules.

All three stereo output busses are metered individually. Two internally-assignable and transparent mix-minus busses support the telephone without any front panel set-up or operator assistance required.

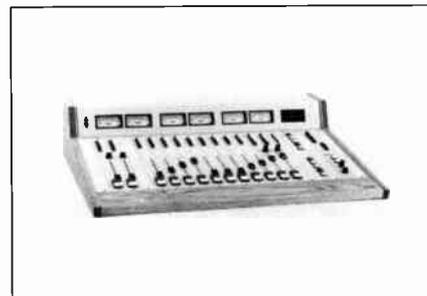
A ten-minute up-timer with panel controls and module reset capability is standard. A variety of option modules is also available, including a DA module, remote selector and turret modules.

The input modules feature VCA audio control to eliminate faders becoming noisy from time and wear. Only the finest quality

components are used throughout the console: Penny & Giles slide faders; custom conductive plastic rotary faders with stainless steel shafts and bushings; ITT Schadow switches, heavy aluminum panels and solid oak trim.

Gold board connectors are used to connect the PC boards and all ICs are socketed. Modules are programmable via DIP switches. Attention to detail makes the 12,000 the most mechanically and electrically reliable console that can be built today.

For more information, circle number 116 on the Reader Service card or call Arrakis at 303-224-2248.



# Equipment Report:

Wheatstone

Reader Service #117

## New Flagship On-Air Console

by Gary Snow, Wheatstone Corp.

The Wheatstone A-6000, introduced at this year's NAB convention, has been specifically engineered for major market stations.

This new on-air console series begins with a truly open architecture mainframe that allows any module to be located anywhere in the frame, so accessories and inputs can be custom-located to suit exact programming needs.

A unique part of the design is the onboard routing switcher -- Smart Select(TM) -- that features individual input module Scroll and Take selector buttons, complete with an alpha-numeric display located above the fader, identifying the current source or showing a preview of the next source.

The Smart Select system is really handy in large complexes with many inputs, where the potential for confusion is great. This feature allows virtually instant reconfiguration of the console as needed.

Another unique Wheatstone feature is the A-6000's Bus-Minus(TM) system, which can produce individual mix-minus feeds from every input channel -- a powerful feature for complex news and sports events. Bus-Minus can feed literally dozens of phone hybrids or talent foldback monitors.

For more traditional applications, the console also has four internally-switched mix-minus busses, each with an independent electronically balanced output.

Although designed primarily for on-air use, the A-6000 has four assign busses: Program, Audition, Auxiliary and Utility. All are stereo, so the console can also serve as an 8-track production board.

The A-6000 even offers an array of optional auxiliary send controls, for use as talent feeds or special effects sends in the production environment. These may be configured as separate mono Send 1 and Send 2, or alternatively as a full stereo send.

The technology inside the console is different, too. It uses differentially balanced active combining networks to achieve superior crosstalk and separation performance and to reject electrostatic and magnetic interference from the busses.

Front panel switch controls are LED-illuminated, sealed to protect against spills and rated at five million operations. While FET switching has been around for a long time, no one has gone to such great lengths before to achieve this degree of performance and reliability.

The bottom line with the A-6000 is simple: It's designed to be easy on the engineer. There are no jumpers to solder; absolutely everything is internally switch-selectable, including logic, mix-minuses, mix-minus pre-

post selects, cue options and effects sends options, to name a few.

We are offering this console as truly a la carte: you can have any combination of features included or deleted; one module could have four bus assigns, the other might only be fitted with two buttons; one could have a single effects send and several others might have two.

Mode selectors, A/B sources, routing switchers, stereo cue speakers, meter combinations -- all are available in any combination required.

All this flexibility and new technology, along with ground-breaking aesthetics, make the Wheatstone A-6000 a very intriguing console for today's broadcaster.

For more information, circle reader service card number 117 or call Wheatstone at 315-455-7740.



Radio Guide Page 29

### Flexible Automation and Routing

by Ed Fritz, Sierra Automated Systems

Audio switching systems make it much easier to plan and provide comprehensive audio distribution for a radio broadcast facility whether you are planning a rebuild, expansion or new facility.

The SAS 32000 Audio Routing Switcher is a high quality microprocessor-based audio switching and mixing system designed to meet radio broadcaster's stringent requirements. The system architecture and rugged design sets Sierra Automated Systems equipment apart from the field.

The system is modular and easily configured. The heart of the SAS 32000 is a 32-stereo-input/16-stereo-output switching subsystem housed in a three-rack-unit frame. Each frame houses all input amplifiers, output/crosspoint cards and power supplies required for a complete system.

For systems requiring more than 32 stereo inputs or 16 stereo outputs, the frames are simply connected together with expansion cables. No additional support electronics are necessary. Each switching frame may also be configured as 64-mono-input/16-mono-output or 32-mono-input/32-mono-output.

Stereo and mono frames may be intermixed within one system. This provides an

economical solution for installations which must handle a large number of mono sources.

The system provides one plug-in module for each output providing crosspoints, output amplifiers and a microprocessor with two serial data ports. One RS-485 data line connects directly to a remote output control panel at 76.8 kilobaud while the other communicates within the system to a frame controller for X-Y control. This allows true "destination orientation" so that each output may operate independently of the others.

The use of individual processors on each output buss gives the SAS 32000 high reliability, fast access and superior fault tolerance. The central frame has locations for two redundant plug-in power supplies, each with its own line cord, allowing separate AC feeds to be used for a greater level of redundancy.

Many different control panels are available, from simple pushbutton per crosspoint to alphanumeric dial-up. The alphanumeric panels feature eight-character dot matrix LED displays and a shaft encoder to allow the operator to scroll intuitively through the available sources in alphabetical order.

Two external RS-232C ports are provided, one for connection to a terminal or personal computer for central control and system monitoring, and one for connection to an automation computer or to a modem

for remote control. The protocol is available to all systems integrators.

The SAS 32000 provides internal audio summing and mixing capability. This feature makes possible other applications and may be important if certain automation or communications functions are envisioned. Mix-minus generation, teleconferencing, IFB operations, intercom and console emulation all require a switching system with summing capability.

Digital gain-controlled amplifiers are available for mixing or control of input sensitivities. Up to 12 (96 channels) may be housed in the DAS 9600 main frame.

Automation is also available from SAS which allows time of day programming for selection of crosspoints and for control of other equipment, such as roll-recording a tape machine.

For more information, call Sierra Automated Systems & Engineering Corporation at 818-840-6749 or circle number 118 on the Reader Service card.



# Equipment Report:

## Ramko Research

Reader Service #119

### Beyond the Price/Performance Barrier

by Ray Kohfield, Ramko Research

The word "value" is playing an increasingly important role in today's broadcast reality. The life of a product has to be weighed against the dollars spent and evaluated along with how the performance meets a station's needs and its service over the long term.

Ramko has designed its new XL series consoles in an effort to bring new meaning to this concept of value and provide satisfaction for every dollar spent.

New developments in IC technology and hardware have allowed us to design a series of consoles with fewer components and less manufacturing labor and still provide higher performance than was previously possible.

Our double module shielding and "star" grounding system, along with MOV protected outputs have eliminated problems with RF and static or lightning discharge.

Ease of operation was given top priority to make sure that the buyer as well as the end user becomes part of the value and satisfaction equation.

For example; the consoles are designed so the operator's arm can rest comfortably; all input/output selectors are illuminated and can be operated with the operator's hand on the mixers; and there are extra large meters that can be read from across the room.

To please the installer/engineer, all installation can be performed with just a screwdriver and wire stripper. And since all hook-up information is prominently displayed in the interior, a console can be set up without the need to refer to the manual.

The weakest link of most consoles is inherently the mechanical faders and select switches. We have overcome this by using custom pots with longer life and silent switches with as many as five million actuations. This amounts to five to twenty times the life in other consoles.

We are convinced that it's nearly impossible to determine the value of a console without a test drive. Therefore, all of Ramko's consoles have a two week trial and two year warranty built into the sales agreement. We also offer a free VHS video to educate a potential buyer about our consoles before the decision is made.

We are gratified by the response Ramko has received from its satisfied customers. Two examples are Bacilio Maciel of KTAA, who said his decision to buy the xL82S helped make him "look like a genius," and Bill Bro of WBZM who congratulated us for building what he calls "the most perfect audio console available to broadcast stations."

To us, that means we've found a way to make sure the cost-value equation is a balanced one.

For more information, circle number 119 on the reader service card or call Ramko at 800-678-1357.



### The Air-Worthy Mariner

by Tag Borland

The Mariner on-air console is a redesign of Logitek's popular Perfectionist series, reworked from the ground up.

Our first goal was to reduce initial cost by designing the Mariner to be easy to install and to interface. Our second goal was to reduce long term cost by keeping the Mariner simple to use and service while making it more durable and reliable.

With this in mind, we have used water-resistant switches and pots, along with a special enclosure that keeps dust, dirt and even liquids away from sensitive areas. In fact, the Logitek Mariner will continue to operate even while soda is being poured over its mixers.

All key switches are molded out of translucent rubber in a single sheet with integral sealing bezels and will survive ten million operations. Gold switch contacts provide added reliability and LED backlighting provides even, burnout-free illumination.

The switches are momentary action with electronic latches. The actual audio is switched by sealed relays or speed-controlled FET transistors. Long-term reliability is significantly increased because audio is not routed through mechanical switch contacts.

We use Penny & Giles slide pots which have a built-in dust deflector that keeps out

dirt and even chicken soup. The mono pots feed stereo VCA amplifiers that are designed to maintain low THD to within 1 dB of clipping and left-to-right tracking to within 0.25 dB.

Several new circuit features also are included in the Mariner. The input circuit provides adjustment-free CMRR of 100 dB and a 40 kilohm input impedance while being protected from almost any kind of static or lightning strike.

The electronic transformer circuit used in the outputs provides a constant level 60 ohm drive, whether used in a balanced or unbalanced configuration. All the control outputs are opto-isolated for reduced noise interference, with a separate start and stop signal being supplied for each input. An optional backup power supply extends primary supply life while adding reliability.

The Mariner is available in three main-frame sizes that hold 6, 12 or 22 mixer modules. There are three types of mixers. One has a single stereo line input with a six-button, LED-lighted, machine control. Another has two line inputs, and the last has a single microphone input with pan control and phantom power. Optional features include an 8-input preselector module and a clock/timer unit.

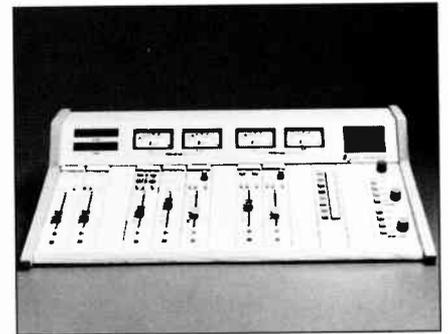
Soon to be released options include a line input mixer with a balance control and a right-left-stereo-mono mode switch, an intercom module and a telephone interface module.

For flexibility, the Mariner has five mixing busses. Two stereo busses feed the main output channels. Two auxiliary mono busses are for mix-minus or IFB use. And the mono cue buss feeds a built-in amplifier and speaker.

The Mariner is fully modular. The plug-in mixers can be removed with the power on for quick replacement. All connections are made to wire-capturing terminal blocks. And the slim desktop cabinet is easy to position and install.

The new technology used in the Mariner, along with tight control of the assembly process, has allowed us to make a board with greatly increased reliability for only two-thirds the cost of our previous console.

For more information call 800-231-5870 (Alaska, Hawaii and Canada 713-782-4592). Or circle reader service card number 120.



## Pacific Recorders

### Reader Service #121

## Equipment Report:

### Radiomixer: Major Market Quality, Middle Market Price

by Mike Dosch, Pacific Recorders

For years, Pacific Recorders has made high-end consoles for major market and network broadcasters. But for many radio stations with limited budgets, the price of performance was just too high. We were asked by countless customers to offer a more affordable version of our popular BMX.

This proved to be a difficult engineering assignment. We had no desire to make operational or performance compromises, yet we had to reduce costs. What ensued was the Radiomixer(TM) project, a company-wide development effort aimed at producing an on-air console optimized for broadcasters with real-world budgets.

Every aspect of the console's features, design materials and manufacturing processes were scrutinized. We found that by investing in new production machines, special tooling and computerized test equipment, we could produce the Radiomixer with greater precision and less cost.

By reducing our manufacturing expenses, we were able to offer more standard features and better quality construction than competitive consoles in the same price range.

The finest components were selected for reliability, including gold contact switches and connectors, sealed nitrogen-filled gold contact relays, real VU meters, conductive plastic faders and pots and a massive toroidal transformer in the separate rack-mount industrial-grade power supply.

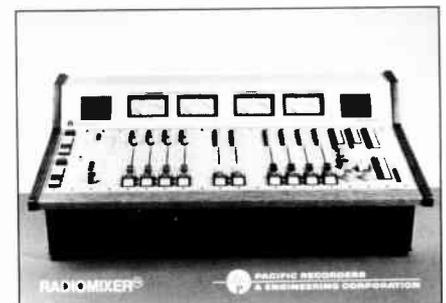
Radiomixer's standard features include one monaural and two stereo distribution-style output amplifiers; automatic telco mix systems with outputs for recording contest callers and interviews; logic-controlled event timer and temperature compensated time-of-day clock compatible with master clocks; built-in cue speaker and amplifier and flexible monitoring circuitry. All this, in an easy-to-use uncluttered control layout.

The success of this console among radio broadcasters led to the design of Productionmixer(TM), the production companion console to Radiomixer. Productionmixer shares all of Radiomixer's standard

features while adding equalization, sends and multitrack mixing capabilities. Productionmixer also serves as the console platform for our new ADX digital audio production system.

Radiomixer and Productionmixer are examples of Pacific Recorders & Engineering's commitment to offer more capability and value for the quality-minded broadcaster.

For more information, circle 121 on the reader service card or call Pacific Recorders & Engineering at: 619-438-3911.



### Cost-Consciousness With No Compromise

by Scott Martin, Fidelipac Corp.

In a market environment where broadcasters want the most quality and performance for their money, Broadcast Audio Series VI consoles by Fidelipac offer design integrity and premium components at a moderate price.

Reliability and serviceability are essentials in today's world. Studio downtime is simply unacceptable. The Series VI architecture has universally interchangeable modules for both input and output.

All input modules may be used with mic or line levels and all output modules are identical. Modules may be replaced while the console is operating, so there need be no interruptions.

Output modules use top quality audio transformers. This assures virtual indestructibility and affords very high common mode rejection. Each amplifier is capable of driving five watts into eight ohms, assuring they are used conservatively and linearly at line level. Straightforward circuit design helps make repairs easy to do.

At the operational heart of an audio console is the attenuator. The Series VI uses

premium Penny & Giles 4000 series conductive plastic faders for long life and low noise. These faders are hand-trimmed for excellent stereo channel balance.

Fast response push-pull meter drive is used to minimize the mechanical effects of the meter movement. All meters are driven directly from the output stage for best accuracy. The meters feature peak indicating LEDs which may be set to indicate a user-defined overload level.

The power supply is external to the console to keep noise to a minimum. To further reduce noise, independent power supplies are used for audio, clock/timer and remote control/lamps.

Component selection is fundamental to great performance. Series VI mixer modules use Analog Devices' SSM2015 mic preamps. The "AN" version of the 5532 op amp is used for best noise and offset characteristics. All ICs are socketed and all audio-related sockets and connectors are gold-plated for reliability.

The audio sections use only 1% metal film resistors for low noise and high stability. Audio wiring harnesses are shielded coaxial cable. Mixing busses are low impedance at virtual ground to eliminate crosstalk and noise.

Operational flexibility is not compromised in the Series VI. Each console features three inputs per mixer and three stereo output busses in addition to an independently derived mono output buss.

Broadcasters expect all of these design attributes and component quality in a premium console. Discovering them at an affordable price is what sets the Broadcast Audio Series VI apart from the competition.

For more information on Broadcast Audio consoles, contact Fidelipac at 609-235-3900 or circle number 122 on the reader service card.



# Equipment Report:

### Clean Audio For Today

by Dave Buck, Broadcast Electronics

Today's broadcasting environment is leaning toward totally clean audio, whether analog or digital. Although the cost-effectiveness and performance of digital consoles is not there yet, sonically superior analog consoles are available now.

The Air Trak consoles recently introduced by Broadcast Electronics have a typical dynamic range in excess of 113 dB (well above a CD's 94 dB) with a program channel crosstalk specification of -100 dB at 1 kHz.

Our generous use of VCAs on every audio gain control protect the audio signal from noise generated in dirty pots and worn faders. These Air Trak features, plus an extremely flat frequency response, offer broadcasters a clear, accurate audio performance that rivals digital.

Today's studio operators are demanding more from their consoles as well. The standard requirement is for a flexible yet powerful design that is convenient to use, reliable, and easy to maintain.

More so, the console design of the future must provide more than just audio mixing if it is to keep up with the digital audio systems on the horizon.

The Air Trak addresses these demands with a long list of standard features which include: three inputs per channel with mic and line level selectivity; stereo and mono program and audition outputs; separate telephone mix-minus buss; flexible source machine remote control; clock and dual timer capable of driving slave units; cue speaker and an extensive use of logic hybrids to tailor the operation to an individual station's requirements.

Yet with all these features, Air Trak's control surface is easy to learn, with lots of "finger room" to accommodate mistakes -- a welcome benefit considering the constant turnover of air talent.

The Air Trak line consists of the 90 and 100 series, each in six, 12, 18 and 24 channel configurations. The 90 series is the standard console with control surface and meter bridge.

The 100 series features a control surface with an extended-height meter bridge designed to accommodate accessory modules above each audio channel. This arrangement provides easy visual assignment and effortless ergonomic control of the accessory positions.

Available modules include equalization, remote control, processing, talkback and custom features. Air Trak is designed to offer quality performance with reliable service for the long term.

For more information, circle reader service card number 123 or call Broadcast Electronics at 217-224-9600.



### Wide Appeal of Signature Series

by Edward W. Devecka Jr., LPB Inc.

Nearly 3,000 LPB Signature series audio consoles are in service around the world. Over half of LPB Signature console owners bought more than one, with over 1,800 in 1,000 licensed U.S. radio stations. What's the appeal?

First, with uncompromisingly heavy-duty components, LPB Signature consoles have a well-earned reputation for durability and longevity. Then there's on-air performance.

Signature consoles have very respectable SNR and distortion specs, and not just under test conditions. These specs are likely to be achieved fully wired-up in a studio, complete with all the real-world noise and RFI sources.

The reason for the performance is modern transformers, with static-shielded windings and balanced capacitances. All LPB Signature inputs are transformer-balanced with isolated ground. This provides very high common-mode rejection of static, RF and noise induced on the low-impedance audio lines.

The rugged one-eighth-inch aluminum construction screens out RF and noise. And Signature program and audition outputs are also transformer-balanced with isolated

ground.

The Signature series includes interchangeable modular electronics. Inside the console, mono plug-in modules are used for microphone preamps and/or balanced 600 ohm inputs (in the first four channels); and for line inputs: two per channel for stereo consoles.

Plug-ins can be swapped among Signature consoles, even between stereo and mono models. Signature III plug-ins are nearly 100% compatible with Signature II and Signature I.

The optional mix-minus plug-in nulls the caller to better than 40 dB down and plugs into the mono mixdown slot for all Signature series consoles, mono and stereo, and those with mono mixdown in use.

Operators like the simplicity of the consoles' front panels. A/B/C input switches, as well as headphone and monitor controls are easy to reach above the mixing area.

Rugged telephone-key switches control program content to P1 (Program), P2 (Audition) and Off. Faders with cue detent have remote starts positioned for thumb use. Operation by touch allows talent to concentrate on the presentation.

Engineers enjoy the consoles' ease of installation. All Signature input-output connections are to screw terminal barrier strips.

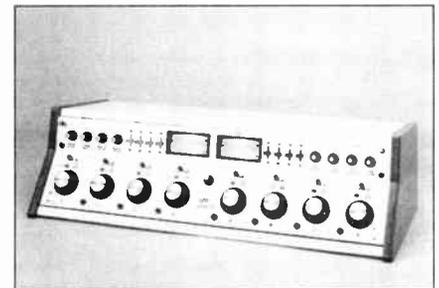
Each screw terminal is clearly identified to aid in wiring without referring to the manual.

Separate P1 and P2 tape outputs permit easy recording or logging. Mono/stereo input switches on stereo consoles allow a mono input into the left side only, to automatically split to left and right output.

Signature consoles make maintenance tasks easy. Each component on every PC board is uniquely identified, corresponding to a parts list with component values in the manual.

The LPB Signature III series has seven models, including 6, 8, 10 and 12 channel stereo, and 6, 8 and 10 channel mono consoles. List prices range from \$3,395 for 6-channel mono to \$6,895 for 12-channel stereo.

For more information, circle reader service card number 124 or call LPB at 215-644-1123.



# Equipment Report:

### Quality in a Compact Design

by Dan Viamonte, Autogram Corp.

Autogram introduced its newest console -- the Mini Mix 8 -- at the NAB '92 show in Las Vegas. It offers eight channels, 12 stereo inputs with two additional mic inputs and a very friendly price tag.

The Mini Mix 8 is a versatile, high quality, all-VCA professional audio console built with broadcast standards for those special situations where a small, compact audio console is needed. Such uses include news, mini-vans, production studios and educational facilities, to name just a few.

The Mini Mix 8 offers eight plug-in slide pots. Two are dedicated mic slide pots. The remaining six slide pots each have two program sources (A or B) for a total of 12 stereo inputs. The "A" source has six high-level balanced professional stereo inputs with interchangeable pull-out connectors for easy and fast combination choices.

The "B" program source has six unbalanced stereo inputs for direct connection of consumer CD decks, cassette machines, audio decks and other equipment. There's no need to hot-wire or look for adapters to interface

with the system. Just plug in the consumer connector directly to the back of the console.

The Mini Mix 8 makes extensive use of NE5532 and TL072 type ICs to provide high quality audio performance. Typically, the SNR on the high level inputs is better than 80 dB (20 Hz-20 kHz) when referred to the standard +8 dBm output.

The harmonic distortion is in the range of .012% and the IM distortion runs about .015%. The maximum output is +25 dBm, insuring plenty of headroom. The output level may be calibrated to something other than +8 dBm if desired.

Construction of the console is essentially on one main board with a sister board for the balanced circuits and a meter board which is connected via two ribbon cables. The power supply is external to the console and can be wired for either 115 or 230 VAC and 50 or 60 Hz. The front panel is hinged for easy access to the boards and the plug-in ICs.

The Mini Mix 8 weighs only about nine pounds and measures 19" x 14" x 4". Its sleek, low profile gives you the added flexibility to locate the console wherever needed.

The Mini Mix 8 has a built-in amplifier with speaker. It is assembled in an all-aluminum case with attractive wood endbells.

Our customers, which include AM and FM stations, TV, college and university production facilities and corporate facilities have made it clear how happy they are with Autogram console performance.

We've been serving the broadcast community for more than 23 years, and the Mini Mix 8, the latest addition to our console line, supports the Autogram tradition of quality at an affordable price.

For information, circle 125 on the reader service card or call Autogram at 800-327-6901.



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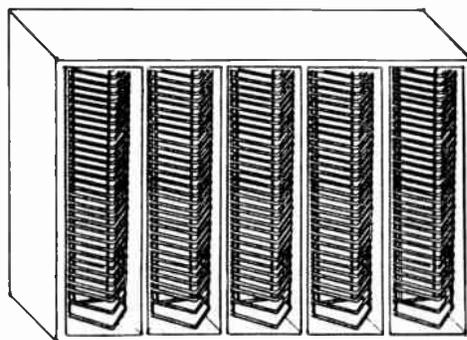
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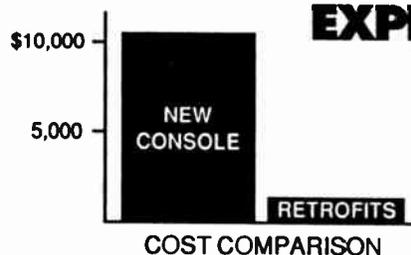
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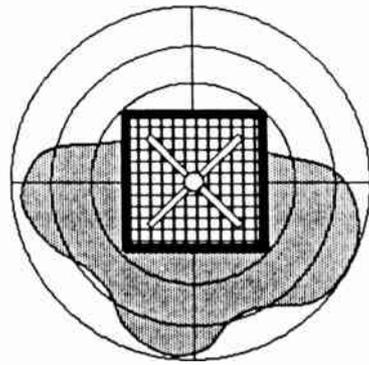
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Reader Service #140

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# The Downlink Side of Satellite Remotes

by Mike Callaghan

Last month, I suggested that remotes by V-Sat using Ku band satellite transponders could be a way to achieve high quality audio without the problems often caused by working through the telephone companies.

I talked about my experience in using satellite remote equipment, which provides digital quality and keeps transmission cost-effective. Part of the key is the introduction of new technology from companies such as Comstream, which markets the V-Sat equipment.

The remotes I've worked with also use MUSICAM digital audio compression provided by Corporate Computer Systems, a MUSICAM licensee. Audio compression is one of the ways to keep bandwidth needs from going out of reach.

Many stations that want to do satellite remotes or similar applications using new digital phone services such as Switched 56 and ISDN turn to California Digital, a new company which specializes in setting up such services, even turn-key setups including FCC license filings.

California Digital is an authorized vendor for both Comstream and Corporate Computer Systems. You might think you would pay more money going through a service company to either lease or buy the equipment, but such is not the case here. California Digital offers all the equipment needed for a satellite remote for the same costs as if you started from scratch.

And if it's an important setup and your job is on the line, you may welcome the experience and assistance.

But just so you understand what's involved, let's continue our discussion of the components which make up the system. Last month we considered uplinks, so let's now take a look at downlinks.

### Downlink Primer

Downlink antenna size, like the uplink, depends on the service and satellite power used. All things being equal in a single point-to-point shot, the size of the uplink and downlink antennas don't matter as long as they

have enough gain between them to do the job.

For a network, the smallest downlinks possible make economic sense. Also, the "squaring-out" of the transponder may mean that you'll end up with more power than you need. If this happens, you may as well save money with smaller dishes at the downlink because the power will be there anyway.

If the fade margin is low, larger receive antennas may make sense, even though they cost more initially. By incurring a larger capital cost at the start, you will save money each month by reducing the satellite capacity required. (When buying dishes, the antenna cost increases as almost the square of the antenna size.)

For a simple downlink, the downlink electronics can be a unit as small as a 3-1/2" rack panel. It contains the downconverter, the digital audio encoder/decoder and the RS-232 port to control the receive frequency and to send the operating parameters to a computer or modem. A combination uplink/downlink (as used for remotes) will fill a 10-1/2" rack space.

The audio interface to the downlink is another panel with the appropriate meters and amplifiers to get the audio in and out of the system. Finally, a second computer and software or a modem and phone line is needed to control the downlink.

Fixed satellite facilities can be controlled either by a



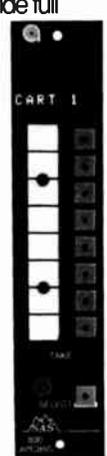
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APC-88      CPI-80

## Radio Satcom

... continued

### The Downlink

local computer using the serial port or from another location through a modem. Carrying this further, a network can be controlled from the hub simply by providing each downlink with a phone line and modem so the hub control can call each downlink and log into the receiver to check that location's performance.

### Getting Started

Building and operating a V-Sat system is a sort of balancing act; you have to consider your specific application and balance that with the satellite power you want to use, the dish size, the audio bandwidth, and the weather attenuation safety margin that makes you comfortable.

All these variables come together in a rather complicated set of calculations called a Link Budget. This is usually one or two sheets of printout from a computer.

The link budget serves many purposes. It calculates the azimuth and elevation setting for the uplink and downlink dishes. And, given the type of digital encoding and forward error correction you want to use, it returns information about the amount of power and bandwidth you'll require from the transmitter.

The information you enter into the link budget includes:

- The size of the uplink and downlink dishes.
- The digital bandwidth your digitally-compressed audio requires for transmission.
- The noise figure of your receiving system.
- The amount of power the satellite radiates to your downlink site.
- The sensitivity of the satellite receiver toward your uplink site.

In turn, the link budget will provide you with the amount of power you will have to use to produce your required safety margin.

Among the questions you'll be asked when you request a satellite channel are the amount of power you

need and the bandwidth you'll occupy. Transponders have a limited amount of each. A high-power, low bandwidth application may easily fill up a whole transponder. Or, a low-power, super-wide bandwidth program could also require one.

The operator tries to "square-out" each user for optimum transponder utilization. If you need 1% of the available power, the operator will usually charge you for 1% of the bandwidth as well, and vice versa. So, you may as well square up your use, also.

The bandwidth you'll buy depends on whether you're using mono, stereo, or bi-directional mono. Consequently, the power you specify will be either what the link budget says you need as a minimum, or whatever it takes to "square out" the channel, whichever is more.

### Setup on Site

Before you commit to doing a satellite remote, it's a good idea to visit the site with a compass and make sure you have access to the satellite from that

*(continued on page 40)*

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## The Downlink

location. Your preliminary link budget will tell you the azimuth and elevation angle and a compass will get you aimed in the right direction.

All you need do is make sure a building or other structure won't be blocking the path. Remember that compasses can lie, especially when close to large metal surfaces.

Upon first arrival for the remote, you set up the satellite dish and electronics. Included in the satellite package is a sampler that will pass 60 MHz downconverted RF to a spectrum analyzer.

The satellite dish itself is assembled on a small tripod, and the levelling screws on the legs are used to level the mount. The radio head is fastened to the front of the dish and the electronics are connected. Then the dish is swivelled up to the proper elevation, as found on the link budget.

Power is applied to the spectrum analyzer and the satellite electronics. Sweeping the dish back and forth through the computed azimuth should make the satellite signals appear on the spectrum analyzer. Once the satellite is located, the spectrum analyzer is used to peak both the azimuth and elevation for the highest peaks on the screen.

After connecting the laptop computer to the RS-232 port on the electronics, the correct transmit and receive frequencies and power levels are typed in and the satellite performance program is used to display a bargraph of the received signal.

This is easily visible from some distance, and the bargraph is used to fine-tune not just the azimuth and elevation, but also the polarization of the radio head.

A local mic preamp and monitor speakers built into the electronics case can be used to call the station and to use the satellite link itself to compare notes and make any adjustments. This feature is invaluable in locations where there is no reliable telephone service.

If the other end of the link is unattended, an internal modem in the laptop can be used to call it and check the performance figures remotely. Once the link is up and established, you can then assemble the audio equipment at the remote site itself.

### Start-Up Caveat

Many of the parts you need to begin are available from a number of vendors. If you have a desire to pick and choose you will have a number of important and costly decisions to make. The interpretation of a full link budget is a complex exercise.

There are a number of places you can turn to when you start your exploration of remotes by satellite. There are satellite vendors such as Prodeline and Scientific-Atlanta; but they may only wish to deal with large-scale users.

Satellite time can be investigated by contacting GE Americom and GTE Spacenet.

But even with the help of others, you have your work cut out for you in calculating link budgets, setting up computer interfaces and obtaining the necessary licenses. In general, you can plan on spending somewhere in the neighborhood of \$12,000-\$15,000 just for the radio head and electronics alone.

In addition, some of the components we've used aren't readily available yet. As an example, we had to build our own audio interface panel to connect the consoles and monitor systems to the satellite unit.

This needn't be complicated - we used a pair of VU meters, some off the shelf line amplifiers and a switching arrangement to display the various levels. We also included a microphone preamp so we could talk through the uplink without setting up the console.

Many first timers opt for the turn-key service I mentioned before from a company like California Digital. They handle everything from link budget to FCC license to actual setup. Also, the company has developed its own interface software and electronics and, for remote vehicles, supplies an automatic roof mount antenna that will rotate to and lock on a satellite automatically.

As you can see, all these decisions carry a lot of responsibility, and making a mistake can be a rapid introduction to a new career. I would encourage anyone who has never at least participated in a satellite remote setup, if not successfully done one, to not go it alone.

Mike Callaghan can be reached at KIIS-FM at 213-466-8381. California Digital can be reached at 805-523-2310; Comstream at 619-458-1800; and Corporate Computer Systems at 908-946-3800.

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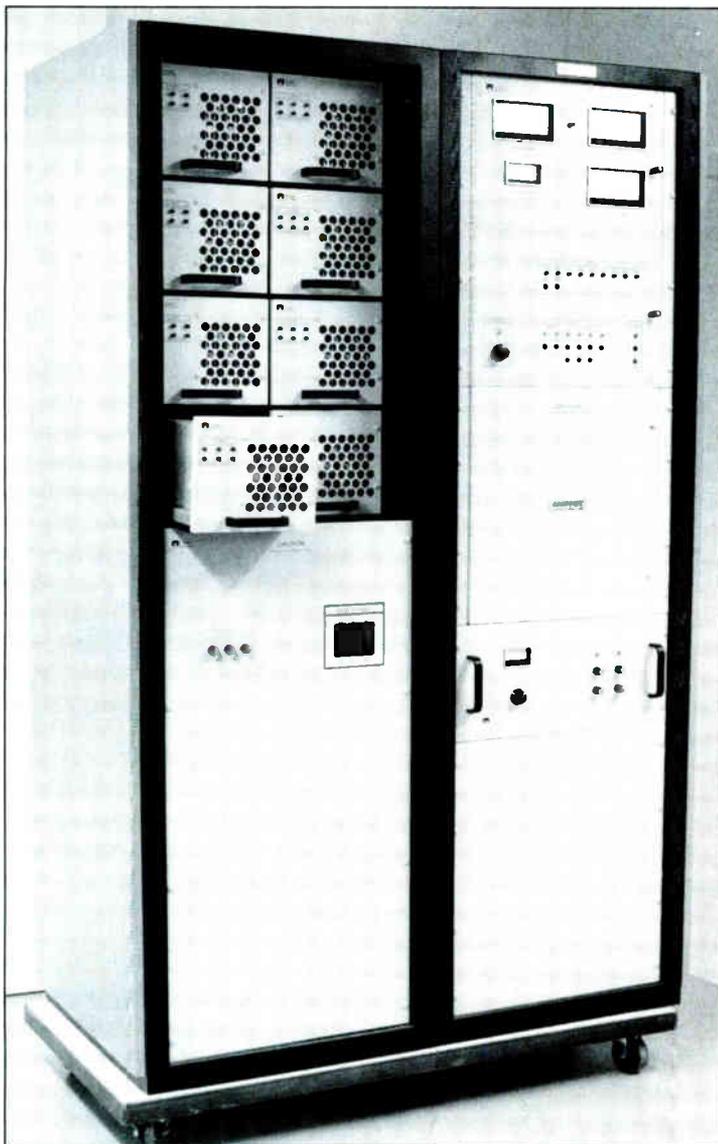


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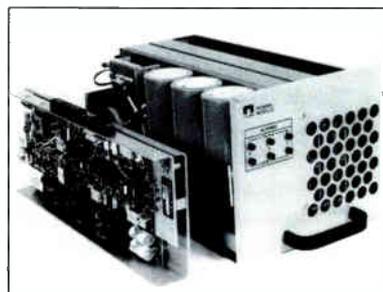
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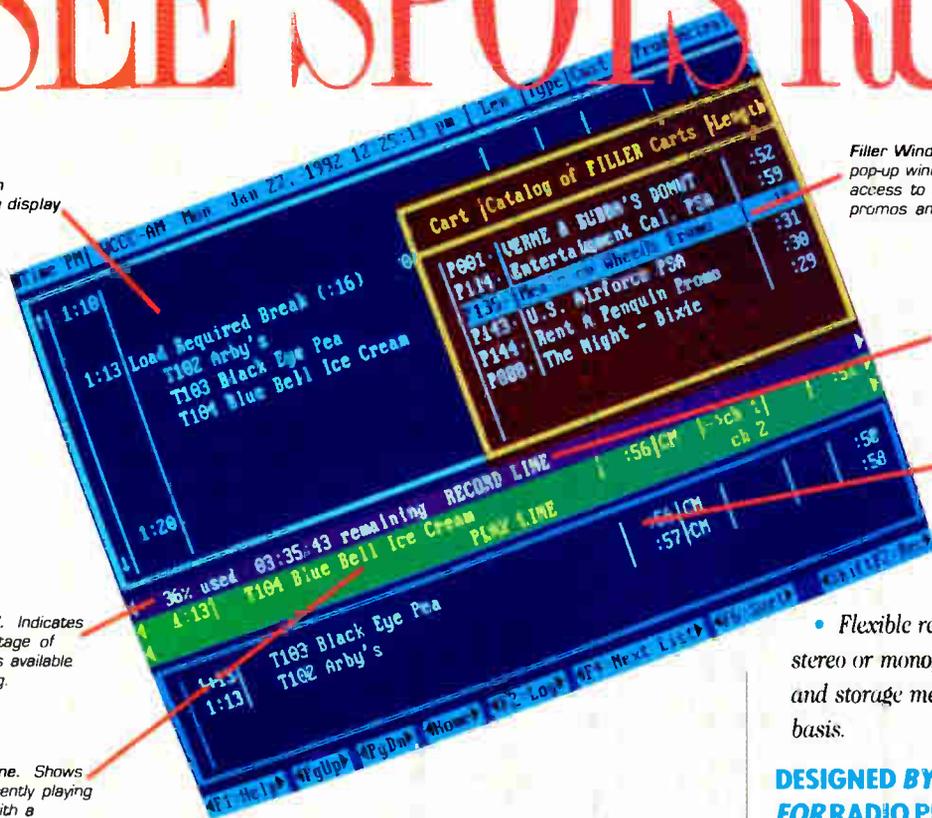
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Reader Service #144

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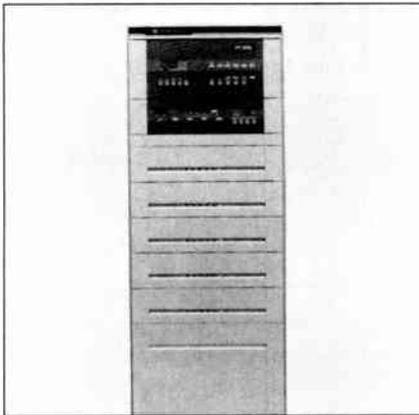
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## Las Vegas Convention Wrap-Up

By Judith Gross

### Hot Product Intro Highlights

**Harris Allied** became the cornerstone of the new Radio/Audio hall with a variety of product intros. A complete surprise was the CDR600, a stand-alone compact disc recording system from Marantz. It not only solves the problem of partial disc recording by allowing uncompleted discs to be played in any Orange Book CD player, but at \$7500 it has cut the price of CD recording systems in half.



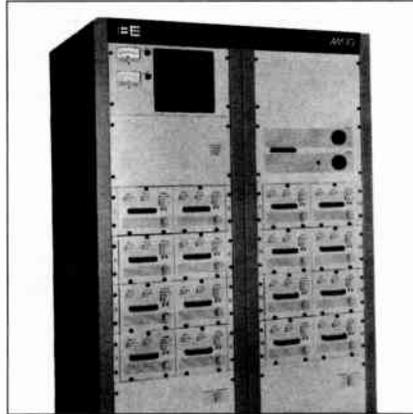
*Harris PT 5FM Solid State Transmitter*

Also new from Harris is the Platinum solid state FM transmitter line. These new transmitters are available in 2, 4 and 5 kW models and feature interchangeable 1350 watt solid state FM modules with rugged FET devices and a low maintenance design.

New products from other companies featured in the Harris Allied booth were the Autogram Mini Mix 8, a compact broadcast console; the Pro-Audio Fiber fiber optics receiver and transmitter from T-Tech Engineering; and the DigiStor from Henry Engineering, which records up to four minutes of audio in a digital memory for interface to a telephone line.

**Broadcast Electronics** also ventured into the realm of solid state transmitters. For AM the line includes 1, 5 and 10 kW models and features state of the art Class E amplifiers and power supply technology. There is also a pat-

ent-pending Star combiner network to provide for uninterrupted power without using a dummy module. But the most unique feature of the new AM line is that they offer C-QUAM AM stereo built right into the transmitters, eliminating the need for an add-on exciter.



*BE Solid State AM10 Transmitter*

On the FM side, BE also introduced a 1 kW transmitter, but the company maintains that it will wait until the cost-efficiency ratio is more favorable before extending the solid state FM line into higher powers.

**Nautel**, which pioneered the development of solid state AM for broadcasters, also introduced a solid state FM line at the show. Nautel is offering 4, 7 and 10 kW solid state FMs and has designed the transmitter to be frequency specific and tuned the drive and switching output for maximum efficiency at an affordable cost.

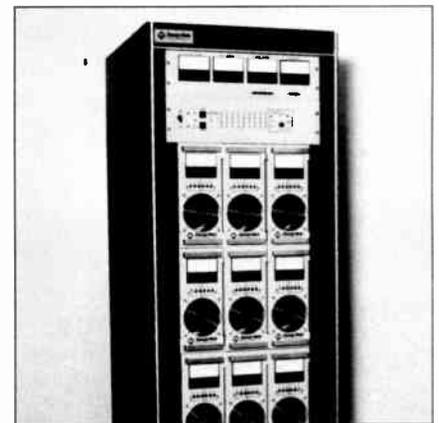
**QEI** also introduced a solid state FM transmitter, but one with an unusual twist. The model QSS-10,000 is a 10 kW transmitter that is liquid cooled for heat dissipation. There are redundant RF modules and power supplies and the low cost modules can be changed while the transmitter is operating. Because of the unique cooling, QEI is promising a long life for this model,



*QEI Liquid-Cooled Transmitter*

and also, without the need for cooling fans, calling it the "quietest transmitter in production today."

One other company which ventured into the solid state FM marketplace was **Energy-Onix**. The company introduced the Legend series in medium power ranges of 1-4.5 kW. The line is designed with thermal protection and uses Motorola MRF151G MosFET power transistors and support circuitry.



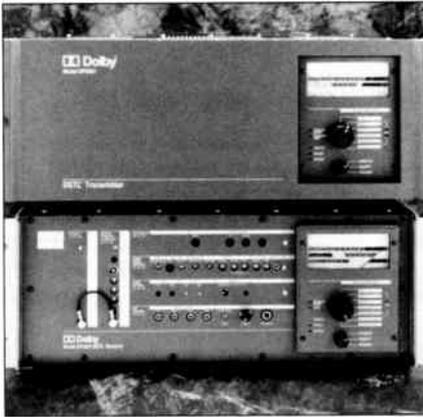
*Energy-Onix Legend Transmitter*

Digital RF was another hot area for product introductions. Following the success of digital STLs already enjoyed by Moseley, **Dolby** unveiled its new digital STL. The DP 5500 series offers

*(continued on page 44)*

## Las Vegas Convention Wrap-Up ... continued

left, right, SCA and voice channels and features 44.1 kHz sampling. Dolby AC-2 audio data compression is used for spectral efficiency.



*Dolby Digital STL*

In a similar vein, **TFT** introduced its DMM-92, a digital encode-decode system for STL use. It requires only 75 kHz of composite baseband for use on existing STL systems without modification. Four digital channels provide left, right, two SCAs and transmitter remote control. The DMM-92 is compatible with most of the better known data compression algorithms, including MUSICAM, APT-X, Dolby and others.



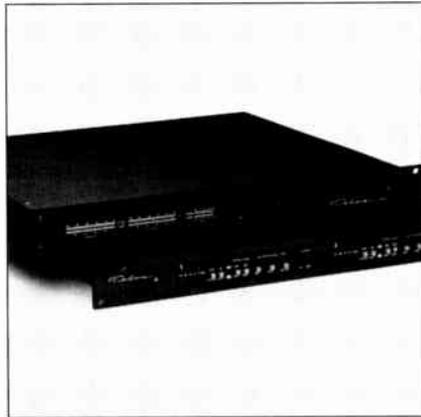
*TFT DMM-92 Digital Encoder/Decoder*

Another company with an audio data compression algorithm has entered the point-to-point RF distribu-

**Radio Guide Page 44**

tion market as well. **Audio Processing Technology** introduced the DSM100 two-channel Digital Audio Transceiver. It uses APT-X compression at a 4:1 ratio to allow transmission of full fidelity audio. The DSM100 is designed specifically to be used with ISDN phone lines to send CD quality audio anywhere in the world.

There were several major unveilings of digital telephone products. In a mock wedding ceremony, **Telos** introduced the 100 Delta, a digital hybrid with full duplex performance and dual, mixable inputs. The company also showed the new One Plus One which offers two digital hybrids in a single rack unit enclosure. The two can be used individually or as part of a multi-hybrid system.



*Telos One + One*

**Gentner** also added to its telephone hybrid line. The company introduced the Digital Hybrid I, a digitally processed hybrid which features Record and Cue functions, quiet line switching, and offers a cost advantage over the company's Digital Hybrid II.

Blooming like desert flowers after a rainy spring, new digital audio storage and editing stations were on display almost everywhere you looked. It seems that nearly any company with a

software guru and some audio savvy is eager to bring a product to market at varying costs and complexities. The differences are subtle: Touchscreen, mouse or keyboard? Mac or DOS? How about windows? Dynamic audio graphics, and if so, in what colors? Two noteworthy introductions in this area were at the top and bottom rungs of the market ladder.

At the top, was the ADX from **Pacific Recorders & Engineering**. The audio production system is a computer-editor and console automation system in one. The workstation, or computer, is Mac IIci with 5 Mb RAM and 52 Mb hard drive. It also features a 1.6 Gb drive for four track/hours storage; samples at 44.1, 48 and 96 kHz frequencies; and has eight channels analog in and out (expandable to 16 and 24).

The MixStation is an 8-input automated mixer designed around a PR&E ProductionMixer console, offering the same functions found in the company's other console designs. In addition, the ADX system offers Snapshot automation to recall fader settings for each track prior to playback. Dynamic automation allows real time adjustment of parameters, however.

The concept basically adds digital editing-storage capability and automation to an analog multitrack production console.



*PR&E Production Mixer & ADX*

## Las Vegas Convention Wrap-Up ... continued

On the other end of the pricing spectrum is The Card from **Digital Audio Labs**, featured in the Broadcast Supply West booth. The Card is just that — a circuit card add-on to any DOS-based or IBM clone PC. It turns a PC into an audio editor and records full frequency (44.1 kHz) audio onto a hard disk. Figure 10 Mb of memory for every minute of 44.1 stereo audio.



Digital Audio Lab's The Card

The Card displays a snippet of "audio" on the screen and allows two-track editing of music, voice or sound effects, making it useful for spots and promos. It can also store small pieces of audio in files and recall them instantly and repeatedly by pushing function keys. Throw away those morning zoo carts! One attractive feature of The Card is its price: just under \$1000. Add that to the plummeting cost of PCs and even a station counting every penny ends up with a digital audio editor that won't break the bank.

Also at the BSW booth, was a new line of on-air and production consoles and furniture. The Audioarts line, from **Audioarts Engineering**, offers many of the fine features as its near-cousins manufactured by parent company Wheatstone. But since it's offered exclusively through dealers, the Audioarts line offers different choices for different pricing needs.

**Wheatstone** itself unveiled a "Cadillac of consoles" in a manner of speaking. The company took all of the state of the art and super high-tech electronics it had developed in designing other consoles and put them into the A-6000. It's an open-architecture that allows for customization in a non-custom-ordered console. All switching is electronic and uses FET front-panel switches.

**Auditronics** also had a new console offering, the 850 Series. It is designed to be used either as an on-air or production console and can switch from one to the other with only a little adjustment. Features include either signal processing or input pre-selection above and electrically in-line with each input module, and a user-programmable logic control system.

**Comrex** unveiled the Talk Console, a compact mixer combining one or two phone lines with two mic channels. The second channel can be fed with CD or tape and the second phone line will work with the handset of a PABX to allow call-screening. The Talk Console has two self-adjusting hybrids and mix-minus circuitry. A Cue position allows the host to talk with callers off-air and the caller hears the program while on hold.



Comrex Talk Console

In the area of cart machine replacements, **Broadcast Electronics** followed the lead set by Fidelipac and showed a digital cart machine using 3.5-inch floppy discs. The technology in BE's Disc Trak is virtually the same as in the Fidelipac Dynamax DCR 1000. Digital audio compression allows digital audio to be recorded onto a floppy disc with storage time varying with bandwidth. BE is offering a 3-deck unit with each deck capable of independent operation.



BE Disc Trak

**International Tapetronics** Corp.'s Digital Audio Operating Platform, formally Digidcenter, is still in development, although the company did have a pre-production model on the



ITC Digital Audio Repeater

(continued on page 46)

## Las Vegas Convention Wrap-Up ... continued

NAB exhibit floor. For a different type of digital audio application, however, ITC introduced the DPR-612 Digital Program Repeater. The Repeater can handle up to 15 monophonic programs in varying lengths with a storage time of six to 12 minutes, depending on sampling rate. The memory is battery-backed-up solid state. There are two active balanced line level program outputs and the input level is active balanced and mic/line selectable. The DPR-612 is ideal for repetitive audio and the digital memory eliminates the degradation of quality through constant playback.

CD players have become the backbone of most station playlists these days. Now **Pioneer**, well-known for consumer audio gear, has entered the broadcast marketplace with the CAC-V3000 pro CD changer. This is a 300 disc automatic changer which uses a double CD player design for seamless switching between discs. But you can daisy-chain 32 of them together to handle up to 9600 discs online at a time. You can control the changer through RS-232C or RS-422A ports and program it for a fully automated set-up or operate it manually. In addition, there is a variable speed playback feature and both a digital and an analog output.

In processing, digital has taken center stage recently with introductions from AKG-Orban of the Optimod 8200 FM; Cutting Edge with the Unity 2000; the Gentner Lazer and Audio Animation's Paragon. But there were developments of a non-digital nature as well.

**Inovonics** introduced the David, an integrated processor stereo generator for FM featuring stereo audio processing, including dynamic compression

and peak limiting; digital synthesis of pilot and subcarrier for good separation and freedom from drift; built-in combining for SCA or RDS and easy set up.



*Inovonics Sentinel*

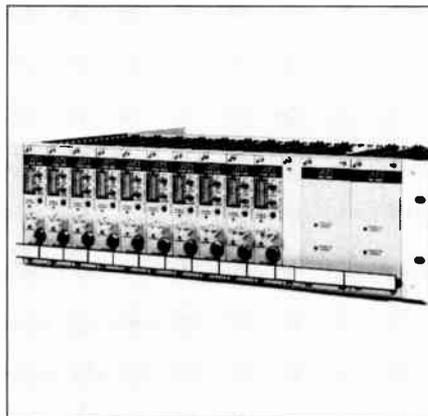
To take the guesswork out of off-air program monitoring, Inovonics also showed the Sentinel program audio monitor. It analyzes, evaluates and displays key parameters of any program and allows comparison with other signals in the market. Some of the features displayed are total modulation, stereo sum and difference, dynamic range and stereo balance and image. The Sentinel allows for 24 station presets, which may be mixed between AM and FM.

Two products were unveiled by **Circuit Research Labs**. The Modulation Signature FM limiter/stereo generator features stereo sound field enhancement which lets you expand stereo separation of program material; low frequency bass enhancement; fully adjustable limiting/clipping control and absolute over-modulation control.

The Real Time Event Sequencer from CRL has a microprocessor-controlled system which lets a station store and sequence up to 200 events. Each event can control up to eight contact closures over a seven day time period.

Clock and program menu readouts allow easy programming capability. The RTES has a built-in long-life lithium battery. The battery life can be checked on a display, or the battery function can be disabled if desired. No more waiting around to throw a switch or turn on a piece of equipment.

Two new accessory products were introduced at the show by **Audio Technologies Inc.** The LA-1000 modular line amplifier system allows a user to plug in up to ten single or dual line amplifier modules and two power supply plug-ins. Features include screwdriver front-panel level controls with knob adjustments available as an option, and a headphone monitor jack; also backup, alarmed power supplies.



*Audio Technology's LA-1000*

ATI also showed the new PB2X8 Pressbox/Mic Distribution System. This handy box eliminates that press conference podium clutter with just a single or back-up pair of mics. It features two low noise mic/line inputs, phantom power and a headphone output.

From **RCS** comes a way to log audio and even play it back while it's still being recorded. The RCS tracker lets a station record up to 14 days of

# NAB 1992

## Las Vegas Convention Wrap-Up ... continued

audio onto a single DAT cassette. It can record up to three sources simultaneously and provides random access to any logged segment – even by phone – without interrupting the recording process. The Tracker is set up as a turnkey system with IBM compatible 386 computer, DAT drive and DSP signal processing. The average playback access time is 35 seconds.

Another unique logging system comes from ESE. The Seven Channel Audio Multiplexer encodes up to seven channels of audio for recording onto the video channel of any VCR. The decoder allows playback selection via a front panel thumbwheel switch.

ESE has also upgraded its audio level indicators. The ES-214 is the

company's Mono "Digital" Audio Level Indicator. It is now available in a horizontal version (ES-215); 1-3/4" X 19" rack mount version (ES-215P); stereo or dual mono rack mount (ES-215P2); dual stereo version rack mount (ES-215P4); Mono "Digital" Audio Level Indicator in a meter mount package (ES-216) and rack mount (ES-216P), stereo or dual rack mount (ES-216P2) and dual stereo (ES-216P4) versions of the same.

To help keep both the FAA and FCC happy, **EG&G Electro Optics** unveiled its new FlashGuard line of aircraft warning beacons. The unique design focuses light beams using parabolic mirrors rather than Fresnel lenses to be more efficient and reduce opera-



*EG&G FlashGuard*

tion and maintenance costs. The line includes the 2000 white strobe beacon; the 2000 Red, the first FAA-certified red-flashing beacon that uses a red strobe rather than red incandescent lamp; and the 3000 full integrated red and white warning beacon.

### Views From NAB 1992



# A Visit To South Mountain

By Judith Gross

It's the largest city park in the largest hottest city in the U.S. And with the most number of Class C FMs – count 'em, 14 – on a single site, it's a wonder that there are as few problems as there seem to be.

The site is South Mountain Park in Phoenix, Arizona, elevation: 2880 feet above the flat desert floor of this number 22 market serving two to three million listeners and growing.

The ride up the treacherous switchback road one sunny day after a rare rainy spring was a panorama of colorful desert flowers and giant saguaro cactus. The saguaros have been around a lot longer than the radio towers which now dwarf them. The giants don't even grow an arm until they are seventy-five years old.

The mountain summit is an endless row of communications towers of all kinds, with the highest some 270 feet tall. The 14 Class Cs share space with five UHF and five VHF TV stations plus numerous translators, two-way, cellular and microwave operations.

The South Mountain Class Cs are: KOOL, KMLE, KKFR, KESZ, KPSN, KBRY, KDKB, KOY, KKLT, KJZZ, KSLX, KMXX, KNIX, and KUPD.

### RFR Alert

All stations have about 1600-1700 feet HAAT and good clear coverage of the downtown Phoenix area due north. A large electronic fence surrounds the site, not to keep out vandals, although one would-be tower jumper posed a problems a few years back, but to protect park visitors from RF radiation exposure.

A 1986 study by Hammet & Edison pinpointed the highest concentrations of RFR and orange paint was originally used to identify the areas where lingering could prove hazardous. The paint has been replaced by

signs cautioning against spending too much time in one particular place outside among the transmitter shacks.

But although it is a public park, RFR exposure on South Mountain is more of a problem for the engineers than would-be sightseers.

"If I spend too much time there I can feel it," said Eric Schechter, CE of Shamrock's KMLE. "We have a Holiday meter, and inside the buildings we're well shielded. But nobody spends more time here than they have to."

### Brutal Climate

RFR is only one small problem posed by the unique conglomeration of towers in a desert climate. Take the heat, for instance. With direct sunlight and temperatures that can exceed 110 degrees in the summer, air cooling is critical, not just a luxury.

"Any station has to have at least a redundant air system. In the building with KOOL and KMLE we have five systems. If you don't have at least two, you'll be in trouble," noted Jay Bretlinger, whose ABE Services does engineering for Adams stations.

Schechter related how his assistant chief, Andrew Heim, recently found a naked man, wrapped in bubble wrap from spare parts boxes and sleeping inside the standby transmitter shack on Shaw Butte, another Phoenix mountain.

The intruder had used an empty coke can and managed to fill it with condensation from an air conditioner for liquid, so he wouldn't die of thirst. The water supply was in the next locked room, but the cruelty of the desert can lead to some ingenious survival techniques.

"We all keep five gallons of water at the sites and I keep five extra in my truck," said Schechter.

### Dusty and Dry

But the heat and dryness cause other problems an engineer in, say, the northeast, might not have to deal with. There's extra maintenance to be done.

"The dryness causes electrolytic caps to dry out, and the radical temperature shift from hot daytime to cool night causes metals to expand and contract. You have to check your connections all the time," Schechter explained.

Then there's the dust, which we found out about first-hand the night before the visit when a dust storm raged and sand-blasted eyes, ears and throats.

"The dust is so fine it can actually go through most filters. We use two-inch pleated filters, but you can get dust inside your PA tube," explained Bretlinger. "You have to have closed air systems, and that can be an added problem because it can get as high as 180 degrees inside.

"The tremendous heat inside can knock your transmitter out of tune. And sure enough, one cooling system will go and you won't know it, until the other one goes and then you have trouble on your hands," Bretlinger said.

### Desert Pests

The desert brings other annoying and occasionally life-threatening problems. Desert wildlife seek a refuge from the midday sun, and cool, dark transmitter buildings provide ideal shelter. We shuddered when KJZZ's Dennis Gilliam crushed a brown recluse as it skittered from under his transmitter.

But Bretlinger had a more interesting near miss. He entered his transmitter shack one afternoon to check out what sounded like pressurized gas escaping. The hissing sound turned out to be a four-foot rattler behind the door.

... continued

## A Visit to South Mountain

"I got out fast and called a snake-catcher to come up and remove it," Bretlinger said. But no, he added, he doesn't keep a snake bite kit handy. "The snake catcher says if you get bit in a muscle or fatty tissue a snake bite kit would help. But if he gets an artery or major vein, just cross your arms and forget it."

As if those problems weren't enough to fill up many an SBE Chapter meeting with colorful tales, Bretlinger explained one more hazard from the heat on South Mountain, or any desert park – broken glass.

"In direct sunlight it acts as a magnifying glass and a can start a fire in the dry brush. One time the whole top of the mountain caught fire and kept us from getting to the sites."

Then there was the time that it snowed on the mountain, but not down in Phoenix. Icing caused some problems for equipment which normally has no need for de-icing gear most of the time. But Bretlinger said the engineers consoled themselves with a rare snowball fight.

And don't forget the flash flooding that can render impassable any road with dips – and there are many on the way to the top of South Mountain – especially during the Phoenix monsoons.

### Infamous Intermod

But most of the time, South Mountain engineers have the normal technical problems to deal with. One of the most persistent is intermod distortion and interference, caused not only by the proximity of the 14 Class Cs to each other, but by the addition of other communications transmitters and tow-

ers, some of whom are not held to the stringent guidelines imposed by the FCC on broadcasters.

"The problem doesn't just affect our main paths, but our STLs as well. Everybody up there has experienced some intermod problem over the years. For a long time, the newest station on the site was responsible for solving any problem it caused," said Bretlinger.



*Thousands of feet above Phoenix ...*

Many of the engineers have already installed bandpass or notch filters or product eaters to take care of the intermod problem, but the engineers say it's hard to get the non-broadcasters to take the problem as seriously. There's talk that the FCC may actually monitor the problem, but there's been no formal word yet.

Other concerns the South Mountain Users Association deal with have to do with using a municipal park for commercial stations. "We just finished negotiating a new 20-year site agreement with the city, and a lot of what we talked about has to do with future growth at the site," explained Schecter.

It seems the city would like to see all guyed towers replaced with self-supporting towers, and would also like to have everybody on one tower, or as few towers as possible. The users have agreed to consider the city's aesthetic concerns when making changes.

The city itself, however, would be wise to consider the 14 stations and other users to be a valuable local resource. At \$1000 per commercial user license fee, the total input into city coffers is not bad.

And despite the problems caused by desert heat, dust storms and unwanted critters, there is one readily apparent benefit of having the largest number of radio stations on a single site: the spirit of cooperation and camaraderie it fosters among the engineers.

"There's a healthy degree of cooperation. We coexist because we need to; we need to cooperate to be competitive," Schecter said.

Bretlinger agreed. "We try to help each other out. If someone needs a part he can get it from another engineer. Someday you may need the favor returned."

*Next Month: New facility & format spells success for major market AM*

# How To Improve Your Telephone Sound

by Steve Church

We observed in last month's article that announcer voice distortion during call-in segments is caused by poor trans-hybrid loss. While trans-hybrid loss is a key indicator of overall telephone hybrid performance, its characteristics can be confusing.

As the announcer speaks, his or her voice travels through the hybrid's phone line output, to the caller and back to the studio into the hybrid's telephone line input.

Trans-hybrid loss is that portion of the announcer's voice signal that leaks through the hybrid from its audio output. This "leakage" is distorted and phase shifted after its long journey. Ideally, the output of the hybrid should consist of the caller audio only.

In a broadcast studio, the announcer audio on one console input is mixed with the hybrid output on an-

other input to create the "on-air" mix. When hybrid "leakage" is combined with the clean announcer audio, a "hollow" or "tinny" sound is produced as some frequencies are more effected by phase cancellation than others.

The greater the trans-hybrid loss, the less announcer audio that leaks into the hybrid output and the less announcer voice distortion.

Last month we examined problems that cause problems with caller and talent audio. Now, let us examine two more sets of problems.

### That Awful Feedback

Feedback usually becomes a problem in a situation where there are low or widely varying phone line levels. When it is necessary to monitor calls with open loudspeakers, rather than through headphones, and you are using a hybrid, there can be a feedback path created by a hybrid's imperfect cancellation.

When line levels are low, the monitor gain must be increased in order to hear the caller at reasonable volume. With more gain in the loop, feedback is more likely.

According to an AT&T study of the nationwide U.S. phone network conducted in the early '70s, the level one can expect from a typical phone connection is -17dBm. The AT&T engineers also found a wide variation from call to call, with long distance calls being generally lower in level than local connections. That was when much of the network was analog.

However, now, since digital "bits" are "bits," the digitization of the phone network since the study was conducted should cause levels to be consistent, right? Wrong! The effect of digitization seems to have only been to

divorce the relationship of distance to level. In our office, we routinely observe that long distance connections are better than local ones.

There are still plenty of sources of level variance to cause serious problems. Level changes occur at points where the analog meets digital in the phone network and have a variety of other causes ranging from poorly designed PBXs to those \$7 discount drug store phones.

### Level Variations

Much of the problem likely originates at the source, the caller's phone. The FCC spec is quite loose and ambiguous, allowing manufacturers wide variation in output level. Since the vast majority of phones have no AGC (although some PBX phones, such as the

*(continued on page 52)*

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World Radio History

### Improve Your Telephone Sound

AT&T Spirit, do), the mouth-to-mic difference and talker loudness can have dramatic impact.

Interestingly, this is less a problem in many European countries because phones have to meet a spec which involves sending audio into a receiver from an "artificial mouth" and checking the line to see if send level is within range.

In this country, I've heard from some poor souls who are stuck with lines that produce levels ranging from -35dBm to over 0dBm! Of course, you can take your problem to the phone company.

Unfortunately, varying levels are a difficult problem to resolve because there are so many places where trouble can arise. You may be able to help locate the problem by asking your staff to write down the calling ex-

change prefix when a bad call is encountered. Perhaps a pattern will appear, and the phone technicians can be guided to the problem source.

In the case where levels are consistently low, the "local loop" from the Central Office to your site should be checked for loss. If it is out of spec (8 dB maximum, for most), the phone people may be able to adjust their equipment to increase gain.

A solution more in your station's control is to use a high-performance digital hybrid. The better the trans-hybrid loss, the greater the feedback margin. Additionally, a well-designed "ducking" function, which carefully inserts loss into the inactive speech direction, can be valuable to this end. Pitch-shifting can be another aid, as it prevents sustained feedback from occurring.

### Other Answers

Some phone problems are those caused by the studio set-up itself. To improve feedback margin, you want the least possible coupling from the hybrid output to the input. Anything in the path is suspect.

To avoid making the problem worse, you should not use any mic processing for the audio which feeds the hybrid. When the announcer pauses, the AGC increases gain in the loop and the gain increase triggers feedback.

If you must use AGC, make sure it has a gate which can be set to reduce inappropriate gain increase. Good hybrids have "smart" level control on the input which is arranged in such a way that the AGC gain is frozen when required to keep feedback down.

If there is an AGC on the caller audio, watch for the same problems. Pay attention to acoustics. Use a directional mic and position it so that the phone monitor speaker has the least possible coupling to it. Of course, sound deadening material applied to studio walls can help.

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... continued

## How to Improve Improve Your Telephone Sound

When all else fails, in very difficult situations, a notch filter could be used at the most offending frequencies.

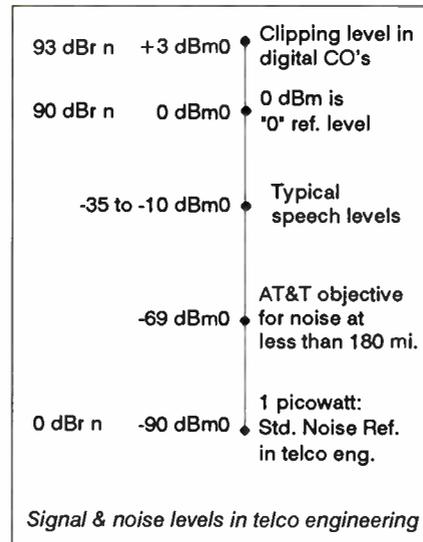
### Multiple Callers

Other problems can arise when multiple callers are being conferenced. Often, the economical "brute force" conferencing method, where lines are hard-paralleled, makes for trouble.

The on-air audio will probably be OK, but the caller-to-caller audio level is totally at the mercy of the quality of the phone network. Recall that levels may vary from 0 to -35dBm. Multiply by two to account for both conversation ends, and you can see why callers could have trouble hearing each other.

You can solve this one by using multiple hybrids, with one for each caller. That way, it is possible to insert gain (with AGC, if desired) in the caller-

to-caller path. It's also preferable to have a console fader dedicated to each caller so that levels can be ridden separately as required.



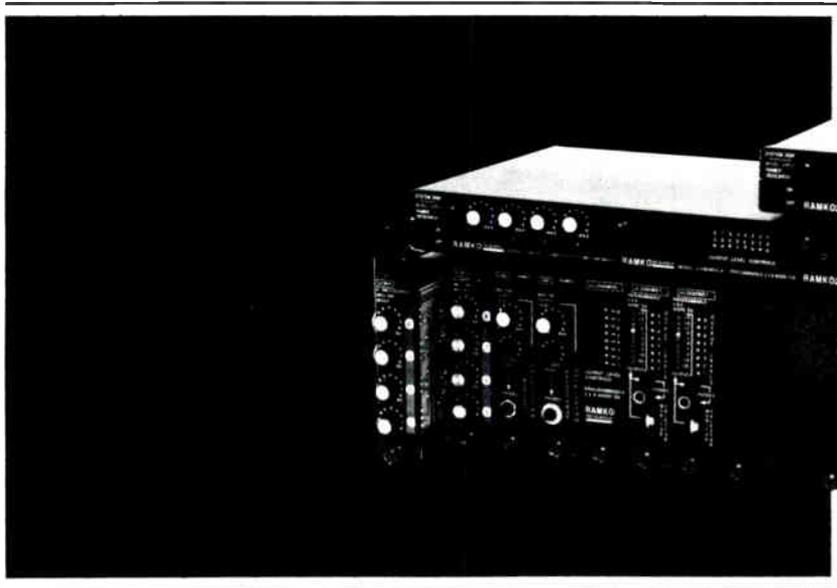
You can insert as much total gain as you have total trans-hybrid loss. If you try to have more than a gain of unity, "singing" can occur as feedback results from the hybrid-to-hybrid coupling. The better the hybrid, the more gain that can reliably be added and the less the possibility of singing.

With new understanding of your station's phone and call-in problems, you should be able to settle on a solution that fits your individual needs, from rearranging your control room set-up to eliminate feedback, to adding multiple digital hybrids to a multi-caller program.

Steve Church is president of Telos Systems which specializes in the manufacture of telephone-to-broadcast interface equipment. Steve can be reached by phone at 216-241-7225 or fax at 216-241-4103.

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