

NAB
Wrap-Up

Radio World®

Vol 14, No 9

Radio's Best Read Newspaper

May 9, 1990

Atlanta Hosts Lively NAB

by Charles Taylor

Atlanta GA It was a show where we aimed forward with the formal bow of digital radio transmission; where we witnessed the car radio of tomorrow, capable of tuning by format and where we looked back with honor at several veter-

rans of radio.

It was also a show where scads of Grateful Dead fans camping out for a three-day concert nearby wandered in tie-dye, creating a near-grotesque but amusing contrast to the more contained appearance of broadcasters.

The National Association of Broad-

casters 1990 convention and engineering conference, held here 31 March to 3 April, also boasted its highest attendance ever—50,443—but apparently a low concentration of radio attendees, tainting what generally was otherwise a smoothly executed, well-regarded show for equipment manufacturers and the technically oriented.

"We were really pleased. We received more contacts than at any other NAB show," said Gary Crowder, national sales manager for Gentner, which set up its

booth in a TV-related section of the hall when sufficient space wasn't available with other radio companies.

Slow on the radio side

Crowder added, however, that he noticed a distinct difference in traffic when he ventured to the radio area. "It seemed slow over there. Some of the booths had no people in them."

"We did notice fewer radio chief engineers as a percentage," added Neil

(continued on page 12)



NAB trade show attendance was high, although traffic was lighter on the radio side.

TV Marti Draws Fire

by John Gatski

Atlanta GA The United States Information Agency (USIA) will continue to test the controversial TV Marti service that has incited intense opposition from Florida broadcasters and the NAB.

President Bush and USIA officials reaffirmed the policy to continue the \$7.5 million test of TV Marti in separate discussions of the issue during the NAB convention.

TV Marti testing began 27 March with broadcasts of western news and enter-

tainment from a directional antenna perched inside an Air Force blimp housed 10,000' above Cudjoe Key, FL.

Cuba almost immediately began jamming the signal aimed at Havana with a counter-signal of 50-100 vertical lines. Initial reports from Cuba indicate that the signal was effectively blocked in downtown Havana, but it was received in outlying areas of the city.

US radio stations in Florida have experienced interference from high powered Cuban AMs for several years

(continued on page 21)

Delco Balks at NRSC "IQ" Certified Radio

by Alan Carter

Kokomo IN Delco Electronics, manufacturer of some six million automobile radios annually, is not going along with the NRSC standard for the NAB/EIA "IQ" certified receiver.

One of Delco's main concerns is the effect first adjacent channel interference will have on car receivers with a 10 kHz bandwidth, according to Bill Gilbert, staff engineer for Delco receiver component development.

"My concern in the whole situation is that there is serious first adjacent channel interference which has more effect in car radios than home receivers," Gilbert told Radio World.

Variable bandwidth

Rather than a set 10 kHz bandwidth, Gilbert suggested Delco would be satisfied with a variable bandwidth from 5 kHz to 10 kHz, to compensate for areas with heavy first adjacent interference.

Gilbert notified the NAB and Electronic Industries Association in letters on

the 14 and 27 March of Delco's problems with the NRSC standard.

Specifically, Delco asked the National Radio Systems Committee to rewrite the standard and call it a guideline; emphasize the voluntary nature of the issue and work to reduce interference on the AM band.

The NRSC committee meeting 29 March in Atlanta at the NAB convention refused to change the wording from standard to guideline. But the committee made editorial changes to further emphasize the voluntary nature.

"It was unanimous against taking the word 'standard' out," said NRSC staff coordinator Stan Salek, a NAB staff engineer.

Support for the NRSC standard has come from Denon and Philips, which has receivers; and Sony and Thomson Consumer Electronics, which noted approval in letters to the committee.

In Delco's letter, Gilbert noted that while the NRSC standard addressed second adjacent interference, it has the

(continued on page 8)

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AM Plan Reactions Vary

Mandatory AM Stereo and Limits on Simulcasting Meet with Mixed Reviews

by Charles Taylor

Washington DC While broadcasters praised the FCC's overall proposal to remedy a number of AM's ills, the Commission can expect a mixed review on suggestions to limit simulcasting and require AM stereo.

The Commission's notice of proposed rulemaking, based on MM Docket 87-267 for technical review, was presented at a meeting 12 April. It tackles a wide range of comprehensive AM technical issues ranging from stereo and the expanded band to interference and simulcasting.

But Assistant Engineering Mass Media Bureau Chief Bill Hassinger made clear that the FCC recommendations are not the end-all of AM reform.

"We encourage people to come up with their own ideas," he said. "We want everybody to think not only about what we're proposing, but other ideas that we may have overlooked—fresh, bold thoughts. We just ask that they move in the direction of overall good for the AM service."

A comment deadline had not been set for the proposal, but Hassinger estimated it would end around the beginning of August. Reply comments would be due a month later.

Standing back

The NPRM is unique in that, unlike previous AM proposals, it aims not toward concessions for individual stations, but toward improvement for the band as a whole.

"Up until now, so many Com-

mission items have always been, what can we do for you, can we get more on the air, give you more power, longer operating hours," Hassinger said. "It's always been more, more."

"This, I think, is the first item that says, let's stand back and see if this is doing any good, that maybe there ought to be less or fewer (stations)," he said.

Initial reactions to the broad array of reforms were generally supportive. Officials of the NAB, which has been a firm proponent of AM reform, were quick to react to the Commission's action with praise.

"Today's FCC actions and initiatives move us closer to the government/industry goal of a more competitive AM medium," said NAB Radio Board Chairman William Sanders, president and owner of KICD AM/FM in Spencer, IA.

"These Commission actions, in the aggregate, offer improvements for all classes of AM stations," he said. "They also look to the future of possibly radical changes in the currently dense population of the AM band. But most importantly, the FCC seems to be firmly on the right track ... toward interference reduction on the AM band."

Staying competitive

NAB Science and Technology Senior VP Michael Rau said that FCC Chairman Al Sikes and the other commissioners should be applauded.

"They've recognized that a fundamental technical restructuring of AM must take place to insure that AM radio remains competitive in the 1990s," Rau said.

Glynn Walden, director of engineering for AM stations with

(continued on next page)

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Industry Reacts to AM Remedies

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Group W, also was pleased with the action.

"I think that somebody at the Commission had to do something. The broadcasters alone could not solve the problems," Walden said. "Some of these things are hard pills to swallow, but if we're really going to move ahead as an industry and stop the decline, we had to stop doing nothing."

One of the more controversial proposals, judging the feedback from the industry, is the Commission's proposal to limit or banish the simulcasting of FM stations' programming over AM.

"We apparently hit a nerve with that one," Hassinger said. "But if a station can only stay on the air programming what another station is already doing, what useful purpose is that to society? The Chairman expressed that simulcasting is used to prop weak stations, but at some point you've got to stop propping. That's what we want to explore."

Simulcasting: good and bad

"It's good and bad," said Bob du Treil, a principal with consulting engineers du Treil Lundin & Rackley. "In big markets, you don't need simulcasting. In smaller markets, it's conceivable that folks with only an AM radio might lose the benefit of service."

"With everyone I've talked to so far,

that's the proposal they have a problem with," said consulting engineer Karl Lahm, owner of Karl D. Lahm & Associates. "I think it will run into a lot of resistance because of plain and simple economics. It costs a lot more to run two radio stations."

"It's a concern of mine," said John Marino, VP of engineering for NewCity Communications. "I think there will be a strong reaction from broadcasters that are simulcasting. I think they'll end up dropping the proposal as broadcasters very much support keeping the simulcast rule as it is."

But Walden supported the measure. "An AM station on the air duplicating FM programming is doing nothing but keeping that radio station on the air and propagating interference. If they don't want to use the station for programming, they should turn it off or sell it to someone who's going to try to make it profitable."

Say maybe to AM stereo

The issue of AM stereo also has prompted some disagreement. In its proposal, the FCC questioned whether it should require all AMs to implement stereo by a specific date or allow incentives in granting licenses or upgrades for AMs that would convert to stereo.

Tony Masiello, director of technical operations for CBS Radio, said stereo

should be a local decision based on the competitive tenor of a market.

"If, in a particular market, stereo is necessary to compete, we gladly do it," he said. "I don't know if mandating it makes it any more palatable. I think NRSC will contribute more to the overall quality of AM than stereo."

"I don't think ordering anybody to go

ported by industry officials.

"The whole purpose of the exercise as (the FCC) identified it was to reduce interference on the AM band, and on that basis the proposed use of the expanded band would accomplish their purpose," said Wally Johnson, a consulting engineer with Moffett, Larson & Johnson. "I think what they're trying to accomplish is notable."

Art Suberbielle, president and GM of KANE-AM and chairman of the NAB's AM improvement committee, agreed. "I am especially pleased that existing AM stations indeed will be able to relocate to the expanded portion of the band, an equitable step that also will help reduce the rampant interference on the existing AM band."

"Interference is an area where we were at the total mercy of regulators," said Ted Snider, chairman of the NAB's AM receiver manufacturer liaison task force. "The FCC has just come through beautifully in giving us a way to think out the band in allowing stations to migrate to the expanded band."

While reactions to the NPRM were swift, the industry was anticipating a two week wait before seeing the actual wording of the proposals and learning comment deadlines.

For information on the notice of proposal rule making from the FCC, call 202-632-6460.

... the FCC recommendations are not the end-all of AM reform.

stereo has any intrinsic benefit," said Lahm. "Encouraging people to go in a certain direction or giving incentives makes a lot of sense, but a lot of programming doesn't lend itself well to stereophonic transmission.

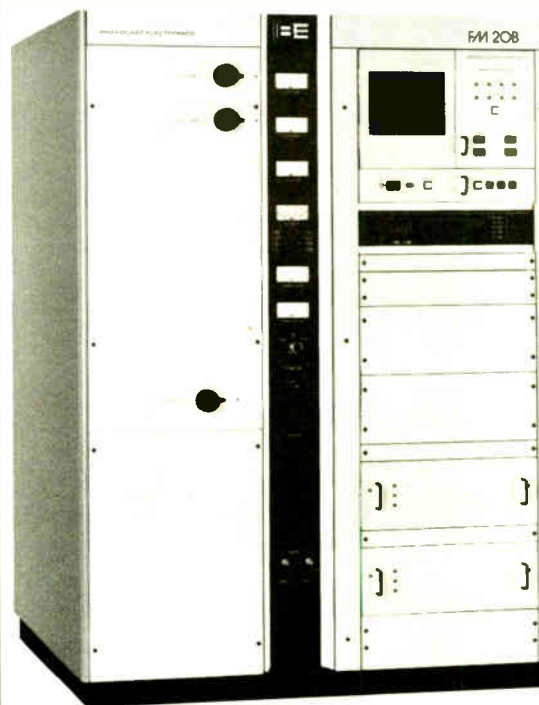
"Some people are saying go stereo just so they can say the band is all stereo," Lahm said.

Expanded band gets support

The Commission's desire to move to the expanded AM band (1605-1705 kHz) those stations causing the most interference on the existing AM band was sup-

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Where Service and Engineering Make the Difference

Tie Dye, Lost Hours at NAB

by Judith Gross

Falls Church VA NAB Planning Meeting in late 1989: Say, let's move the convention to Atlanta!

Good idea.

Let's have it on the same weekend we move the clocks ahead and lose an hour.

Yeah. Nobody sleeps at these conventions anyway.

Oh yes, let's also schedule it to coincide with a Grateful Dead concert right across the street, so we can contrast all those stuffy dark business suits with colorful tie dye.



What a great idea!

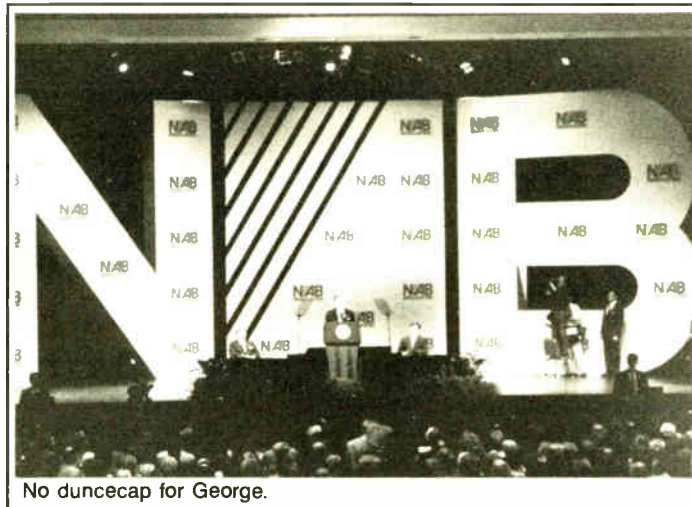
Well, it probably wasn't decided exactly like that, but it might as well have been.

OK, the show itself was a rousing success, if you measure overall attendance.

But, where were the radio folks? They relegated radio booths to the back of a long hall, all the way at the bottom of the three (or was it four) tiers? Little hard to find. And there was only one way to get

from the east side of the place to the west.

So, you guessed it, every time you were five minutes away from that important meeting, you were all the way over at the other side of the convention center.



Radio exhibitors would still like NAB to give them a count of radio attendees. Up to now, NAB has said "no go." C'mon, guys, how can a company do business without the correct facts and figures?

One thing you notice, walking around and around and around the convention center: the show has gotten too big. Too big, I mean, on the video and TV side.

So it might be the best of times to revise that old tune we've sung many

times in the past. Namely: Give radio its own show. Spring can be for video and TV. Fall can be for radio.

And while we're griping about the convention, before I get to my impression of all the nifty new toys, I have a few other observations.

First, why did NAB put the publication bins all the way down in an obscure corridor where nobody can find them, while the NAB-produced NAB Daily was hitting you in the face everywhere you turned?

I mean, they even hired rent-a-nymphettes to hand them out.

And who wrote that headline on the first one? I mean, 'Broadcasters March on Atlanta?' Give me (and all who respect the memory of Dr. King and the civil rights movement) a break!

Then, there were those NAB stores. Yes, in the plural. Seems wherever you turned in the corridors of the convention center, no matter how lost you were, there was an NAB store staring you smack dab in the face. In a subtle marketing tactic, they were everywhere.

And then there was the Engineering Luncheon. Because of past conflicts, it was held on the last day of the show where it conflicted only with: early departures. Lots of folks flew the coop on Tuesday morning, so the FCC's Al Sikes, Engineering Achievement Award recipient Hilmer Swanson of Harris and the CES' Peter McClosky all spoke to a two-thirds empty room.

President Bush's appearance was a highlight of the show. And it's a darn good thing they had his stand-in double get up in front of the mic before George himself arrived. You see, the big cutout "A" in the NAB's larger than life backdrop logo formed a nice little dunce cap triangle over the Prez's head.

Some quick-thinking staffer had them fill in the cut-out, so the Chief Exec wouldn't look like a schoolboy who flunked math. Now if it had been the Vice President, they could have let it be.

But enough carping. The high points of the show (other than the shuttle bus rides, which I'd rather not talk about) were too numerous to mention.

Bradley Broadcast attracted avid golfers to the hole-in-one challenge at its booth. There are more pros out there than Bradley apparently first thought, however. The holes-in-one came fast and furious and the company was forced to come up with more prizes than it had originally anticipated.

(continued on page 10)

BURK
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Mr. Jim Stagnitto
Director Of Engineering
WNSR-FM
485 Madison Avenue
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Dear Jim:

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Simulcast dangers

Dear RW:

A few points to ponder:

First, are AM's that simulcast their sister FM's programming vulnerable to license renewal challenges?

Since penetration of FM receivers is almost universal, can a station that is simulcasted and therefore has no community service programming of its own, withstand an attack from a challenger promising to make the AM a viable product, with unique programming directly serving the public need?

With the trouble many AM stations are in these days, many combo operators are opting for the simulcast button to cut costs and up profits, and bolster the audience for the FM.

The question is, is increasing bottom line numbers justification enough to withstand a shrewd challenger offering to put that frequency to real use? The FCC allows simulcasting, and it of itself is not wrong.

However, which will be preferred in a standoff: cuts in costs, or promises of community-based programming? I wonder.

Second, I've been following with keen interest the situation developing with

HDTV. It seems there are several competing systems, not unlike the AM Stereo situation.

The "marketplace" approach has been supported by the FCC for some time now, and has been lauded. Surely, since it worked so well once, it will be used again for HDTV, right? Won't the developers of the losing systems threaten to sue if one system is given official certification?

Also, if a decision is made, and stuck to by the FCC, what message does this send the manufacturers and public about the importance of AM radio?

The whole (AM radio) world watches! Keith Harris, Programming Mgr WASK-AM Lafayette, IN
P.S. Does Leonard Kahn have an HDTV system?

In praise of entertainment

Dear RW:

I have just completed reading Mr. Buffalo's letter (11 April *Readers Forum*) in which he condemned "the juvenile style of writing" in your publication.

Quite frankly, who cares.

The style is not important. What is important is the end result. The end result is to communicate ideas to us poor folk who are bored to tears from reading all those technical manuals.

I sincerely doubt that management people are so naive that they perceive a "negative and immature" image of the broadcast engineering profession from a magazine article.

I strongly suspect that negative and immature engineers do a far better job of projecting such an unwanted image to management.

I thoroughly enjoy reading your articles, including those of Judith Gross and Al Peterson. I find your publication both informative and entertaining.

Keep up the good work!

Bill Lakatas, CE/TD
HGF Media Group
Allentown, PA

Indecency standards

Dear RW:

Thanks for the article *Indecency Ban Panned* (*Radio World*, 28 March).

It's maddening, but the FCC has threatened non-commercial radio broadcasters to the point that some fear airing basic American slang in a news clip could cost them their license or get them in trouble. Surely it's freedom of speech to use that classic American term of opprobrium "B.S.!"

I suggest those concerned keep a log on "community standards," and write the FCC. While they give radio a hard time, television gets away with murder (multiple murders, even, plus way too much reckless driving!).

Example: To the FCC:

On (fill in date) in a network broadcast on (fill in station) in a program (fill in program name) at or around (fill in time), a character spoke the

The NAB convention, in Atlanta for the first time ever, was considered to have been a healthy, well-attended show with many companies reporting brisk business. But attendees and exhibitors had barely returned from Atlanta when rumors began circulating about a lack of attendance by radio station personnel.

The vastness of the show, the crowds at the TV and video exhibits, and the decreasing participation by radio networks should prompt NAB to reexamine radio's place in its spring show.

As the NAB spring convention becomes less a broadcaster-only show, the radio segment is playing a smaller part. In addition, the interests of radio and TV/video are diverging more each year, as evidenced by the separate exhibit space afforded HDTV, which is expected to grow in size next year.

With so many trade shows on the schedule, especially in the fall, radio exhibitors are being forced to ask themselves if the spring show generates a volume and quality of business equal to the increasing costs of exhibiting.

Separate But Equal For Radio

Wouldn't it be more cost effective for radio exhibitors to speak only to radio attendees at a radio show?

The NAB already has a fall show devoted to radio. But primarily because NAB continues to run a full slate of radio engineering sessions at its spring convention and orients the fall show towards managers and pro-

gramming, many radio equipment companies are reluctant to pull out of the spring show and support the fall convention.

It's up to NAB to take a leadership role in splitting off radio interests from the spring convention. NAB could hold a full and exclusive slate of sessions for engineers, as well as programmers and managers, and encourage the engineering attendance that will draw exhibitor support in the fall.

The space vacated by radio companies at the spring convention would be quickly sold out to TV/video exhibitors and companies which market to both radio and TV can choose to exhibit at both shows, as many of them now do.

While splitting the spring show would be a major decision on NAB's part, and one that requires its members' support, two well-attended shows might end up being more profitable for the organization in the long run and would certainly offer proof positive that NAB has its radio members' interests at heart.

The radio networks have already spoken by postponing their lavish participation until the fall convention. It's time for NAB to give both the radio and TV industries the successful shows they deserve.

—RW

Radio World

Vol 14, No 9

May 9, 1990

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"I was not offended, and neither was anyone else I know. I call this to your attention as an indication of current community standards on language, both in this immediate area and across the country."

F.L. Werden, Ind. Radio Producer
Kansas City, MO

More AM proposals

Dear RW:

Keith Harris of WASK-AM, Lafayette, IN, was "right on" in his letter about AM radio published in the 21 February RW.

He advocated reinstating the three year anti-trafficking rule, eliminating

simulcasting, immediately eliminating stations that go dark, and requiring all new radios to be AM stereo and FM stereo.

In essence, he is advocating an aggressive "use it or lose it" philosophy for AM. In addition, equal receiving capability for AM and FM should give a more even playing field for AM. With that, more AM owners will be inclined to install stereo.

Let's move forward with these proposals to clean up AM and broadcasting.

Mark Persons
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SMP-950 Tri-Band AM Stereo Matrix Processor



The CRL SMP-950 Tri-band AM STEREO MATRIX PROCESSOR offers state-of-the-art circuitry coupled with precise implementation of the NRSC standards for the loudest, cleanest signal on the AM dial. AM Stereo is quite different from FM and requires special techniques to provide full stereophonic fidelity while maintaining full monophonic compatibility. The CRL patented matrix processing circuitry is designed specifically to meet this criteria.

SPF-300 Standard Pre-Emphasis/Filter for AM Broadcast Transmission



The CRL Standard Pre-Emphasis/Filter contains all the functions necessary to convert virtually any monaural audio processing chain to meet the NRSC (National Radio Systems Committee) Voluntary National Standard of January 10, 1987. This transmission standard defines specific pre-emphasis and filtering requirements which are intended to help solve many of the technical concerns in AM broadcasting. The pre-emphasis curve was developed to allow receiver manufacturers to employ a complementary de-emphasis characteristic in wideband radios while improving the frequency response of narrower and medium-bandwidth radios. The filter specification, which limits transmitted audio bandwidth to 10 kHz, is intended to greatly reduce much of the interference between stations by reducing the conditions that cause "splatter" effects.

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The CRL Monitor De-Emphasis/Filter provides all the functions required to update any AM modulation receiver for the recently approved voluntary transmission standard. This allows easier setup of audio processing for the audio characteristic of the best-possible commercially produced radios. Additionally, the unit reduces the interference typically heard in the station air monitor.

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WAEB Bows Out of NRSC, NAB

by Judith Gross and Alan Carter

Allentown PA Multipath tests will continue, but the station conducting the study has ended its affiliation with the NRSC multipath group and resigned from the NAB, which co-sponsors the NRSC.

WAEB-FM CE Harry Simons took the action, with support of station management, at the NRSC meeting held prior to the NAB convention in Atlanta.

In a written statement to the NRSC, Simons questioned the committee's ability to make the test findings public if results were considered sensitive or controversial.

"It has become very apparent to me that the NRSC does not have the ability to disseminate any of our research findings to the broadcast industry without placing the NAB in a possible compromising position," Simons stated.

While the NRSC, co-convened by NAB and the Electronic Industries Association, asked Simons to conduct the work outside the committee, Simons said people have still assumed the NRSC controlled the project.

"There had to be two divorces," Simons told RW. "When the NRSC tried to separate itself from me, that didn't work. I had to divorce myself from the NRSC too."

"My motive is to be able to release all this information to the broadcast industry," Simons said. "If it's controversial, so be it. To bring a terribly controversial issue to the NRSC is taboo."

Distribution plans

The conclusion of Simon's statement in withdrawing the NRSC multipath group noted that the formal interim report of the multipath tests will be copyrighted and distributed to the industry via reprinting in *Radio World*.

Radio World publisher Stevan Dana confirmed that the report will be published in the newspaper. "We believe the results of these studies will be valuable to the industry, and we're pleased to be able to provide the service," he said.

In a separate letter to the NAB Presi-

dent and CEO Eddie Fritts, Simons resigned his station's membership in NAB effective 30 April, with the approval of WAEB GM Jeffrey Frank.

The letter noted that recent criticism of the NAB for action during some NRSC subgroup meetings which have raised the possibility of litigation, "seems to have strained the free flow of information to the industry via the NAB."

Simons also maintained, in the letter to Fritts, that the multipath tests have received no service or support from the NAB, specifically the Science & Technology department, in conducting the tests.

Frank, whose signature also appeared on the resignation letter, noted that the action was "the last link in a big chain of events." He said that WAEB had been the last station in the CRB Broadcasting family to remain an NAB member, and had done so only because of involvement with the NRSC project.

Frank also said the entire incident leads back to "a question that has been asked many times before: when it comes to radio, what does NAB really do?" He added, "It seems all radio people can say about NAB is that they run a convention."

Simons explained that what had finalized the break with NAB and NRSC was NAB's lack of response to a request from him, and WAEB corporate management and counsel, to reconsider the NAB Board of Directors action earlier this year barring press coverage of NRSC meetings after allowing press attendance for four years.

"All they had to do was acknowledge my request, and I would have done nothing," Simons said. That complaint was noted in the letter of resignation. "I was ignored," Simons said. "I was never contacted."

NAB Science and Technology Senior VP Michael Rau disagreed about the amount of support his department had

provided for the WAEB multipath tests. "I will say for the record that NAB supports the WAEB multipath studies," he said, adding that he has said so at NRSC meetings.

Unrealistic expectations?

But Rau said that the NRSC's role in the tests is, by the definition of the committee, limited. "As far as he (Simons) thinks the NRSC should take a more active role, it's just not realistically possible. The NRSC is not a standards committee, it is not a research committee. It does not manage projects at all."

Rau also noted that the NRSC, even in its formation of the AM transmission standard, did not undertake its own studies, but used outside consultants.

He added that to have gotten more NAB involvement he would have needed a formal outline of the project, which he says was never submitted.

"It would have to be a very specific plan for us to commit resources. I have not seen that; I have seen drafts of such a plan but such a plan has not had the consensus of any of NAB's committees. Had such consensus existed, I'm sure we would have gotten more involved in it."

NAB Staff Engineer Stan Salek, staff coordinator of the NRSC, said at the outset that he suggested Simons conduct the tests independently of NRSC because Simons was moving the test faster than NRSC procedures would allow.

Simons maintained, however, that Salek's request that WAEB conduct the tests independently of the NRSC was not made at the start of the project, but after two to three months of planning had elapsed.

He also revealed that just prior to Salek's suggestion, some of the test participants, including Delco, had recommended disaffiliation from NRSC due to frustration with the NRSC process.

Both Rau and Salek said the multipath tests being conducted by WAEB are

important.

"We look forward to receiving results and we hope the industry benefits significantly from the research," said Rau.

Only "lip service"

Simons questioned how Rau could say he supports the multipath tests when the station never received any help from NAB, except for the loan of a spectrum analyzer.

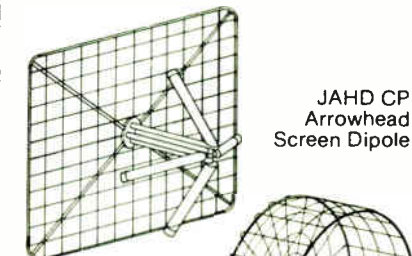
"I agree that Mike Rau has stated in NRSC meetings that he supports the WAEB multipath project. It gave the members the assurance that it has the

(continued on page 8)

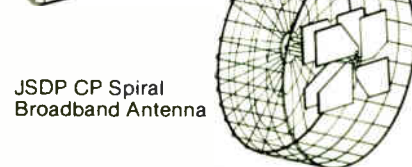


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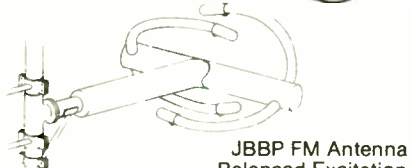
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Delco Criticizes Receiver Specs

(continued from page 1)

potential to increase problems with first adjacent interference when stations are allowed to increase transmitted power.

Protecting the band

"My basic goal is to protect the band," Gilbert said. "I'm afraid a wider band will allow more interference to come through."

Gilbert suggested the NRSC committee needs to study first adjacent interference like it did second adjacent problems during the standard's development.

NAB Science and Technology Senior VP Michael Rau said the standard is already

voluntary. "Delco does not have to go along with it, nor do they have to support it for it to become reality. We obviously would like to have Delco on board."

Rau speculated that Delco would make a radio with a bandwidth greater than 7.5 kHz "when they feel the technical environment is right."

He also said some of the concerns Delco questioned about interference conditions are being addressed by the FCC: first adjacent channel interference, transplanting stations that cause interference in the existing band to the expanded band, and better science for engineering calculations (all of which were

addressed in a recent comprehensive rewrite of AM technical criteria put forth by the Commission).

"The letters do not recognize the point that we're making progress at the FCC," Rau said.

Additional questions

Delco is not the first group to question parameters of the NRSC standard for receivers.

At the NAB convention, consultant Almon Clegg released results of a confidential survey of receiver experts he conducted that revealed there is not 100% faith in the standard. (See related

story this issue.)

Five out of 11 surveyed noted that some technical considerations were overlooked. Included were an underestimation of performance against interference and listener intolerance for increased noise and interference.

The survey also found the addition of a night/day or narrow/wide switch will almost certainly be necessary—which will make the receivers more expensive.

In his letter, Gilbert questioned

. . . Delco would be satisfied with a variable bandwidth from 5 kHz to 10 kHz . . .

manufacturers that are readily adopting the standard.

"To implement the proposed standard blindly, which some manufacturers may choose to do, could actually produce a reception system that will pass significantly more interference through to the final audio output and ultimately increase the rate of listeners abandoning AM."

For information from Delco, contact Bill Gilbert at 317-451-7275. For information from the NRSC, contact Stan Salek at 202-429-5391.

Tests On at WAEB

(continued from page 7)

support of the NAB," Simons acknowledged.

But he maintained that declarations of support from NAB were just "lip service."

"My definition of support is more than just lip service in a closed meeting. It means some sort of hands-on activity, such as assistance in development of test criteria, providing test equipment—more than just one spectrum analyzer one time," Simon said.

"I submitted test agendas and asked for comment, suggestions and requested support during NRSC meetings, with NAB staff present and they never responded to it. Nobody at the NRSC meetings did."

Simons added that those present at NRSC meetings, including Salek, made a point of making it known that the multipath testing was affiliated with neither the NRSC nor the NAB. Simons, however, maintained those people wanted the favorable publicity generated by the tests without contributing.

"The NAB wanted to reap the benefits of their alleged support but in reality their support stopped short of any valuable contribution whatsoever," said Simons. "I believe the NAB is a self-perpetuating organization that is constantly trying to reestablish its value to its dues paying constituents—but in fact its dues paying constituents in my opinion receive nothing in return."

Simons said that response to his actions have been positive. He also noted that companies have volunteered to participate that otherwise said they would not have joined in while NRSC and NAB were involved.

For information on the multipath tests, call Harry Simons at 215-434-4424.

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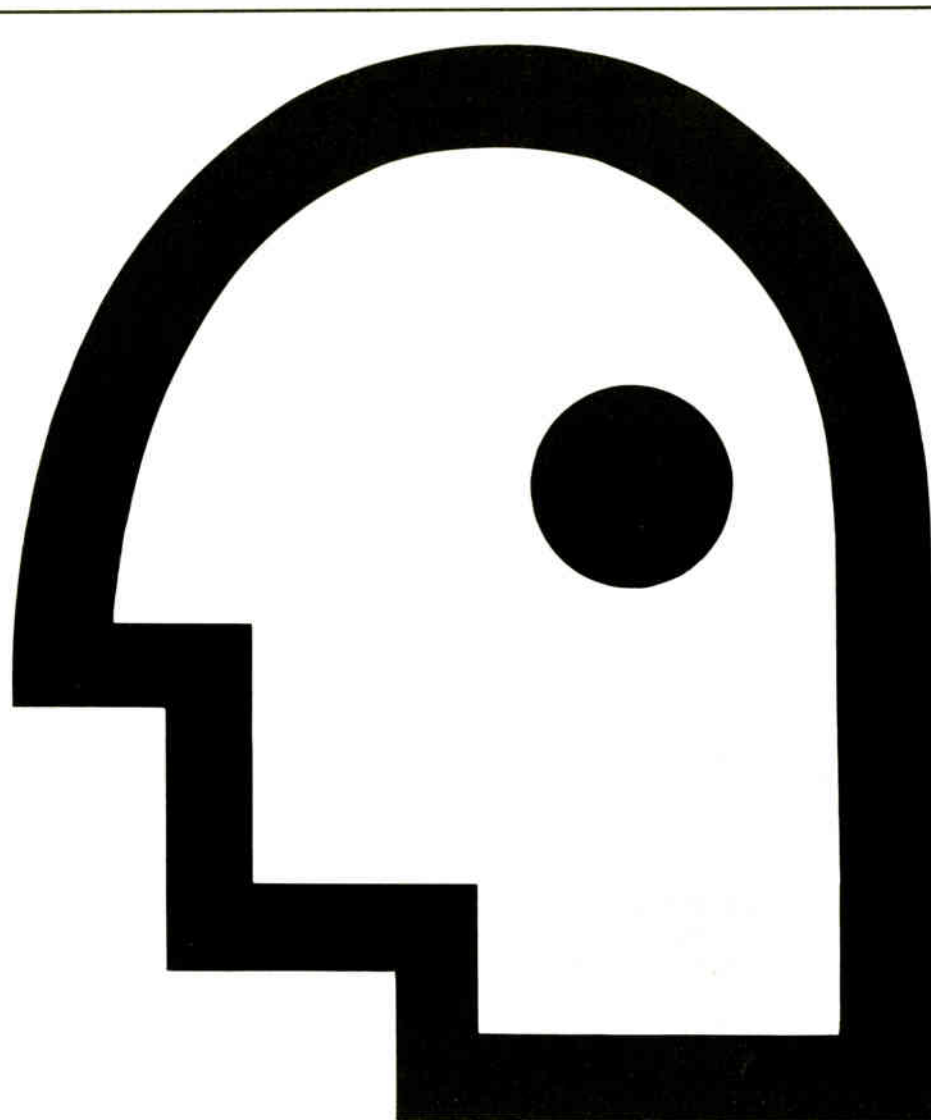
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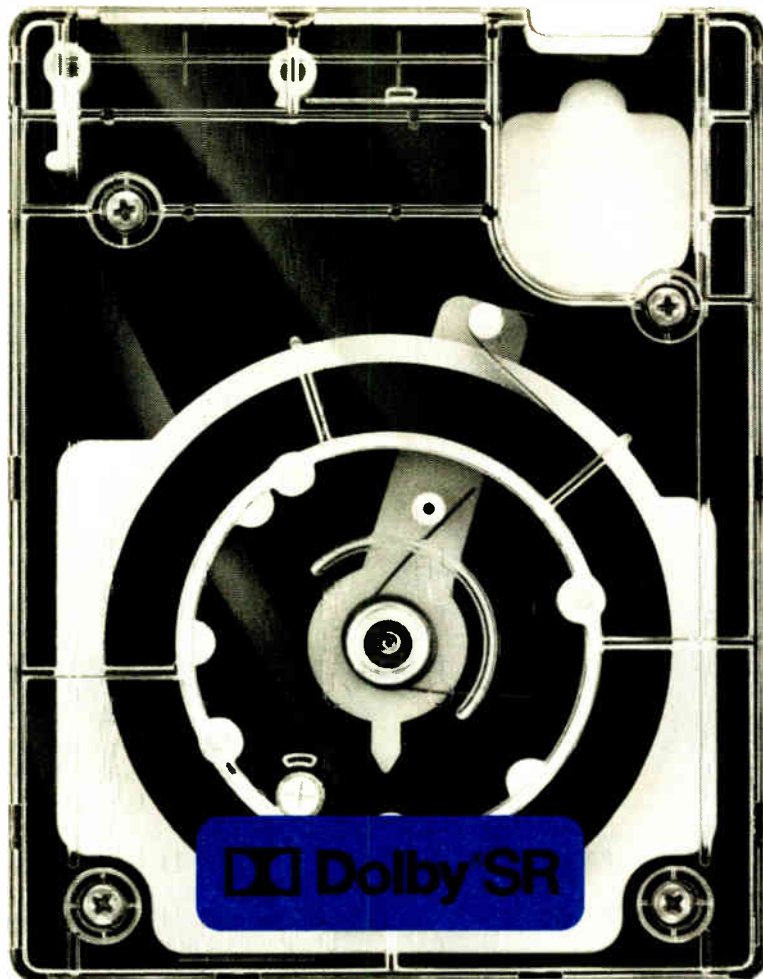
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The Good, the Bad, the Tie Dye

(continued from page 4)

There were lots of give-aways at other booths. The NAB's Mary Locke helped Peter Burk give away a Burk Technology transmitter remote control system. Two old Noo Yawk pals of mine were involved. Doc Masoomian, repping Northeast Broadcast Labs, supplied the winning entry for WNSR's Jim Stagnitto, who won the prize.

What products were hot at the show?

Well, I won't go into the bells and whistles, which are presented in vivid detail in stories throughout this wrap-up issue. But a few things did catch my eye.

After roaming around for the past several years having new and older companies tell me that the age of digital is here, I can finally feel comfortable about the digital offerings I saw at the show.

For one thing, lots of these companies seem to have done their homework, by asking real radio engineers and PDs what they want in a digital product.

Along that line, I liked the 360 Systems DigiCart, which promises to be the first ready-for-prime-time digital replacement for a cart machine.

The removable Bernoulli-type disks are going to cost more than cartridges. But with the capacity to record numerous cuts, and digital quality to boot, it is a small stretch in the average station's thinking. Plus it's priced right.

I think AKG has come a long way with its digital workstation, the DSE-7000. Radio producer Jay Rose does a nice job of covering the bases with radio-type concerns in the demo. It's a real product and it's also priced right—as a complete and easy to learn production station.

Allied-Harris is to be commended for its large number of new and cutting edge products (many of them exclusive to the company) running the gamut from the high to low end markets.



And the winner is ...

Gentner made some bold new moves in the area of processing while presenting an impressive array of products in the telco and RF arenas—where the company has already established firm inroads.

The Prizm digital audio processor, a product concept, is a solid step in the

right direction and interest is running high. The Lazer digital FM limiter/stereo generator, meanwhile, looks to be well on the way to market.

DAT is almost, but not quite there. The gathering momentum on the consumer side, which awaits the acceptance of legislation solving the copying problem, plus the expected acceptance of the new professional timecode standard should help spur this area along.

And it's nice to see that some bread and butter items, like studio furniture, are finally getting their due. Since so many stations are not in a position to order up turn-key systems, companies like The Express Group, Murphy Furniture, Wheatstone, and now even Pacific Recorders & Engineering are responding by offering practical, affordable furniture to meet the needs of a variety of stations.

I was generally impressed by the number of companies who have married the computer to broadcast functions to bring radio into the next decade.

But I still have my doubts—also expressed by many engineers I spoke to—that a computer keyboard and/or system with computer monitor will ever find a happy home in an on-air control room. With other alternatives popping up all over, some companies with those alpha-



The pros invaded Bradley's green.

numeric keyboards, and even the mice, may want to think it through once again.

And finally, I don't want to hear one more person ask if that new product will still operate if a Coke is spilled all over it. How many gadgets do you own that will still work if you pour the sticky stuff on it? Your phone? Computer keyboard? Your car engine?

C'mon now. Let's lose the Coke test as a technical criterion, OK? A lot of CEs I know won't work if Coke is spilled on them, either. Or GMs. Or PDs ...

Have a juicy tidbit? Spill your guts to Ear-waves by faxing JG at 703-998-2966, writing to PO Box 1214, Falls Church VA 22041, or calling 703-998-7600. Who knows, you could win a coveted RW mug.

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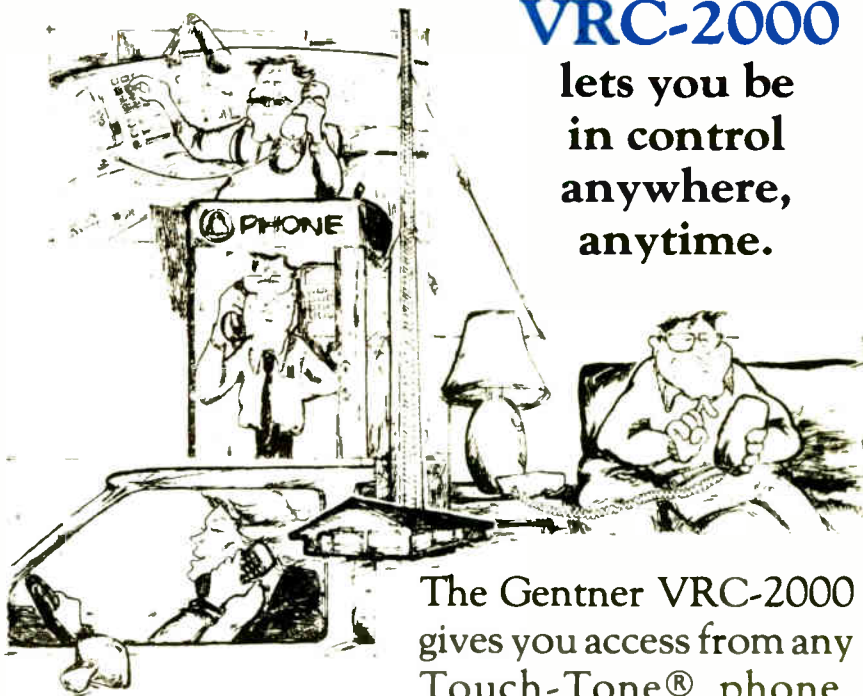
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Fortunately for us, most radio engineers look before they leap.

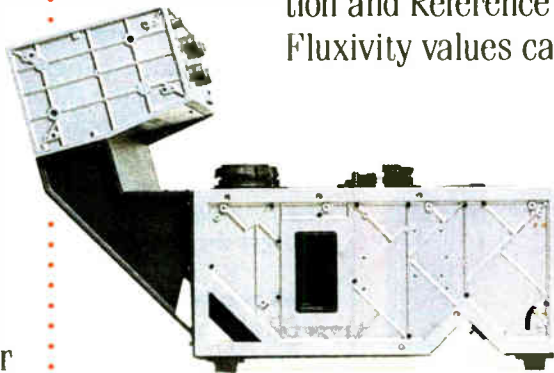
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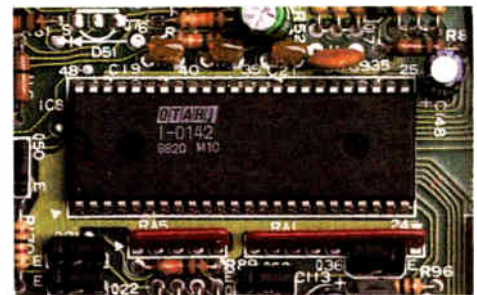


Three cue locations and a zero memory can be accessed via the MX-55NM's built-in locator.

through its paces, notice that the vari-speed control

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NAB Attracts Crowds

(continued from page 1)

Glassman, sales manager for Bradley Broadcast, which also was set up in a TV area. "But we had an excellent show, over 2000 people."

Logistically, NAB was faced with a real challenge as the convention was hosted for the first time in Atlanta. Unlike its usual venue, Las Vegas, hotels here were

contained products from more than 750 companies spread over 430,000 net square feet.

But most exhibitors reported a brisk business boosted by a healthy attendance. "Things seemed to work out for us in Atlanta. I was pretty happy there," said John Phelan, president of Shure Brothers and chairman of



In Atlanta for the first time, NAB exhibits and sessions occupied three tiers of exhibit areas and meeting rooms (above). Grateful Dead fans—"Dead heads"—shared Atlanta with broadcasters for three days (left).

spread over a 20-mile span of the city. To ease the pain, NAB organized a caravan of nearly 200 buses.

More confusing was the sprawling Georgia World Congress Center, which

NAB's exhibitors advisory committee.

Business seemed healthy too. "We got a lot of quality people there, not as many tire-kicker types that just come through and nose around. The whole thing was

a very pleasant experience," he said.

At least part of the show's spark came out of digital audio, which showed its burgeoning capabilities in packed sessions and through innumerable equipment advances, from switchers to processors and DAT.

DAB makes an impression

Perhaps most impressive was the European Broadcasting Union's demonstration of Digital Audio Broadcasting (DAB), which ran throughout the show.

DAB allows a new terrestrial—or satellite—means of transmitting digital radio signals directly to new receivers in cars and homes and to portable radios.

The service, however, is not compatible with current AM or FM broadcasting and would require spectrum allocation approval by the FCC.

Another highlight was the debut of the Radio Data System (RDS), already gaining acceptance in some parts of the world. The system allows a listener to tune an FM station by format rather than by frequency. Atlanta's simulcast Y-104 and Y-106 carried the RDS signal over prototype receivers furnished by several manufacturers.

Announcements also added intrigue to the show, including a discussion between Rep. Matthew Rinaldo (R-NJ), the

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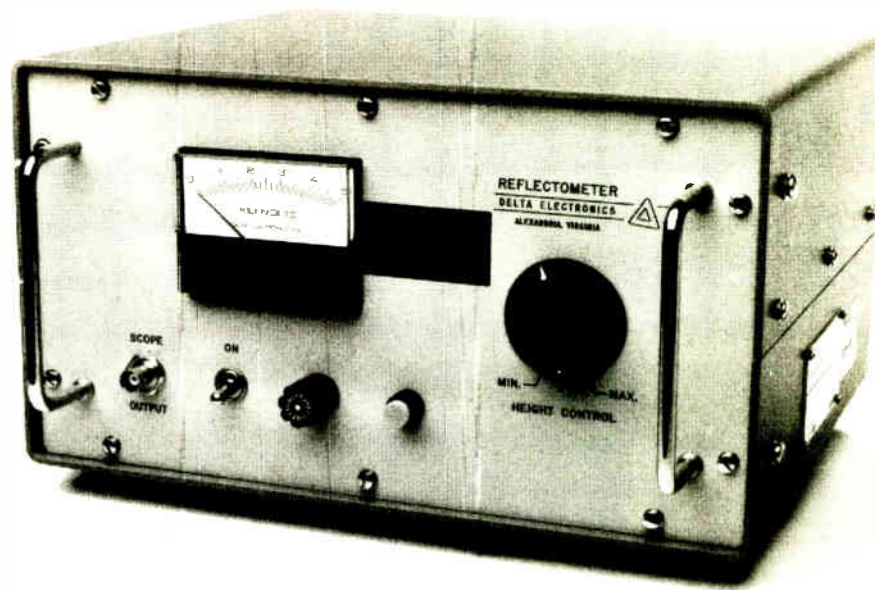
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Bush Asks Broadcaster Support

by Charles Taylor

Atlanta GA President Bush implored broadcasters at NAB to stand up for freedom by lending support to the controversial TV Marti, which began transmitting into Cuba in late March.

But Bush was speaking to an audience that is vehemently opposed to the US government-sponsored TV Marti, which broadcasts Western views and entertainment similar to Voice of America's Radio Marti.

"I have come here to ask something of you," Bush said. "I ask you to stand by your traditions—the best traditions of America. I ask you, once again, to stand for TV Marti, to stand for freedom."

He added that he and Congress supported TV Marti because it represents freedom of speech, an ideal that defines the cloth of America.

"No government should fear free speech, whether it's from entertainment programs or accurate, unbiased news about world events," Bush said.

Full House In Atlanta

(continued from previous page)

ranking member of the House Telecommunications Subcommittee, and its chairman, Ed Markey (D-MA).

Rinaldo told showgoers at a session that the two had met to iron out fine points of bi-partisan legislation on radio. Rinaldo said that the bill would mix his legislation in HR. 2714 for technical improvements, with codification of the FCC's abuse of process rules.

And the winners are . . .

Among those honored at the convention was Hilmer Swanson, a senior staff scientist at Harris Corp's Broadcast Division credited with development of much of today's AM transmitter technology. Swanson was cited at the engineering luncheon on the show's final day, Tuesday 3 April.

In the past, the luncheon had conflicted with other events, so this year, show planners blocked it apart from other luncheons on the final day of the show. Unfortunately, because of the timing, attendance was an embarrassment, with nearly half of the ballroom's salad-laden tables vacant.

Radio veterans Charles Osgood and Hal Jackson were inducted into NAB's Broadcasting Hall of Fame at a Sunday radio brunch. Osgood is a long-time correspondent for CBS News and Jackson, president of Inner City Broadcasting, is credited with pioneering numerous pathways for blacks. He is the first minority inducted into the Hall.

Finally, to add to the luminaries already in attendance at the convention, attendees were treated to a visit and speech by President George Bush and also heard an address from FCC Chairman Al Sikes.

Next year, the NAB spring convention returns to Las Vegas and becomes a weekday-only show to ease problems with hotel accommodations.

"I do understand the concerns some of you have about this," he added. "But I also understand that you represent the very principle TV Marti exists to serve—the free flow of ideas. Before we are businessmen and women, before we are doctors, lawyers or mechanics, we are Americans. Americans have always stood for free speech and we always will."

NAB President Eddie Fritts drafted a response to the president's speech, reaffirming opposition to TV Marti.

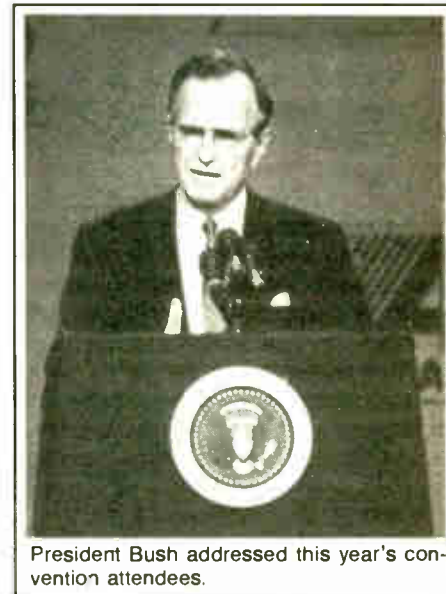
"We wholeheartedly accept his concept of freedom across frontiers, but we do have concerns about the technical

aspects of TV Marti on two levels: one is direct interference from the TV Marti signal to Florida stations, and two is retaliatory interference to AM stations from Cuba," Fritts said.

In his speech, Bush also asked broadcasters to be conscious of the example they will establish as doors open for counterparts in the Eastern block.

In addition, he congratulated active participation of American investment in joint ventures to establish new radio and TV networks in the East.

"Most of all, I am here today to recognize your energetic international leadership," he said.



President Bush addressed this year's convention attendees.

When You Consider Remote Possibilities...



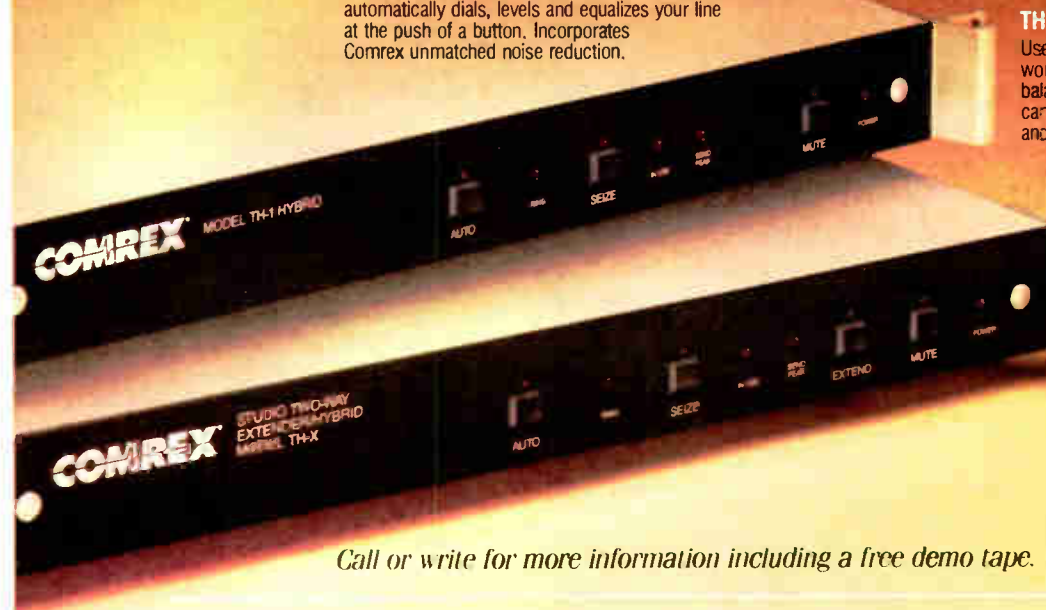
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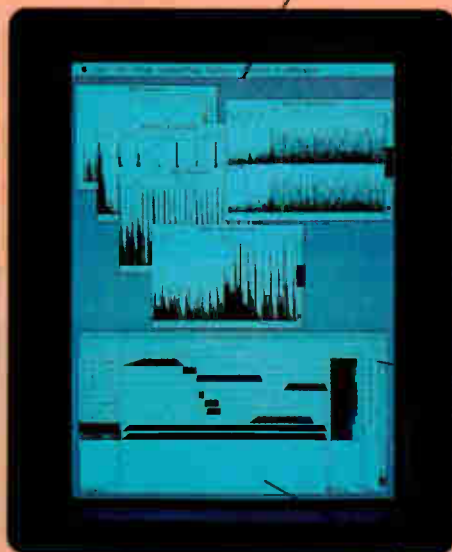
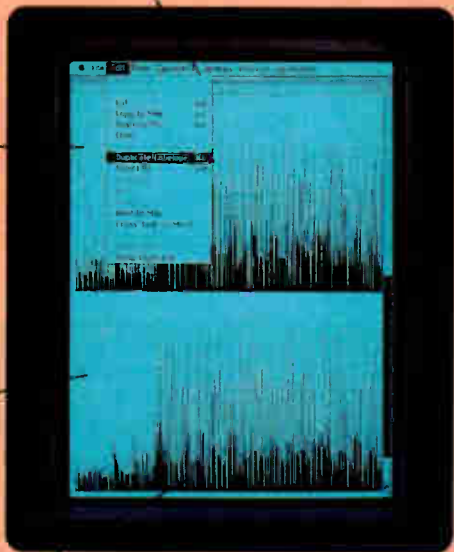
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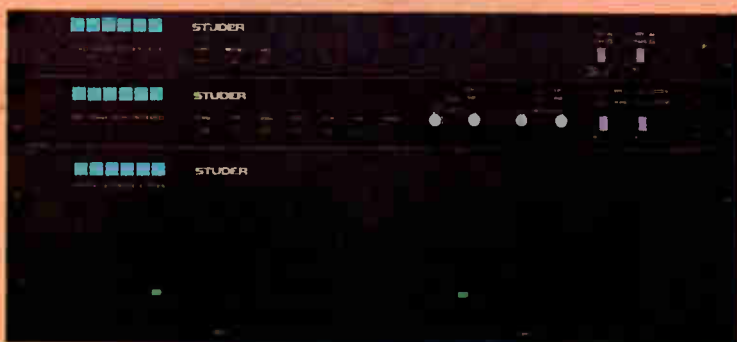
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World Radio History

DAB Shows Future of Radio

by John Gatski

Atlanta GA Although radio broadcasters are uncertain whether digital audio broadcasting (DAB) will be a friend or foe, those at NAB were intrigued by the technology that may be practical before the year 2000.

More than 700 broadcasters packed the DAB engineering conference and perhaps thousands flocked to the European Broadcasting Union's (EBU) DAB booth here.

Canadian Broadcast Corp. (CBC) Representative Tom Holden said the taped DAB demonstration at the EBU booth, which compared DAB to normal FM, was astonishing.

"I walked away with the comment that one would have to assume the demonstration was faked. It (DAB) is that good," Holden said.

The EBU and its partners in the project have invested about \$40 million in the DAB research project, known as EU 147/DAB and have made significant progress in solving inherent problems with digital broadcasting.

CD-spec sound

DAB technology will allow satellite and terrestrial transmission of compact disc-like (20Hz-20kHz) audio signals. The satellite signals would be augmented by gap-filling terrestrial transmitters

on the ground 40 to 80 kilometers apart.

According to the EBU, its version of DAB will deliver 12 to 16 stereo channels in 4 to 6 MHz on VHF (terrestrial) and UHF (satellite) bands, occupying the same spectrum as one TV channel.

When the technology is implemented, DAB broadcasting can produce programming that is unaffected by multipath, making it ideal for fixed or mobile listening, EBU officials said.

DAB technology, however, is not compatible with existing FM and AM broadcasts, which worries US broadcasters.

Society of Broadcast Engineers (SBE) President Brad Dick said the technology is promising, but it will not succeed in the US unless it includes current broadcasters.

If broadcasters have first choice on any DAB frequency blocks, DAB may have a chance, he added.

NAB Science and Technology Senior VP Michael Rau said the technology, is "exciting" but could be a possible "threat" to existing broadcasting.

On the plus side, current DAB technology enables spectrum efficiency four times that of FM and it is not affected by multipath, Rau said.

NAB and the EBU are already planning a DAB terrestrial demonstration at next year's NAB convention in Las Vegas.

The NAB, however, has not yet taken a position on DAB, according to Rau.

"We are still in the policy-forming process," Rau said. "We are going to discuss the issue with our board members in June."

Do AM and FM broadcasters have to worry? According to EBU, DAB will be in use in Europe sometime in the 1990s if frequency allocation is addressed by the European rulemaking bodies.

DAB progress continues

Canada plans to test DAB, terrestrially and via satellite to determine the possibility for its use in that country within the next year, according to CBC.

Some form of DAB is possible for the US before the turn-of-the century if a standards squabble or other unforeseen obstacle does not develop, Rau said.

In his NAB technical discussion of DAB, Daniel Pommier, deputy director of France's broadcasting authority, CCETT, said technology advances have made quality DAB audio possible for mobile listeners.

The multipath problems associated with transmission delay of the satellite and terrestrial digital signals have been solved through COFDM (Coded Orthogonal Frequency Division Multiplex) and gap-filling terrestrial transmitters, he said.

By using the COFDM technique for the encoding and decoding process, the time-interleaved data stream is split among numerous narrow-band carriers that are digitally processed for modulation and

demodulation, according to an EBU DAB technical paper presented at NAB.

"The bit-rate carrier is very low and, therefore, the transmission is insensitive to delayed multipath signals," according to the paper.

Mobile reception also is dependent on gap-filling terrestrial transmitters, Pommier said.

No multipath

"A good sounding broadcast service to portable and mobile receivers requires uninterrupted reception in all environments, whether in heavily built up urban areas, tunnels, blocks or flats, while using a low gain antenna," Pommier said. "In practice, such a condition can be met only if the satellite signal is boosted by small co-channel transmitters."

Small ground transmitters also lessen the amount of satellite transmission power needed for DAB, which cuts down on interference.

A version of US DAB several years down the road, based on comments at NAB, and its implementation in Europe are not assured either, according to Pommier.

"One of the most important factors affecting the development of such digital satellite broadcasting networks is the need for the International Telecommunications Union (ITU) to allocate sufficient band of UHF spectrum, between the limits of .5 and 2 GHz . . . preferably on a worldwide basis," he said.

The world is "pinning its hopes" on the ITU allocating such spectrum at its world conference (WARC) in 1992, Pommier added.

New Radios Are IQ

by Charles Taylor

Atlanta GA Among four candidates for the NAB/Electronic Industries Association certification mark for improved AM radios, "IQ" has been given the nod by the NAB AM Liaison Task Force.

The mark was established to identify radios that promote current and forthcoming technology. Other nominees under consideration were Excel, HDR and SupeRadio.

The announcement was part of a comprehensive look at "AM Action," from the NAB.

"A great deal has been accomplished in the past six months," said Ted Snider, moderator and head of Snider Communications Corp. and chairman of the NAB's Receiver Task Force. "The FCC has the ball very much in their court, and I think they have caught the ball."

According to the NAB, AM stations have already pledged time to promote the certification mark in on-the-air an-

nouncements, and the mark has the support of some, but not all, receiver manufacturers.

Other topics covered in the convention panel detailed recent developments in AM improvement through interference and reception reform and minimum standards for receivers.

Stan Salek with NAB Science and Technology also announced at the panel that preliminary results of the low profile antenna project were expected by the end of March and a final report in June.

The antenna, a mathematical model for a physically small and standardized antenna for AM station operation at night, could enable some broadcasters to increase coverage by moving their nighttime operations closer to the population center of the station's licensed community.

Salek also said that the results of the experimental Suppressed Skywave Antenna System will be presented at Radio '90 in Boston in September.



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CBS Adopts Digital Phone Audio

by Alan Carter

Atlanta GA One of the last areas for CBS Radio to move into the digital domain is telephone audio and that now is well on the way.

CBS Radio Technical Operations Director Tony Masiello explained in a presentation at NAB how the emergence of cost effective digital signal processing, or DSP chips and the growing installation of digital switches in telephone companies led to digital processing techniques to improve telephone audio quality.

In effect, digital switches in telephone company central offices set the stage for the implementation of Integrated Service Digital Networks (ISDN) and 7 kHz audio.

A basic ISDN channel consists of two 64 kBs data channels and one 16 kBs control channel. The two 64 kBs channels known as "B" channels carry the information, and the 16 kBs control channels known as the "D" channels carry on-hook/off-hook information, signaling and other control data.

Basic rate interference

The two, B plus D, 144 kBs channel is called the ISDN basic rate interface. This is the ISDN "local channel" or local loop between the end user and the telephone company central office digital switch.

Masiello, however, noted that ISDN is not fully deployed in the US because telephone companies are slow to replace local channel equipment at central

offices with appropriate ISDN terminal adapters, which convert the users' data to the form necessary to transmit.

In order for ISDN to gain universal usage, he noted, the local channels, which

carry only 3.5 kHz audio. But sophisticated ISDN terminal adapters have been developed to allow the telco twisted pairs to carry the 144 kBs.

In the meantime, there is a "Pre-

ISDN is not fully deployed in the US because telephone companies are slow to replace local channel equipment at central offices . . .

are ordinary twisted pairs, must be able to carry 144 kBs. These twisted pairs, however, were originally designed to

ISDN" service, a switched 56 kBs service. Local telephone companies can more easily provide switched 56 kBs service, because it uses existing local channel equipment that can allow the local channel twisted pairs to carry 56 kBs versus the 144 kBs needed for an ISDN basic rate interface (BRI).

Loop demonstration

Masiello demonstrated switched 56 kBs by giving his presentation over a loop from the convention center to New Jersey and back. Listeners in the audience remarked on the high quality of the audio that resulted.

The switched 56 kBs uses a septet data structure, Masiello explained. The end users' terminal equipment provides 7 bits, which is sampled at 8 kHz for a total bit stream of 56 kBs. The end users must provide a local channel terminal adapter. The terminal adapter, or digital service unit (DSU), takes the septet structure from the user and adds an eighth signal bit. For switched 56, the DSU is a V.35 modem.

Most Regional Bell Operating Companies have the switched 56 kBs service, Masiello said. Each local phone company markets its services under different names.

New York Telephone calls it "Switchway 56," Southwestern Bell calls it "MicroLink 1," Bell South calls it "Accupulse." The cost, Masiello said, ranges from \$100 to \$40 per month for the local channel and about 13 cents per minute of usage.

Who offers what

AT&T, MCI and Sprint offer long distance switched 56 kBs services for an average of 15 cents per minute, he said.

But, "If you were to call your normal broadcast services contact at your local phone company and ask for switched 56 kBs service," Masiello said, "chances are they won't know what you're talking about."

He said there are various companies who act as authorized agents for the local phone companies, which are specialists in data communications and 56 kBs service in particular. CBS Radio uses Northern Transdata Networks of Hauppauge, NY.

CBS Radio is beginning to use 7.5 kHz audio into 56 kBs for local news gathering, network news remotes, sports remotes and as a dial-up STL backup, Masiello said. The availability of 7.5 kHz telephone feeds now exist, he said, and soon 15 kHz phone quality will be a reality.

For information from CBS on ISDN, contact Helene Blienberg at 212-975-3771.

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RDS Shown For Auto, Home

by John Gatski

Atlanta GA R-D-S. It just may be the acronym engineers and station managers need to keep in mind for the future.

Based on reaction to the European-developed Radio Data System (RDS) booth at NAB, the technology could be the next wave for US broadcasters.

RDS indeed was a much-talked about technology at NAB. FCC Chairman Al Sikes forecasted RDS as a coming tech-

ideally can allow a station to transmit its call letters, frequency, scrolling text messages, name of song playing and artist, emergency alert information. And it could actually override a tape playing or radio turned off.

Select a format

RDS also enables a listener to select a format by merely pushing a button on an RDS-equipped receiver.

From an engineering perspective, RDS

came an additional medium?" Lebow asked.

WYAY CE John Bridges said his station was pleased with the station's RDS experiment during NAB.

"When the receivers become available in this country we will jump on it," Bridges said. "I think the stations will support it because of the station ID display."

At NAB, Sage Communication demonstrated RDS's ability to switch from one transmitter to another with WYAY (106.7 MHz) in Gainesville, GA, and WYAI (104.1 MHz) in La Grange, GA. The stations simulcast a country format.

Sage provided automobile rides in and around Atlanta to those who wanted to see and hear how RDS performed. The car was equipped with a portable RDS radio, and a portable antenna.

As demonstrated to *Radio World*, the radio inaudibly switched between the two signals (whichever was strongest). Going north, the RDS radio favored WYAY, located north of the city, and while south of the city, it zeroed in on WYAI.

A few stations across the US are already using RDS full time.

WHTZ-FM in New York operates an RDS encoder to link its three translators. Any motorist with RDS-equipped radios, of which Lebow conceded there are still very few, will maintain a consistently strong signal in the station coverage area because the receiver switches to the strongest translator signal.

"With RDS, it's done automatically," Lebow said.

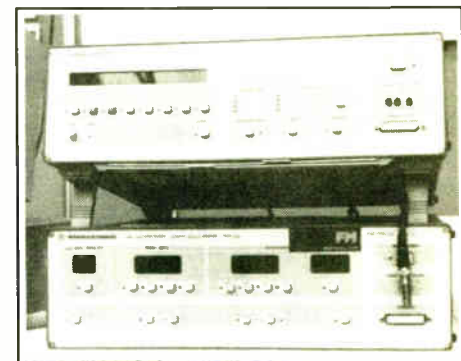
Few RDS stations, so far

Since there are few RDS receivers in the US, Lebow said the station's RDS encoder is somewhat experimental. But he noted that a number of major manufacturers have already committed to making receivers for the European market.

The experimentation allows the station to test the interaction of RDS and the

translators as well as allows receiver companies, such as Delco, to test prototype RDS receivers under real world conditions.

In Europe, RDS is used extensively for traffic alerting and format selection, but there are fewer stations, which allows for greater uniformity of formats than in the US.



Rohde & Schwarz's entry into RDS includes a data coder (bottom) and decoder (top).

The European RDS system as-is will not work in the US because of the numerous formats, but with a reconfiguration of the technology's program information codes and standardization, it can be adapted very quickly.

Besides digital display and transmitter switchover for US stations, RDS could completely revolutionize the emergency alerting system, according to Lebow.

Unlike EBS, which requires the effort of someone at the station to activate, the RDS emergency alert is automatic unless a station engineer overrides it.

A reverse approach

As with EBS, an RDS emergency alert system would require an encoder to be placed at the appropriate agency that initiates the alert, which would send a pre-alert message to each station. The pre-alert would allow the station to decide if the emergency warrants allowing the RDS alert to automatically interrupt normal programming.

If the station decides the alert does not concern area listeners, the engineer (or other station personnel) can override and continue with normal programming.

There is a lot of interest in RDS emergency alert capability for the US, Lebow noted.

For example, Jefferson County TX, an area with a large number of petrochemical plants, plans to implement an RDS alert system next year, he added.

Sage Alerting Systems markets the SAGE I Station Data Terminal that is designed for an RDS emergency alert system as well as RDS mobile and home emergency alert receivers.

With all of RDS's features, it is only a matter of time before it takes hold, Lebow predicted.

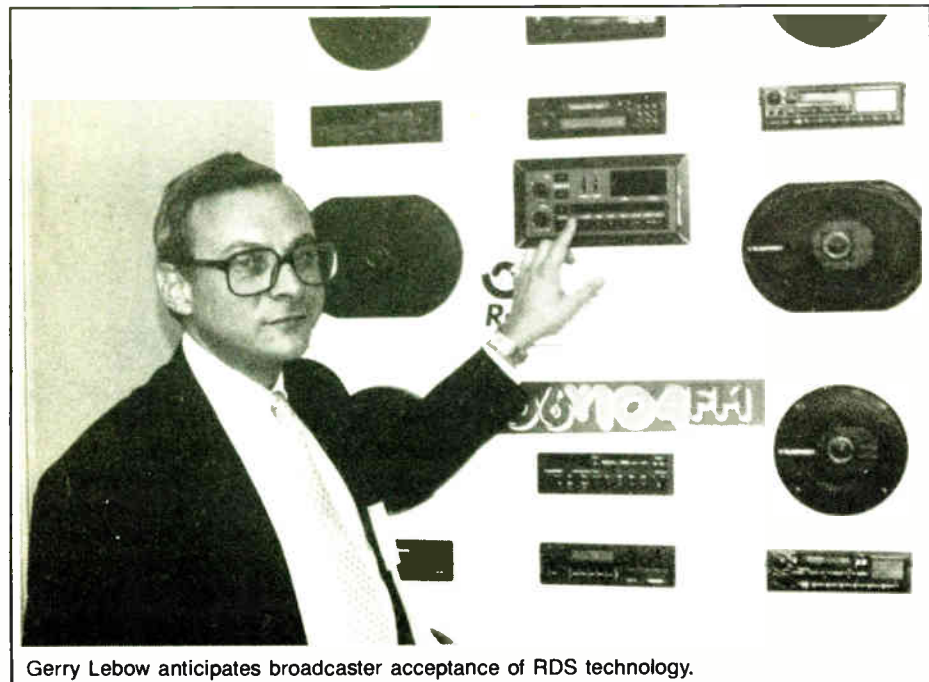
Bridges said that once stations know there are receivers available, they will add RDS, "which is not that expensive."

After the initial stations add RDS, their competition will not want to be excluded from having their call letters displayed on listeners' radios, Bridges said.

There also is substantial competition in the RDS encoder/decoder market including RE Technology in Denmark, VG Electronics in England, Bosch and Rohde & Schwarz in West Germany.

Currently, many foreign receiver manufacturers make RDS units including Blaupunkt, Philips, and Denon and US model production would not be difficult, Lebow noted.

"There is nothing to stop stations from broadcasting RDS right now," he said.



Gerry Lebow anticipates broadcaster acceptance of RDS technology.

nology for FM broadcasting during his NAB address and it was mentioned as a possible salvation for AM during a radio engineering session.

Sage Alerting Systems Inc. of Stamford, CT and several RDS encoder/decoder manufacturers were part of an extensive RDS booth. Also, actual broadcasts of the data display were made from two Atlanta area simulcast stations, WYAY-FM and WYAI-FM.

The RDS digital subcarrier technology

also can transmit technical data relating to the transmitter.

The 57 kHz subcarrier is compatible with most other subcarriers stations broadcast and does not audibly affect the signal or most other subcarriers.

The main reason that RDS may catch on in the US is the potential to advertise station call letters and transmit promotions, according to Sage Alerting Systems President Gerry Lebow.

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World Radio History

TV Marti Causes Concern for Radio

(continued from page 1)

and they fear increased interference in retaliation for TV Marti.

The TV Marti tests, transmitted after midnight through 6 AM, are expected to last up to 90 days. Congress then will evaluate whether the service will become permanent like its radio counterpart, Radio Marti. Radio Marti went on the air in 1985.

Despite concern that Cuba will retaliate against US broadcasters, particularly in Florida, FCC officials said there was no evidence of intentional interference following the initial test broadcasts.

Some Florida stations, however, have reported the normal, intermittent interference that has been coming from Cuban stations since the mid-1980s.

During a TV Marti panel at NAB, broadcasters remained skeptical about the service. Several issues were raised by broadcasters and the NAB, including the likelihood that Cuba will retaliate against Florida AMs and TV stations and begin jamming Radio Marti, which has not been bothered by Cuba.

Clear Channel Broadcasting Service President Wayne Vriesman said TV Marti can only hurt broadcasters in the long run. His group represents 59 US clear channel AM stations that have been

interfered with by Cuban broadcasts.

"We feel that TV Marti is a boondoggle and a waste of taxpayers' money," Vriesman said.

Rep. Al Swift (D-WA), a member of the House Telecommunications and Finance subcommittee, said the probable Cuban retaliation against US radio stations and possible retaliation against TV stations outweigh the partially effective TV Marti transmission to the island.

Congressional opponents of TV Marti said the legislation was buried in a State Department authorization bill and members voted for it, including Swift, without giving it a full hearing and without broadcaster input.

"It's Congress' fault and nobody else's," Swift said.

Congress is likely to re-review TV Marti feasibility in the near future, Swift said.

Wally Johnson of Moffet, Larson and Johnson, a broadcast consulting firm in Washington, DC, said the US government may believe it has a clear mandate to broadcast TV Marti because radio stations have not complained to the FCC about previous Cuban interference.

The engineers are fully aware of interference, but management declines to complain because they believe the issue too political, he said.



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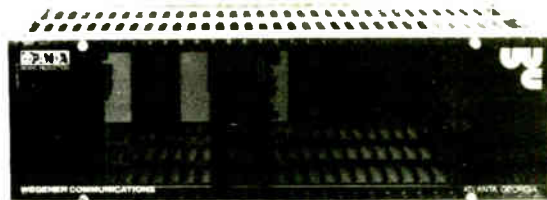
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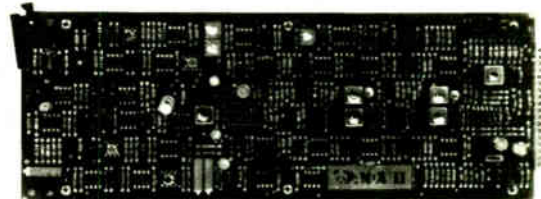
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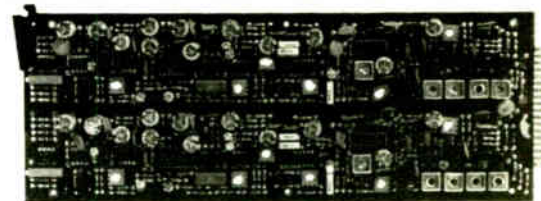
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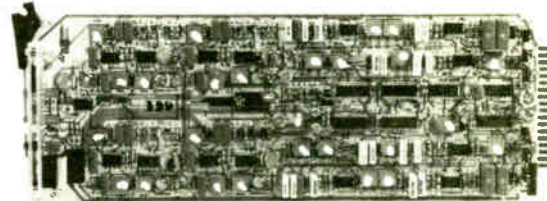
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Corporate Group Engineer
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“This wasn’t our first 200 series purchase, of course. That honor belongs to an early 218 serial 0045 which we bought for our Cleveland station WGAR back in 1982. We’ve bought eight more Auditronics consoles since.”

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Corporate Group Engineer
KZZP-FM
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Tapeless Twist to Storing Audio

by Barry Mishkind

Atlanta GA At the 1990 NAB convention, audio storage techniques seem to be taking a leap "back to the future."

True, three new tape cartridge machines were introduced by major manufacturers. But the technology for a return to the tapeless broadcast studio was much in evidence.

Quite a few exhibitors showed various pieces of equipment for digital audio storage and manipulation. Price tags ranged widely, but overall were much more modest than just a few years ago.

Cart replacements

A lot of interest was generated by the 360 Systems DigiCart. Based on a specially designed Omega removable magnetic disk cartridge, the \$4000 DigiCart provides multiple cuts in digital format.

Using RAM buffers, instantaneous play of cuts is offered. Even segues can be accomplished. While not yet available as a finished product, the DigiCart seems to be trying to duplicate the flexibility of tape carts in the digital environment.

A front panel LED identifies a variety of features and names and times the cuts. While the disks sell for about \$40, unlike carts, several cuts can be recorded onto one disk. If the industry can move past the one-play-per-media thinking, this may become an acceptable cart machine replacement.

Computer Concepts Corporation, long a supplier of computer programs for traffic and billing, unveiled its new Digital Commercial System which it is promoting heavily as a cart replacement.

Designed for flexibility, but ideally suited for stations using program audio delivered by satellite network, the Digital Commercial System "control room" consists of a computer and a keyboard.

Quite a shock for veteran broadcasters! Yet, except for transmitter control, everything from sales input to billing is handled by the system.

Local audio is held on a 766 megabyte hard disk, with a capacity of 340 minutes. Everything from spots to jingles to news to IDs is available for immediate play at any time. A dual redundant system is approximately \$22,000.

Wide variety of storage

Several other manufacturers showed digital storage of audio on hard disks ranging from a limited capacity to units that could conceivably hold an entire playlist.

For instance, Broadcast Electronics has offered a RAM-based digital storage unit for several years. Limited to a few minutes and cuts, it still is useful for those wishing to put ID, liners, etc. on line for quick retrieval.

The Sounder from Corporate Computer Systems is another such unit, providing 10 minutes of digital audio for \$5000.

Then there was the AUDISK, first shown at last year's SBE convention as a satellite automation system. Starting from 180 minutes, the manufacturer—Macromedia—says the system has an expansion capacity up to 160 hours or longer.

CD innovations

So, what about all those CDs you've acquired, or the DAT machines everyone has been pushing for the past several years?

There were several interesting developments there, too.

Many stations moved into digital audio during the '80s by moving from disk to CD. While the consumer grade CD players sometimes caused problems, professional series units have been improved.

Denon had done a lot to bring solid, reliable CD machines into the studio. After clearing up some problems with earlier models, Denon has now introduced its new DN-970FA production CD cart player.

This \$2600 machine will find a place in production rooms where there is a desire to have a vari-speed feature, three separate built-in loops, and the ability to "speak" directly to the digital audio workstations on the market.

Century 21 Productions combines digital computer storage and the CDs they supply to clients to provide a completely local live assist operation that eliminates carts.

Those stations dealing with the premature death of CDs will be interested in the multiple CD players that take the CD out of the DJs hands. Sony, among others, makes a modern version of the Seeberg 50.

Random access to such machines has been mainly provided by pre-programming the day's playlist, or using a computer interface. However, there are alternatives such as the SMC CD Controller. For about \$1000, you can control two Sony units with 120 CDs on-line.

Push for professional DAT

Several other manufacturers showed CD players for the studio environment, but the emphasis on new equipment this year speaks to the push for professional quality DAT recorders.

While not eliminating tape, DAT does move it to the digital domain, with significant audio improvements available.

Like CD players, most DAT recorders in

use have been consumer units or modified consumer units. Radio Systems, for example, adapts a Sony DTC-1000 to the studio environment by adding a microprocessor and controls. Cueing, automation interfacing, and full remote control are among the features added in the combined unit.

Tascam introduced a new broadcast DAT recorder. The DA-30, priced at \$1899, is designed for the production studio. It utilizes the AES/EBU interface, and start ID positioning, full remote control and +4 dBm balanced outputs.

Technics also expects to ship a broadcast DAT at the end of 1990. Designed as an upgrade to the company's consumer machines, the Pro-Dat series offers a professional interface and remote control, along with the infrared remote.

A peek ahead?

Last, but not least, is a very interesting look into the future. Gotham Audio, which spent much of the '80s working on digital audio storage on hard disks, has opened the '90s by offering a recordable CD unit.

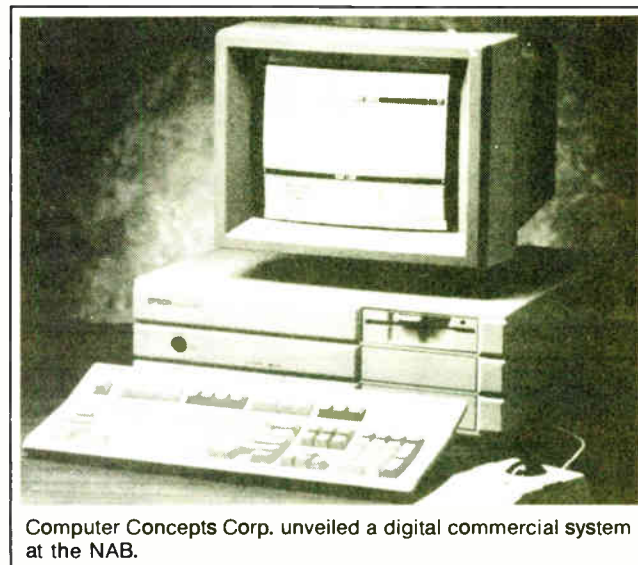
The SPOT 90 system from Gotham combines equipment from several manufacturers including Sony, Yamaha, Fuji, and Dell Computers.

A complete system, the SPOT 90 takes audio input from various sources and produces a master DAT recording that is transferred to the CD recorder. About one hour of audio can be recorded on the CD.

With SPOT 90, spots, jingles, promos

and anything else can be locked down onto a CD for replay in the control room, or transfer to another station, etc.

At \$42,500 for the system, plus \$60 per recordable CD, this isn't for everyone.



Computer Concepts Corp. unveiled a digital commercial system at the NAB.

But it is a reminder of how fast technology is changing. As production continues, it may well become cost effective for your station or chain to produce its own CDs for use.

The digital handling of audio is becoming a larger and larger part of our broadcast chains. The products described here demonstrate that we are moving into the '90s in a fantastic way.

Another product for digital storage and automation included the Schafer Digital system, introduced a few NAB shows back.

And Studer Revox, one of the first companies to introduce a professional CD player, had its latest model CD player on display.

■ ■ ■

Barry Mishkind is a regular RW columnist with a long history of covering NAB conventions.

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Products Sizzle, Digital or Not

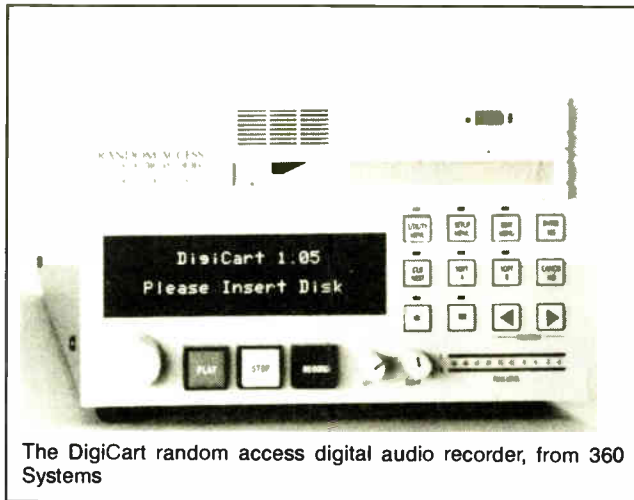
Atlanta GA It was a show of digital glitter and analog's still dominant place in the radio industry.

The NAB exhibit showcase, with close to 200 radio and related equipment vendors displaying their wares in booths, saw the maturation of digital store and play media; the coming of age of production workstations and further steps in the direction of digital processing.

It also gave us three new analog cart machines including one from a new entrant in that market.

After several years of talk about a digital cart machine replacement, 360 Systems offered the first real hint that it might become reality.

The company's DigiCart uses a remov-



The DigiCart random access digital audio recorder, from 360 Systems

deal of feedback from interested radio station engineers and is getting ready to incorporate suggestions into a production model slated for summer availability.

Computer Concepts also introduced a "cart replacement." Its system is a standard computer set-up with keyboard for traffic/continuity and a track ball



Alpha Audio's DR-2 digital hard disk recorder

in developing traffic software, to do everything from recording a spot to scheduling and logging it once it's played.

With the computer setup and the 620 MB of storage, the system costs \$12,000, which takes it out of the normal range of cart machines but makes it a competitive device in the area of station automation.

There were numerous other digital offerings. AKG is ready for market with its DSE-7000 workstation. The product is attuned to the needs of radio station production, and is at a price stations can afford at \$37,500.

Alpha Audio, after announcing an agreement with a venture capital firm, is ready to enter the digital store

and playback field with its DR-2 Digital Audio Recorder, which the company calls a "playstation."

(continued on next page)



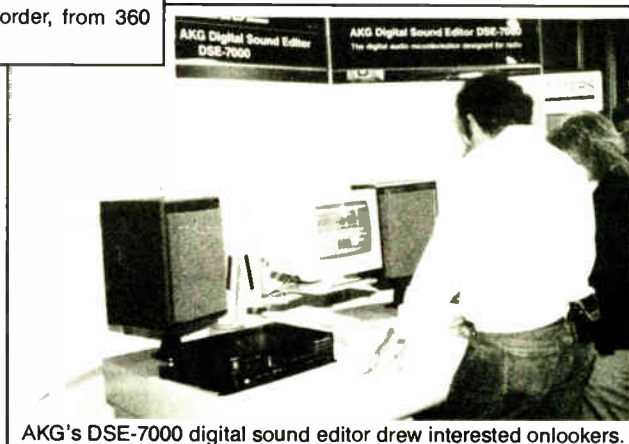
Panasonic showed the SV-3700 pro DAT recorder/player.

(\$35 in volume), recording multiple spots on a disk may put them more in the price range of carts, allowing for digital quality.

The front panel readout is easy to operate and provides features such as running time, name of spot and

whether stereo or mono and what rate it was recorded at, along with the ability to "trim" a cut.

At \$3995 for a stereo/mono record/play unit, it is competitive with cart machines. 360 Systems received a great



AKG's DSE-7000 digital sound editor drew interested onlookers.

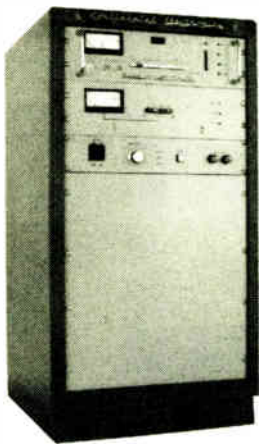
for the studio operator.

It allows for 170 minutes of audio at a 32 kHz sampling rate and makes use of the company's considerable experience

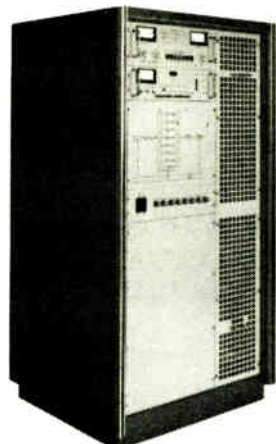
and playback field with its DR-2 Digital Audio Recorder, which the company calls a "playstation."

able hard disk which can record at 10, 15 or 20 kHz to give numerous cuts containing spots, commercials and even music for on-air play. At 15 kHz stereo the disk will yield 20 minutes of storage space. Although the disks cost \$40 each

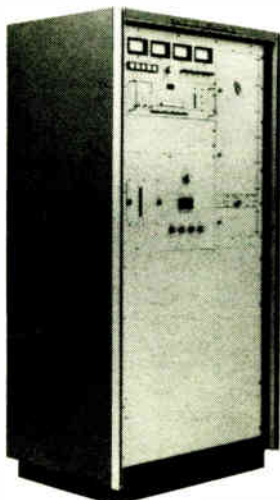
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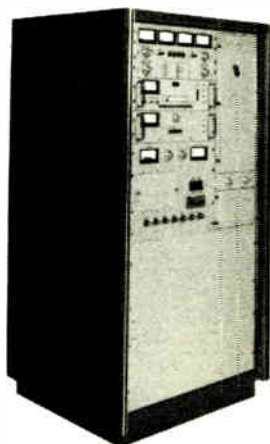
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Radio Zooms Into the 1990s

(continued from previous page)

It is designed to imitate the functions of a two-track tape deck, including cut-and-splice editing, all with digital quality. The price of the easy-to-operate unit depends on the amount of storage time



The Express Group exhibited its line of studio furniture.

and for a full vote on a new worldwide time-code standard to make inroads into production.

But both Panasonic and Sony featured product intros at the show. Panasonic is sticking with standard studio and portable models and waiting on a timecode/editing system. The 3700 is an upgrade to the 3500, currently on back order with the company and the new 3900 features full-function remote control.

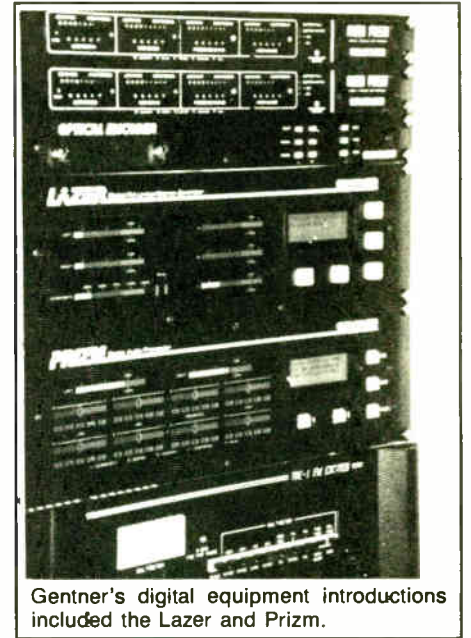
Sony introduced three models: the PCM-7010 record/play DAY at \$4000-8000; the PCM-7030 ProDat at \$7000-12,000; and the PCM-7050 edit player with RM-D7300 editing controller. The record/play/edit deck features timecode and will cost \$11,00-\$17,000, while the controller is priced at \$5000.

In the area of processing, company new to the field although well-known for its other products, Gentner, showed the first offerings to emerge as wholly new products from the company's acquisition of Texar.

The Lazer is an FM limiter stereo generator which was shown working in prototype. The Prizm, meanwhile, is a



Wheatstone displayed the A-50 console.



Gentner's digital equipment introductions included the Lazer and Prizm.

included. The DR-2 is priced at \$10,000 for 15 minutes of stereo full-frequency audio and up to \$15,000 for a full hour of storage.

DAT is still waiting for consumer acceptance to drive the more basic models

product concept: an all digital processor which is still in development, mostly for software. Gentner has committed R&D resources to coming up with a product which will give stations competitive processing while preserving a quality signal.

Furniture is becoming more or a popular offering for stations in medium and smaller markets who can't invest in large custom studio redesigns. The Express Group has been marketing its line for quite some time and it's furniture was shown in several booths.

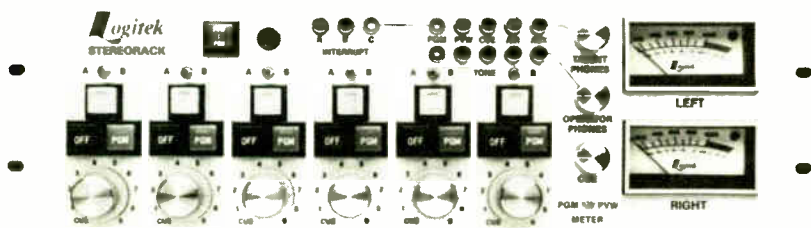
Murphy Furniture added the Premier Series to its already successful Elite Se-

ries. Premier features many of the same elements as the Elite line but is less modular.

A company which has been custom-making furniture for turnkey studio builds is Pacific Recorders & Engineering. Now PR&E has decided to offer a quality line of furniture to those who can't afford the custom designs by marketing a line of stock furniture.

The PrimeLine features many of the quality features associated with the company's custom studio rebuilds and features custom-designed countertops on stock pieces.

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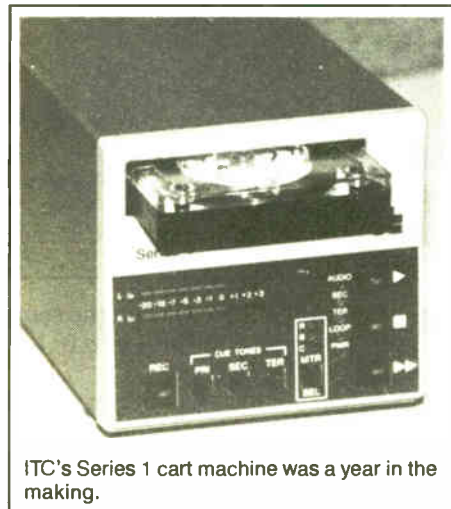


40
YEARS OF EXCELLENCE

New Cart Decks Are Plentiful

by Charles Taylor

Atlanta GA Innovations in cart machines, carts and studio equipment displayed at the NAB show this year proved that even with digital gaining



ITC's Series 1 cart machine was a year in the making.

strength, analog technology remains a strong force in the nation's radio stations.

ITC, under the new ownership of Don Carle, introduced its Series 1 cart machine, which has been in development by former owner 3M over the past year.

The unit, the first of several planned by the company, offers LED meters and easy care and maintenance in a cast aluminum nickel-plated deck, according to ITC.

As a new entrant to the cart-machine market Radio Systems showed its new RS-Cart 2000 cart machine designed by Mike Sirkis, a well-known name in cart machine design.

Features include flutter compression, phase correction, phase display, front panel azimuth adjust, three cue tones, 1/3 rack width and the company's Advanced Cart Hold-Down System.

Dura Trak 90

The Dura Trak 90, which introduced phase-correction to cart decks, was highlighted by Broadcast Electronics, featuring machined 1/2"-thick aluminum deck plate, Phase Lok V head block, toroidal power transformer, instrumentation-quality balanced inputs and cart-previously-played lockout.

Fidelipac debuted its Dynamax CTR90 Series cart machine. The unit features three cue tones, FSK compatibility, Advanced Programmable Internal Logic Network, status indicators, real time minutes and seconds timer with auto-freeze capability, cleaning mode and Dolby HX Pro Headroom Extension.

Also new from the company was the Audiomax 4000 cart, which Fidelipac said was developed specifically for premium quality stereo use at elevated levels.

Shell design of the Audiomax is refined, using first generation molds and the latest in rugged high grade engineer-



Radio Systems used the NAB show to exhibit new and established products.

ing plastics.

Audiopak showed its popular AA-4 cart, capable of extended frequency response for digital source material. The cart shells now sport the Audiopak logo for easy identification. The AA-3 was also exhibited, with the company's "neutral casting" design allowing the cart machine to handle the tape guidance functions.

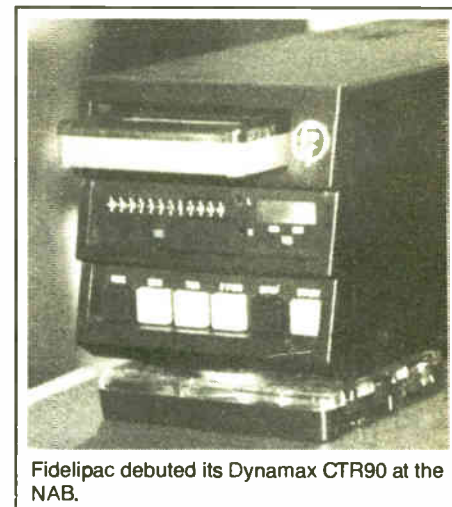
Studio-production recorder

Available now from Otari is the MTR-15 two-track studio-production recorder, unveiled at the New York AES Convention. It features extensive use of microprocessor control, employing a number of advanced systems developed for Otari's state-of-the-art MTR-100A 24-track machine.

Tascam also showed its line of reel-to-reels and its popular "all-in-one" mixers incorporated into four and eight track reel and cassette decks.

The microprocessor-controlled tape transport includes a built-in four point locator, featuring three "one-touch" cue points, search to zero, last play search and

a repeat mode. The large LED tape counter displays ips, cps, hours/minutes/seconds, hours/minutes/seconds/frames or error messages.



Fidelipac debuted its Dynamax CTR90 at the NAB.

Also in the cart machine arena, Pacific Recorders & Engineering featured its Micromax series.

And Studer Revox showed its full line of reel-to-reel decks.



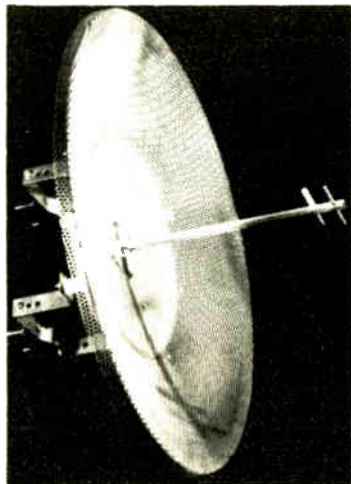
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a superior cart machine. And the new
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features you need at a
realistic price.

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buttons. Flip
the switches,
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and yank it out a few



hundred thousand
times. We've built
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to take anything
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365 days a year.

So before you

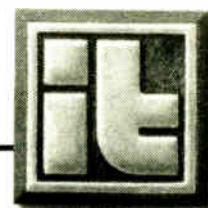
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Many Choices In Workstations

by Ty Ford

Atlanta GA Say the words "Digital Audio Workstation" (DAW) to most manufacturers of such equipment and they will look at you as though you have recently compromised the aroma of their air.

It may be a harsh comparison to say that using the phrase "workstation" was

akin to brandishing a crucifix at a vampire. However, the pale complexions of those software and hardware developers who had spent long hours in the lab in the creation of these devices were not unlike that of Dracula himself.

Because there are so many different approaches to DAW, comparing them is difficult at best. Some come with their own computers, some require that you

get your own.

Some use RAM, some hard drives and others a combination of both. Several systems are now using magneto-optical (MO) disks and "write-once-read-many" (WORM) disks capable of storing gigabytes of information.

There are more differences than similarities in these systems. The chart that accompanies this article is an at-

tempt to bring together significant data in a comparative way.

If you find focusing on the "right" piece of gear difficult, try asking yourself the following questions:

How fast will the system perform the required functions?

How difficult to use is the computer interface or operating hardware and software?

How many tracks need to be recorded at one time?

How many inputs and outputs are needed?

(continued on next page)

Digital Workstation Product Guide . . .

Company/System	Sample Rates/Formats/Oversampling	Hardware	Inputs & Outputs	Track Time
AKG (415) 957-1063 DSE7000, HD & RAM	48kHz, 44.1kHz (with 32kHz option) 16 bit linear PCM 4X output	20MHz Intel 80386 w/ 1M DRAM. High capacity floppy drive, 150M ESDI HD, serial comm. and parallel printer ports, 10 input mixer, 14" EGA color monitor, word processor and custom console.	IN: Two balanced analog or digital. Narrow band dither. Time aligned 18 bit DAC. OUT: Two balanced.	4.4 min @15kHz (expandable to 70 mono track min.)
Alpha Audio (804) 538-3852 BOSS/2 controller DR-2 recorder, HD	48kHz, 44.1kHz, 44.056kHz, 38kHz, 24kHz and 16kHz 16 bit linear PCM 64X input, 4X output	Boss/2 is a 12MHz286 w/EGA color graphics, 20M HD, 1.2 M floppy. Two comm ports plus printer port. Keyboard touch pad for machine speed control, rack mounted.	IN: Two balanced analog, or optional AES/EBU. OUT: Two balanced analog, or optional AES/EBU	15 min. stereo to 60 min. stereo at 44.1kHz (optional HD's for up to 8 hours stereo).
AMS (707) 762-4840 AudioFile Plus, HD & RAM	48kHz, 44.1kHz, 32kHz 16 bit linear PCM 2X input, 4X output	Self powered control surface w/screen, keyboard, jog wheel, soft controls, card rack, and disk drive main frames. 32 bit Transputer open-architecture allows multiple parallel processing. Dual 380M HDs.	IN: Two balanced analog expandable to eight optional digital AES/EBU, SDIF-2, SPDIF, EIAJ. OUT: Eight balanced analog, optional AES/EBU, SDIF-2, SPDIF, EIAJ.	120 min. expandable to 480 min. at 44.1kHz
Digital Audio Research (213) 466-9151 Soundstation II, HD and RAM	44.1kHz standard or optional 48kHz 16 bit linear PCM No oversampling	Dedicated editing rack-mounted. Proprietary touch screen display/controller.	IN: Four to sixteen balanced analog, optional AES/EBU, SDIF. OUT: Four to sixteen analog, optional AES/EBU, SDIF.	60 min. up to 960 min. at 44.1kHz.
Digital Dynamics (516) 271-5600 ProDisk-464, HD	48kHz, 44.1kHz, 32kHz Continuously variable 16 bit linear PCM 64X input, 4X output	Requires computer, from a Mac Plus up w/1M RAM. Mac doesn't process audio. 8mm B/U, for 6 hours.	IN: Four balanced expandable to sixty-four, analog and/or optional digital. OUT: Four balanced expandable to sixty-four, analog and/or optional digital.	120 min. up to 720 min. at 44.1kHz. from 30 min. up to 3 hours per track.
Ediflex Systems (818) 502-9100 Audiflex, M/O Disk, RAM buffer	44.056kHz 16 bit linear PCM Over sampling N/A	IBM 386 w/Microsoft Windows. 19" NEC color multisync screen. One 600M removable M/O disk per track, 380M HD library storage.	IN: Four balanced analog w/proprietary A/D converters, maximum of eight. OUT: Four balanced analog w/proprietary A/D converters, maximum of eight.	220 min. for first side of four disks. Four disks record on both sides for a total of 440 min., but must be flipped. Eight disks per system maximum.
Lexicon (617) 891-6790 Opus E, HD	48kHz, 44.1kHz, 44.056kHz 16 bit linear PCM 4X output	Proprietary 386 with dedicated controller for editing. Edit controller w/meters, display, soft keys and jog wheel. 8mm B/U.	IN: Four to twenty eight balanced analog or AES/EBU, SPDIF, SDIF1-2. OUT: Four to twenty-eight balanced analog or AES/EBU, SPDIF, SDIF1-2.	209 min. up to 869 min. at 44.1kHz
New England Digital (802) 295-5800 PostPro SD, HD and RAM	1Hz to 100kHz, programmable 16 bit linear PCM Up to 100kHz	Mac IIx, 16" color monitor w/256 color graphics card, 80M HD, 4M RAM and trackball. 440M HD and built-in 5.25" floppy drive for sequences and files.	IN: Two, expandable to four, balanced or unbalanced. Optional AES/EBU, ProDigi, SDIF-2, D-2 compatible. OUT: Eight balanced expandable to 16. Optional AES/EBU, ProDigi, SDIF-2, D-2 compatible.	240 min. for eight tracks at 44.1kHz, expandable to 480 min.
Soundmaster (212) 787-5832 Syngram, HD and RAM buffer	48kHz, 44.1kHz, 44.056kHz. real time data conversion 16 bit PCM, 1 bit D/S modulation 64X input	DOS compatible 80386, w/80387 co-processor, 40MB HD, and choice of two floppies, keyboard, optional monitor.	IN: Two or more proprietary digital inputs, also AES/EBU, SPDIF, optional analog OUT: Two or more proprietary digital inputs, also AES/EBU, SPDIF, Optional analog.	30 min to 120 min. per drive at 44.1kHz.
Studer Revox (615) 254-5651 Dyaxis, HD	48kHz, 44.1kHz, 44.056kHz, 32kHz to 7kHz. (140 sample rates) AES/EBU, SPDIF, SDIF, PCM 601, Yamaha, IMS. 16 bit linear Oversampling N/A	Mac II, multi-format audio processor and 105M up to 640 M HD. SCSI based for up to six drives.	IN: Two analog or digital. Four with 2+2 model. OUT: Two analog or digital. Four with 2+2.	20 min. to 720 min. at 44.1kHz
Symetrix (206) 282-2555 DPR100, HD	48kHz, 44.1kHz, 44.056kHz, 32kHz 18 bit linear PCM, 24 bit internal 64X input, 4X output	Mac 300MIPS Proprietary computer and system. Optional hardware control surface (\$15, 500.00) w/eight moving faders, solo, mute, pan, monitor and mix fader, transport controls. Records to 630M HDs. Shuttle wheel slips partial or complete tracks. SoftScreen interface, and backgrounding 8mm backup.	IN: Eight analog, optional AES/EBU, S/PDIF, SDIF-2, Mitsubishi X-86/880, PCM-3324/48. OUT: Ten analog out, optional AES/EBU, S/PDIF, SDIF-2, Mitsubishi X-86/880, PCM-3324/48.	206 min. for eight tracks at 44.1kHz expandable to 1440 min.
Turtle Beach Softworks (717) 757-2348 56K, HD	48kHz, 44.1kHz, 32kHz 16 bit 64X input, 8X output	286 or 386 compatible, 56k-PC card, 56k-D digital audio interface, editing software.	IN: Two AES/EBU, SPDIF, optional analog OUT: Two AES/EBU, SPDIF, optional analog	Up to 52 min. at 44.1kHz
WaveFrame (303) 447-1572 AudioFrame, HD and/or RAM	44.1kHz and 44.056kHz 16 and/or 24 bit PCM 4X output	25MHz 386 computer w/4 M RAM, 40M HD, 1.2M floppy, keyboard, mouse, 19" mon. color option. Optional moving faders w/definable EQ, reverb, send/return controls.	IN: Two to fifty-six, optional AES/EBU, S/PDIF, SDIF-1 & 2, PD DUB and PD. OUT: Eight to fifty-six, optional AES/EBU, S/PDIF, SDIF-1 & 2, PD DUB and PD.	60 min. at 44.1kHz expandable to 720min. dynamically allocated.

Wide World of Workstations

(continued from previous page)

- How much storage is needed?
- How will this system integrate into an existing system?
- Will this system replace an existing console, or just the recorder?
- How quickly will it perform editing functions?
- How readily does the architecture of the system allow for future expansion?

- How important are SMPTE and MIDI sync?
- How can the NAB's concession stands charge \$1.50 for a soda? (Sorry.)
- There are other important questions. How many systems does this company have in operation? Where is a list of unbiased users who can answer application-oriented questions about how well the system works?

- What is their opinion of the manufacturer's commitment and support?
- Will the new system allow you to increase your hourly rate? Check the "real" rates of similar systems in your market. If you are the first on the block, test your clients' reaction to a rate increase based on the new system.
- If they're not prepared to pay for a rate increase, make sure your pockets are deep

enough to eat the cost of the new system. Buying a multitrack tape machine is relatively simple compared to the thought process necessary to make the right decisions about which of these systems will best fit your needs. With careful consideration, and asking a lot of questions, you can save yourself a lot of major headaches.

■ ■ ■
Ty Ford is an independent audio consultant and regular contributor to RW. He is currently writing an advanced production book for Focal Press. Reach him by phone at 301-889-6201 or by MCI mail #347-6635.

Features At-A-Glance

SMPTE/MIDI	Time Compression	Internal Channels and Storage	Features	Price	Comments
TBA: 24, 25 29.97 & 30 frame and drop-frame, master or slave.	TBA	Eight, 150M HD upgradable to 676 M HD.	Digital mixer, N/D editing, Real time or auto: level, pan, time slip, copy, move, delete and undo. Multi-speed search, scrub wheel, 7 auto/loc points, 2 sends/returns, connector for 6 function remote control and status indicator.	\$37,500.00 for basic system.	Includes Intel 80386 based computer w/ AKG DSP ADC/DAC, 4.4 min, dedicated hardware controller, 150M HD and keyboard. Up to three extra 16M RAM cards, (4.4min) \$4,500.00 each. Optional AES/EBU & DAT/SPDIF I/O \$1500.00.
24, 25 29.97 & 30 frame and drop-frame, master or slave.	No	Two per DR-2, 170M HD w/optional 768M	DR-2 recorder is a proprietary design w/ 2 comm. ports, multi video sync, ext. SCSI port, internal time code reader/generator. Cut and paste N/D editing. Small remote control board for transport control plus scrubbing and editing.	\$22,000.00 for Boss/2 with three machine control interfaces \$10,000.00 for DR-2 with 15 min stereo.	DR-2's can be used with a controller without the Boss/2 system if not required to control other machines. DR-2 has built in event playback memory. Remote LCD screen for DR-2 is optional. Expandable to 60 min stereo for \$15,000.00. Optional 8mm tape B/U for DR-2, \$5,000.00.
24, 25 29.97 & 30 frame and drop-frame, master or slave.	50% to 200% program dependent	Eight, Two 380M HDs, to four 380M HDs.	N/D editing to sample to level: Cut and paste, track slipping, jog, copy, shuttle, SMPTE sync/reader/generator, ADR, house/word sync, machine control, level, pan, fades, crossfades, ramps, loops, scrubs.	\$90,000.00 basic system w/two 380M HDs. \$145,000.00 for 8 inputs and four 380 MB HDs, expandable. Includes file management, EDL and CMX.	Optional I/Os: AES/EBU, SPDIF, PCM 701, F1,1610 eight input, rewritable M/O archiving, extension monitors, control surface pod.
24, 25, 29.97, 30 frame and drop-frame, master or slave.	80% to 120% program dependent	Two to Sixteen, One 380M HD to eight 760M HDs.	External machine control, Word/it automatic ADR synch, N/D editing, Cut and paste, track slipping, house or word sync, SCSI port.	\$55,000.00 to \$150,000.00 for 16 channel eight track hour storage.	Optional erasable 650M M/O disk B/U via RDAT or optical disc. Optical B/U runs in background. Digital I/Os: \$2000.00 for two channel SDIF, \$5000.00 for four channel AES/EBU.
24, 25, 30 frame and drop-frame, MIDI time code and MIDI clock w/song pointer.	TBA	Four to sixty-four, One 670M to 4020M.	Auto punch in/out, cut, copy, paste, erase, fill, align w/digital crossfade, scrubbing, waveform display and editing to the sample level. Generates a SMPTE EDL for editing. Multi-track or cue list screen modes, multiple sound storage.	\$28,495.00 for analog four-track, 8 track system \$42,000.00, 16 track \$72,000.00, 24 track \$110,000.00 to \$279,995.00 for 32 in, 64 out.	Optional HDs, digital I/Os and B/Us. Records all tracks simultaneously.
30 frame and drop-frame, Master or slave.	Soundwave expansion or shaving	Four to eight, 600M M/O disks, plus 380M HD and 8M or 12M RAM.	Four serial, 1 parallel port with optional serial or parallel printer port. Random or linear editing. Auto-assembly via SMPTE, CMX, ISC compatible EDLs on 3.5" disk, (optional 8" disks). Master and slave mode.	\$131,600.00 Four optical and one hard disk, internal computer, monitor, keyboard, mouse.	Uses rewritable optical disks for audio. Controls up to four video or audio transports. Wild recording to any track or direct to memory.
24, 25, 29.97, 30 frame and drop-frame, LTC, NTSC, PAL, Master or slave.	50% to 150%	Ninety-nine, One 1.2G HD to four 1.2G HDs	Digital 8x2 mixer, real time: level, pan, crossfades, cut, copy, replace, loop, align. Auto in/out. Simultaneous eight track record. Single channel crossfades.	\$110,000.00 for one 1.2G HD, four analog in/eight out, 8mm B/U, edit controller to \$170,000.00 w/ four HDs.	Options: extra disks, A/D D/A converters, time compression.
24, 25, 29.97, 30 frame and drop-frame, VITC.	50-200% optional program dependent	Eight to sixteen, Two to four 500M HDs.	Mac-based EditView audio editing program. N/D cut, paste, copy, looping, track and event slip. in-sync sound design. Auto-punch in/out, scrubbing. auto-assembly via MIDI, SMPTE, and CMX. Waveform edit to sample level.	\$129,600.00 for eight track, eight sampling voices, 4M sampling RAM, w/Mac and System. Average system price \$175,000.00 to \$190,000.00.	Options: VITC reader, controller/editor/locator, MIDInet, 76-note velocity pressure keyboard, Autoconform software for CMX EDLs, machine control, 2G optical W.O.R.M. disk, Synclavier
24, 25, 29.97, 30 frame and drop-frame, NTSC and PAL.	No	Two per drive, 190M, 380M, 760M HDs, to 650M and 1G rewritable M/O disks.	Ten times play speed for B/U. Real time digital processing: EQ, reverb, delay echo, pitch change. N/D cut, paste, copy, looping, track and event slip, auto or manual punch in/out.	\$22,500.00 for two channel, expandable.	Optional: fiber optic link, syncs for external machines, CMX EDL conversion, analog I/Os, programmable remote pad.
24, 25, 29.97, 30 frame and drop-frame, (optional VITC)	50%-200%	Limited only by drive capacity. One 105M HD to six 640M HDs.	Timescaling, N/D cut and paste, paste to time code, ambience file, ramps, crossfades, ducking envelopes, level, pan, mutes. Internal mixing, all tracks.	\$8000.00 (not including Mac), analog processor, w/105M HD, \$13,000.00 for 320M HD (60 min.), \$16,000.00 for digital I/O, 640M HD for 120 min., to \$42,000.00 for 2.5 GB HD for 512 min.	Options: MIDI time code box, word clock. System sync for reading/writing VITC, LTC, locks to house clock. Abekas interface control, DSP card for meters and time scaling. 2+2 model is 4 in/out.
24, 25, 29.97, 30 frame and drop-frame, VITC, MIDI Time code, word clock.	TBA 50-200% program dependent	Forty, Two to fourteen 630M HDs or 1.2G HD.	Simultaneous 8Tr recording, 40Tr mixing in blocks of 8, cut and paste to sample level. Real time events: crossfades, ramps, EQ, compression, limiting, gating, full dynamic automation/recall, external machine control. A virtual recording studio.	\$79,950.00 for level 1 eight track to \$159,500.00 for level four. Shipping Summer or Fall '90.	Level 2: \$95,500.00, sync board, digital I/Os. Level 3: \$129,500.00, 2nd disk file processor, four additional HD's, 18 to 24 bit conversion, 40 track internal operation. Level Four: \$159,500.00 42 simultaneous analog and digital inputs & outputs, comprised of digital effect send/returns/inserts plus 8 inputs, 8 channel outputs, stereo mix output, 8 inserts, four sends/returns per track, extra HDs.
24, 25, 29.97, 30 frame and drop-frame, or MIDI time code, Master or slave.	N/A	Two, One 80M to 650M HD.	Two track system with N/D editing, Real time EQ and frequency analysis, MIDI and SMPTE (read/write), EDL cut and paste. Digital level scaling, reversing, phase inversion and manual or automatic crossfades.	\$2689.00 for 56K-PC digital card and 56k-D digital interface, cable, software. (needs computer and DAT). \$3684.00 for same system with 56K analog converter (requires computer). Shipping June '90.	Options: 56KA A/D D/A converters. Larger HDs.
24, 25, 29.97, 30 frame and drop-frame, VITC, NTSC, PAL, MIDI, in/ext sync (video or word clock).	No	Four to eight, One 300M HD to five 1.2G HDs (more w/ external chassis), 8M to 90M RAM.	All digital processing and routing. Simultaneous 8Tr recording. Up to 48 channels internal mixing on 64 point digital patch bay. N/D editing, Real time events: EQ, reverb, panning with full dynamic automation and recall. Sampler can use EDL, 8mm backup on systems with disk recording or sampling. Sampler option includes 300+ instrument samples.	\$48,030.00 for four track recorder w/60 min., two in/eight out, \$92,480.00 for eight in/out, 120 min. with 16 ch digital mixer (parametric EQ, reverb). \$249,530 for recording, mixing, sampling system w/color monitor and tape B/U.	Digital processing. Composite and house sync at 44.1kHz, or 44.056kHz. High res. monitors. Options: removable rewritable M/O disks, sound libraries for sampler: Prosonus, Valentino SFX, Digeffects, Sonic Images, Audio Media and Pacific Rim.

PCs Infiltrate Test Gear Arena

by Paul Rebmann

Atlanta GA Exhibits at this year's NAB convention helped demonstrate the infiltration of the personal computer into radio broadcasting's technical operations.

From computer based test equipment to a modulation monitor that allows remote indication and function control via a PC interface, broadcast equipment manufacturers are providing a means to cope with the industry trend toward smaller technical staffs.

The controversy over Eric Small's ModMinder attracted many to the Modula-

tion Sciences booth. The ModMinder ignores peaks of less than one millisecond and provides a count of the number of peaks occurring during the past minute.

When located at the transmitter site for greater accuracy, the unit permits the modulation to be monitored at the studio using either a standard remote control system or a PC connected through the RS-232 I/O.

Small announced that an optional advanced software package will be out soon to provide a 20-minute scan of peak occurrences versus modulation level.

Modulation Sciences is also planning to introduce an RF front end this sum-

mer, according to Small, which would end dependence upon a separate modulation monitor or radio to operate the ModMinder.

Frequency agility

Belar was showing several new items, including a frequency agile RF amp, the RFA-4, expected to be available in July. Belar has completed its current FM series of monitors with the SCM-2 SCA monitor.

In addition to the 67 kHz SCA, the SCM-2 can monitor any three other SCA frequencies by way of front panel select switches once the interchangeable clock oscillators have been installed.

The FMM-4A automatic FM frequency monitor accurately checks the FM carrier, 19 kHz pilot, and SCA frequencies providing off-frequency alarms for each.

Arno Meyer of Belar described a new FM unit expected out this summer that is designed to reduce errors produced by aggressive processing. The unit will be similar to the Belar stereo TV monitor, according to Meyer.

In addition to a sliding one minute window to count peaks of frequent recurrence, Meyer said the new unit will utilize a very accurate technique that does not use sharp cut-off low pass filters. Such filters can introduce considerable error with heavily processed signals.

The monitor will also remove short

spikes of less than 180 microseconds introduced by ringing filters in the broadcast chain, according to Meyer.

In other booths, TFT introduced an economy version of the model 844A FM modulation monitor, the 884. Using the same technology as the top of the line monitor, the 884 has fewer features, allowing it to sell for \$1100 less than the 844A.

QEI was showing the model 691 FM modulation monitor with a couple of improvements. The peaks per minute counter now follows the peak modulation thumbwheel setting instead of being limited to factory calibration of a preset level.

The QEI monitor now accommodates two SCAs with frequency changes accomplished by changing plug-in cards.

Antenna monitoring goes digital

Digital technology is prominent in the AM antenna monitor field. Potomac Instruments introduced the 1900 series of AM antenna monitors featuring digital readouts; it can be repaired in the field. The new antenna monitor provides easy interfacing with remote control units as well as simultaneous remote and local operation.

The Gorman-Redlich digital antenna monitor has a smaller chassis, making it more portable for consultants to use in the field.

Delta Electronics, which also makes a digital antenna monitor, did not show any new equipment this year, but was attracting interest in the splatter monitor for measuring NRSC compliance.

(continued on page 35)

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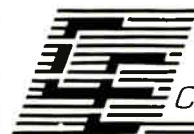
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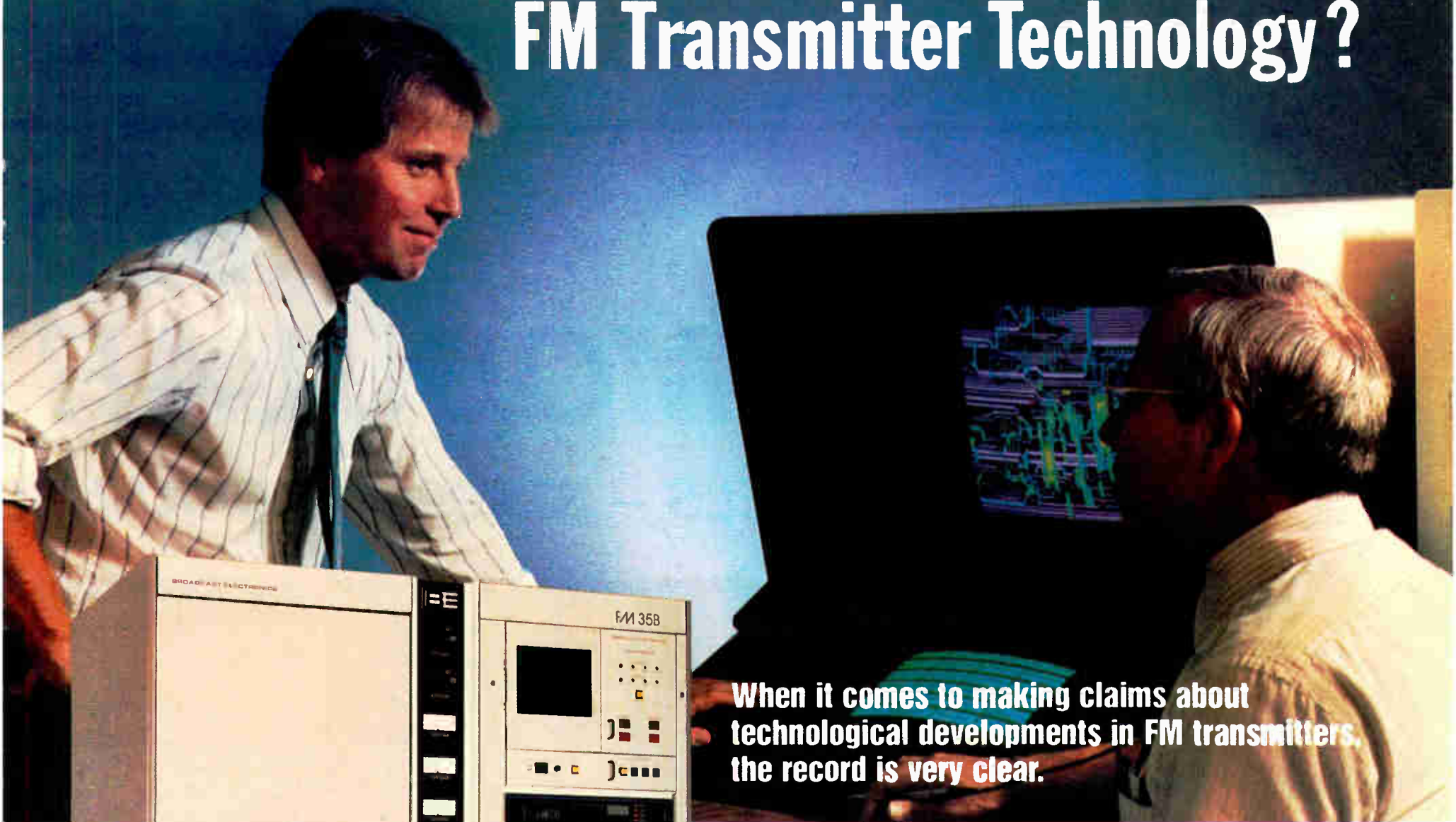
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FM Systems for Today's Terrain

Engineering Session Tackles Gamut From Antennas to Overshoot Control

by Charles Taylor

Atlanta GA As restrictions tighten for antennas atop buildings and mountaintops, the need for a truly broadband high-power circularly polarized

antenna has increased dramatically.

By employing an axial-mode helix, the characteristics of a pseudo-frequency-independent antenna are exhibited, according to information given at the

NAB show in a paper by George Harris and Robert Baker with Shively Labs.

Conquering urban perils

The team endured many hours of research to investigate new styles of antennas that would conquer the perils of urban locations and today's more demanding operational specifications on FM antennas and

transmission systems.

The helical-beam antenna, they concluded, is essentially a simple conductor, wound into a helical shape and placed over a ground plane. Generally speaking, the helix can radiate in several different modes, however, they point out that only three of these are of particular interest in this application.

One is the so-called normal

mode, they explained, which radiates in a direction perpendicular to the helix axis. The second is the axial mode, yielding radiation with major lobes along the helix axis. The third is the conical mode, which produces two major lobes of radiation about 40° to each side of the helical axis.

In its testing of the antenna's potential modes, the Shively team found that the impedance bandwidth of the axial mode helical-beam antenna has good broadband characteristics. Even though the actual value of the driving point impedance seemed high at about 135 ohms, the important characteristic is that the impedance coordinate does not change much over a wide range of frequencies.

They said this means that

Be prepared.

For the first real improvement in AM sound in more than a decade.



The future offers real promise for AM radio. NRSC AM radios are almost here, factory-installed in new cars. Soon, home stereos and portable sets will also be NRSC-equipped.

NRSC (National Radio Systems Committee) has created a voluntary national transmission standard that makes wideband high-fidelity AM radios practical. As broadcasters adopt the NRSC standard, receiver manufacturers can extend and flatten their frequency response without risk of increasing the audibility of interference.

Is your station prepared?

The 9100B NRSC-standard OPTIMOD-AM® is the first choice of AM stations concerned about improving their sound to compete with FM. OPTIMOD-AM sounds great on both the new NRSC receivers *and* on the millions of narrow-band receivers already in the field that will be in use for years to come.

When replacing older-style processors with OPTIMOD-AM, stations experience a significant increase in coverage area. And when replacing any processor, stations experience a dramatic improvement in sound quality, on both *voice* and *music*, with no sacrifice of loudness.

Superior sound is an important part of an overall strategy to increase ratings and profits. With OPTIMOD-AM, your announcers' voices will have presence and impact, while still sounding very clean. Music will have real bass, with punch and warmth, not boom. The highs will seem to open up. And loudness and tonal balance will be consistent from source to source.

OPTIMOD-AM can be configured to operate optimally in mono, C-QUAM® stereo, or Kahn stereo. Mono units can be field-upgraded later to stereo by simply plugging in additional cards.

Be prepared. Call your Orban Broadcast Products Dealer for more information on OPTIMOD-AM 9100B, or call us direct.

The team endured many hours of research to investigate new styles of antennas that would conquer the perils of urban locations . . .

with the appropriate matching networks, this element would exhibit many favorable impedance bandwidth characteristics.

Overshoot control

In the same session on FM systems engineering and improvement, Greg Ogonowski of Modulation Index spoke on a new approach to FM composite bandwidth overshoot control.

The most common technique, he said, has been composite baseband clipping, which is controversial because it causes signal degradation and because early implementations that clipped the pilot could violate FCC rules.

If a system is modeled as a high-pass filter with a single dominant pole, Ogonowski has derived a formula that can be used to compute the percentage of overshoot.

Since the composite baseband overshoot problem is caused by a frequency response discrepancy, Ogonowski maintains it can be corrected to a nearest approximation with an equalizer. This is a linear solution, he said, to a linear problem.

Unlike the composite baseband clipper, no distortion and aliasing products are produced, thereby making it a far more desirable solution to the overshoot problem of composite baseband signals, according to Ogonowski.

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PCs Invade Testing

(continued from page 30)

Harry Gardner of Delta presented a paper, "Maintenance Procedures Simplified Using Stereo Noise," during the radio engineering seminars. In it he outlined some of the uses of the SNG-1 stereo noise generator, which can generate the properly weighted (USASI) pulsed noise for NRSC testing.

Gardner also mentioned in his paper that the Potomac Instruments QA-100 QuantAural audio program analyzer has a setting that duplicates the inverse of the USASI curve, providing an excellent companion instrument to the SNG-1 for audio testing.

Test CD

A test CD was introduced by Sound Technology for use with its 3000 and 1500 series of test systems, which were also being shown at the convention.

The CD can replace a standalone programmable generator at a remote location to test a system using one of the ST analyzers. The Sound Technology CD contains frequency sweeps as well as the FSK codes that the analyzers use for automated testing.

Another new product in the Sound Technology booth was the RTA-4000 real-time program/acoustic analyzer.

The RTA-4000 incorporates some new features, with more being planned. A Centronics printer port allows printouts of the display and an RS-232 serial port allows control from a PC with optional software.

There is also an option for performing RT-60 reverberation analysis. The base price of the RTA-4000 is \$5950.

Series introduction

Neutrik introduced the Audiograph 3300 series to its line of test equipment, which includes the TT402A test set and the A1 test system.

The Audiograph is a modular system based on a mainframe containing the power supply, control circuitry and a chart recorder. Various modules can be attached to the 3302 mainframe to configure a customized test set to meet the specific needs of the user.

With the 3337 analyzer attached, the system can perform all of the basic audio measurements including level, frequency, total harmonic and intermodulation distortion.

The 3302/3337 system is priced at \$4927 and makes an extremely portable test set. Other available modules include separate input and output modules, tracking receive filter, phase module, and noise generator/tracking send filter, among others.

The TT402A test set includes a parallel printer port for graphic or textual printouts of test results. The A1 system has an option allowing test sequences as defined in CCITT recommendation 0.33 to be sent or received.

Both units are available with optional RS-232 serial ports.

The Audio Precision System One was demonstrated performing the various tests within its capabilities, including the CCITT 0.33 sequence, which is available on CD for testing from a remote location.

The System One is a modular computer based testing system, with the basic unit consisting of either single or dual channel generator and analyzer.

The digital signal processing (DSP) option allows enhanced analog measurements, including waveform analysis and FFT spectrum analysis of signals up to 80 kHz.

A digital input/output option is also available to test DAT and CD decks using either professional (AES/EBU) or consumer (SPDIF/EIAJ) interface without converting to the analog domain.

The basic single channel input/output System One sells for \$5995 with a dual channel system configured for DSP and digital selling for \$13,350. Units with only the dual channel generator or analyzer are priced at \$3400 and \$4900 respectively. An IBM compatible computer is required to operate the System One.

The System One also can perform a complete automated alignment of Studer A820, A812, A810, or A807 tape decks with the technician required only to adjust the head azimuth at the proper point in the procedure.

High speed testing

A new high speed test system was introduced by Schmid. Designed to test networks while in use, the entire test procedure takes less than five seconds.

The test system includes units that automatically switch from program to test mode to allow for minimum disruption of the normal program.

The system, used in Europe and Canada, costs over \$25,000 and also conforms to CCITT 0.33 recommendations.

Avcom was showing a portable RF spectrum analyzer which could be of use to radio broadcasters.

The PSA-65A covers a frequency range of 2 MHz to 1000 MHz, but can be extended down to 200 kHz with a 10 kHz resolution bandwidth option and up to 4.2 GHz with external frequency extenders.

The \$2855 base price makes the PSA-65A a practical spectrum analyzer for the radio industry.

Keeping tabs on RF

In the RF radiation measurement arena, Holaday Industries showed a new foam spacer for its probes, in compliance with FCC guidelines for making measurements around metallic objects.

The \$55 spacer works with either the electric or magnetic field probes in the Holaday HI-3002 measurement kit. The HI-3002 sells for \$3895 and measures from 500 kHz to 6 GHz.

The HI-3320 data logger can be connected to the HI-3002 to make automatic readings while climbing a tower. The HI-3320 is \$1645; the price for the data logger and the HI-3002 when purchased together is \$5000.

Narda was showing a radiation monitor that covers the FM and VHF broadcast bands and measures both electric and magnetic fields with one probe.

The model 8512 has a frequency range of 50-220 MHz and is priced at \$1675.

Not new, but also on display were Dorrough's model 1200 stereo signal test set and the Radio Design Labs AMS-1 synchronous AM noise monitor.

Radio Design Labs also featured a new addition to its line of Stick-Ons; the latest one is for the NRSC AM standard.

■ ■ ■
Paul Rebman is CE at Orlando's WEZY-FM/WLKF-AM and a frequent contributor to RW.

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Flexibility Key for Processing

New Products Allow Users to Tailor Sound to Meet Their Individual Needs

by Alan Carter

Atlanta GA So you want your station to sound different?

Even if your crosstown rival has the same processing equipment, manufacturers at NAB said it doesn't matter. Gear on the market, they maintained, allows engineers the versatility to obtain a personalized sound.

Processing and flexibility seemed to go hand in hand.

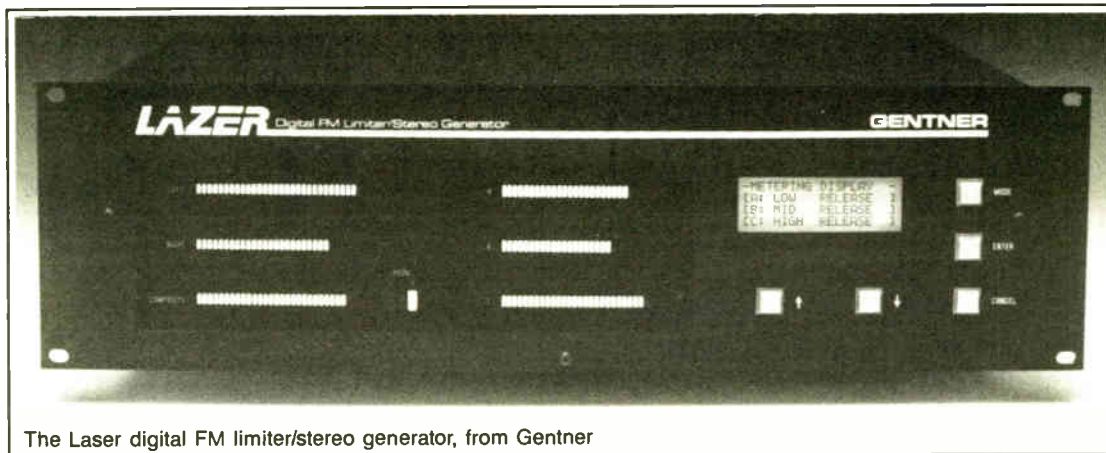
"Loudness is subjective," Gentner Engineering VP Bill Gillman said. Therefore, it is only natural for processing equipment to allow a station to tune the gear to suit its wants.

New alternatives

Among the new equipment, Gentner displayed the Lazer digital FM limiter/stereo generator and Prizm digital audio

June or mid-July.

The Lazer and Prizm can be used individually or together to,



The Lazer digital FM limiter/stereo generator, from Gentner

as Gentner maintained, make a station "the brightest spot" on the dial.

A digital version of the Audio Prism, the Prizm features push

broadcast industry and to recording studios.

The Lazer, Gentner said, is designed to give stronger stereo separation to a composite signal while staying within legal modulation limits.

The Lazer has eight separate presets, to allow an engineer to

said, to obtain a higher dynamic range. The Audio Signature can do everything a digital processing unit can, he said.

Features of the Audio Signature include separate wideband and multiband control, which can go from little or no processing to an aggressive sound.

The DCE has flexible multiformat I/O, independent compressor and expander and is available with 99 user presets. The DDP is a multiple function processor operating on a 16-bit linear PCM format.

In the area of processing effects, Eventide announced an internal sampler board option (HS322) for all H3000 Ultra-Harmonizers. The option adds 16-bit, 44.1 kHz sampling.

In the realm of general audio effects equipment, Dolby announced that its newest digital audio coding process, Dolby AC-2, is being licensed for use in OEM decoders. Dolby AC-2 is a spectrum-adaptive transform coding process for professional-quality audio transmission and storage at greatly reduced data rates.

Dolby AC-2 is incorporated in professional Dolby DP501 and DP502 encoders and decoders operating at 128 kBs, one-sixth the data rate of conventional linear 16-bit PCM.

And also on display at the convention was a previous product introduction from Yamaha, which showed its DMP7 digital mixing processor.

Other product introductions included the MAS-LC audio accessory plug-in module from

fine tune the sound and compare a variety of settings. Its 3-band processing is phase linear.

Seeking a balance

Orban Sales Manager Howard Mullinack also noted that engineers want a way to adjust for a "proper balance between loudness and listener fatigue."

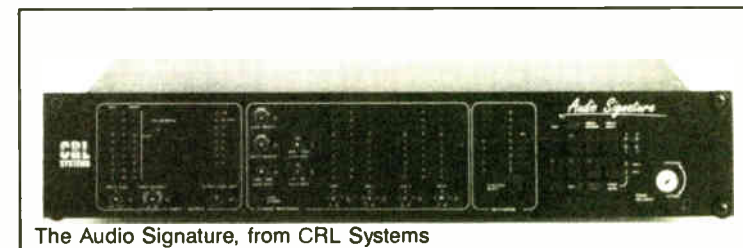
On the floor from Orban was the 4000A Transmission Limiter designed to protect transmission systems from peak overload without side effects or artifacts.

The main automatic gain control (AGC) stage of the 4000A is a gated, dual-band limiter somewhat similar to the Optimod-FM, according to Orban. However, several changes were made more suited to the transmission function limiter. Orban noted that the 4000A cannot create a "competitively processed" sound with pop music like the Optimod.

Orban also had a production model of the 290RX Adaptive

The Audio Signature also has adjustable multiband crossovers, real-time analysis monitoring, eight-position audio diagnostic metering, four-memory recall sound settings and IBM PC or automation remote control capability.

Cutting Edge Technologies showed its Vigilante multiband limiter at the Broadcasters General Store exhibit. Also at



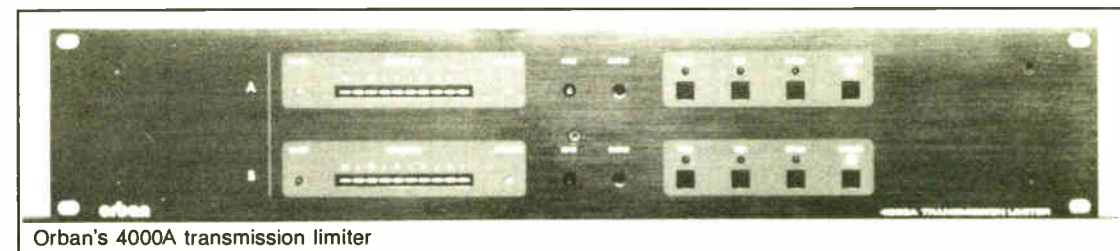
The Audio Signature, from CRL Systems

the exhibit were the California Digital DigiMod 2000 Optimod replacement cards.

Wide offering

Aphex had the new Expressor compressor/limiter, a processor with "special features" includ-

Logitek, a stereo peak limiter and RMS compressor with four DA outputs; a production version of the Model 706 FM stereo generator with FMX option from In-ovonics; and the 8000 series modular system for various tasks called "The Frame" from JNS.



Orban's 4000A transmission limiter

Enhancement Processor, which adds high frequency harmonics without distortion, increases high frequency brightness and provides single-ended noise reduction.

Flexibility outlined

Keeping in line with the trend toward flexibility, CRL Systems showed the Audio Signature. The company's Chuck Adams said the device allows for different processing at different times of the day.

Processing also is analog, he

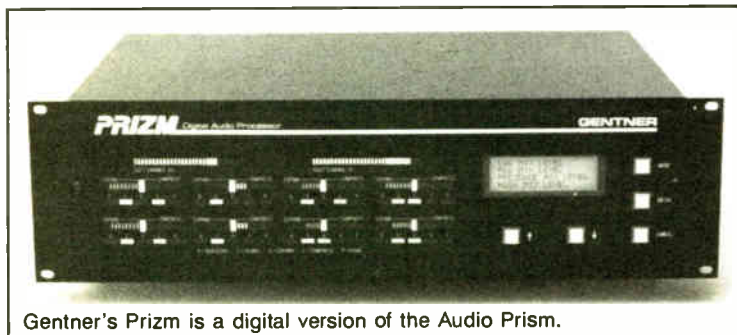
ing adjustable high frequency expansion designed to counteract the dulling effect of high compression ratios, and the spectrum phase refractor (SPR), to correct bass delay anomaly associated with the recording and reproduction processes.

Valley International showed its digital compressor/expander (DCE) that has been available since January, according to President Norman Baker. Available in early '91 will be the company's digital dynamics processor (DDP).

McCurdy introduced several new products including a multi-bus on-air automation system; the TIF-800 telephone hybrid frame and TIF-951 telephone interface and DTMF decoder.

dbx under the aegis of AKG and Orban featured its line of noise reduction modules.

Also, of interest in the In-ovonics booth was a demonstration of Noise Free Radio by its inventor, George Yazell. Yazell generated interest in his system which uses narrowband FM to improve AM.

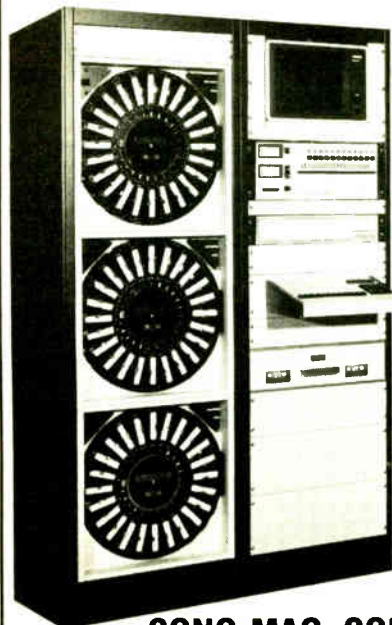


Gentner's Prizm is a digital version of the Audio Prism.

processor. Shipment of the Lazer is expected by June, according to Gillman, and the Prizm should be shipped by late

button control, digital exactitude and repeatability to multiband processing. The Prizm is going to be marketed to the

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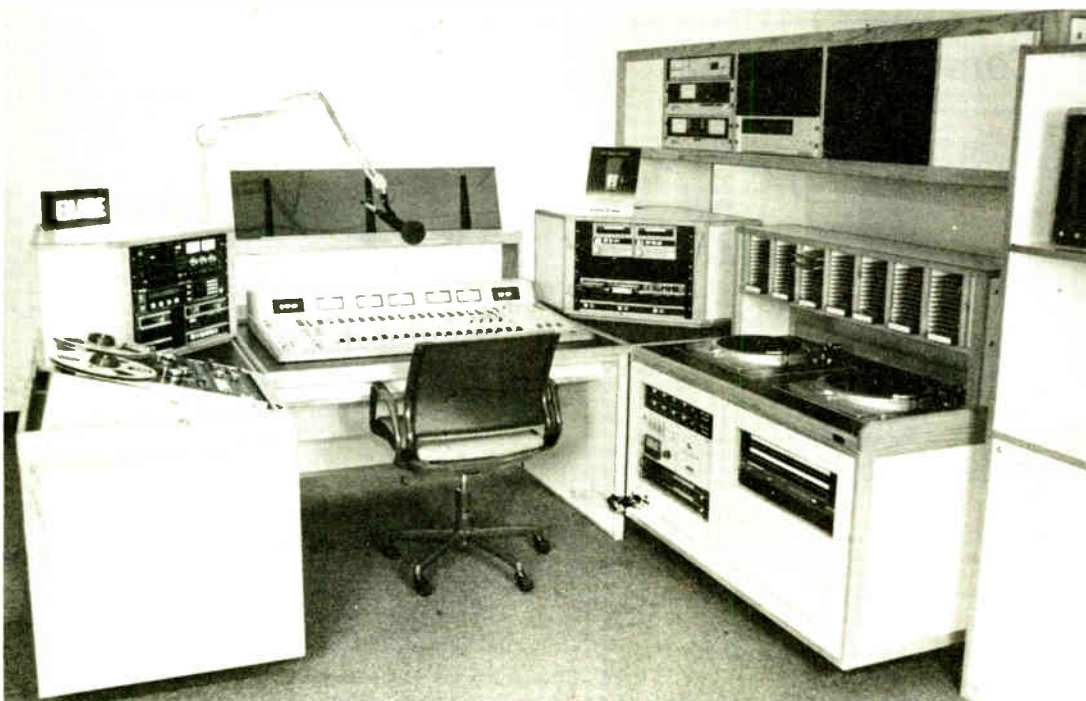


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Console Innovation

by Tom Osenkowsky

Atlanta GA With the ever-changing needs of today's broadcaster comes an abundant selection of control boards to meet individual station requirements.

Over the years, control boards have taken on new faces and now provide numerous functions that their predecessors lacked.

Business agreements

News from the console arena included not only new products but new agreements as well. For example, Neve, known for its production consoles, has

entered into an exclusive agreement with Orion Research to manufacture and distribute the Orion line of audio consoles for the TV, broadcast and production markets.

Orion products feature all-digital control architecture with disk-based ReMem storage of 32 setups, covering all console parameters. The Orion series is available in four configurations.

Neve also announced an exclusive agreement with Wheatstone Corp. to distribute that company's line of broadcast consoles in the Canadian market.

Wheatstone is known for its SP-5 and SP-6 production consoles, as well as the A-500, A-20EX and A-32EX modular design radio consoles.

Wheatstone offers well built, high quality consoles at affordable mid-range prices. Wheatstone specs are typically .003% THD and clean square wave response, with built-in machine interfacing and speech/music busses and clock/timer.

Proven in the field

For broadcasters wanting a durable, field proven design, the LPB Signature III provides a choice of 6, 8 or 10 channel mono/stereo configuration. Rotary step attenuators are used as faders, input and output connections are via easy-to-wire barrier strips.

LPB also features the Citation II console which debuted at NAB '89. The Citation II is modeled after the Citation I, which has a ten year proven track record. Sporting sliding faders, three inputs per fader, and now a lower standard price, the Citation II is a genuine contender in the console arena.

Arrakis Systems introduced its new 1500 Series console featuring DC controlled switching, three stereo, two telco mix minus busses, and pre-fader processing patchpoints.

The 15000 series consoles are available in 8, 18, and 28 channel configurations. Standard are digital timer and mono

mixdown outputs.

Arrakis is known for the 5000, 10000, 12000, and SC-Turbo Series consoles. With the wide range of features and number of channels throughout the series, the needs of any broadcaster can be met by an Arrakis product. And you can add to that the Arrakis Modulux cabinetry—custom built, attractively priced and UPS ground shippable.

Tradition in consoles

Broadcast Electronics has been known for many years as the maker of the 50A, 150A, 250A and 350A lines of rotary consoles.

In keeping with the times, BE introduced the Mix Trak 90 series, featuring sliding attenuators. NAB '90 saw the expansion of the MT-90 series to 21 channels.

The MT-90 is the result of extensive market research and features all gold contacts, no edge connectors, three mix minus busses, processor patch points, and built-in clock/timer.

Also, the MT-90 has built-in automatic source sequencing, allowing walkaway time for the operator. The MT-90 is well built, user friendly and is backed by a company with over 30 years of broadcast product manufacturing experience.

Radio Systems RS series consoles were introduced at NAB '88. Over 260 boards now are operating in the field. Each console is available in 6, 12 or 18 channel configurations.

Full logic, DC control, patch points, talkback, clock/timer and sophisticated machine interface make the RS series a console to consider for the quality conscious broadcaster in the market for an affordable console.

Rugged remote start switches and VCA faders are standard. The RS series consoles are backed by a two year warranty.

Customized consoles

Pacific Recorders & Engineering is a well respected name in the broadcast industry. Well known for its AMX, ABX, STX, the popular BMX and Radiomixer consoles, PR&E offers the ability to customize a console to specific studio needs.

With a variety of mainframe sizes, in-

put modules can be chosen to provide a user-friendly layout. A variety of machine control options are available via external interface modules.

Impressive specifications, standard clock/timer, two mix minus busses and the Pacific Recorders name make the entire series attractive to the on-air as well as production market.

New from the company is the Prime-Line stock cabinetry for the entire line of PR&E consoles.

With solid wood construction, modular design, availability in sit-down or stand-up configuration and a variety of equipment housings, PrimeLine is offered as a cost-effective solution to studio furniture needs for the budget conscious broadcaster.

Digital Destiny

One new offering at the show was more a console concept than an actual product. Auditronics showed the Destiny 2000, a surprise prototype of the radio industry's first sliding toward a digital console design.

The console has only digital controls and a high speed digital data bus connects the control to analog electronics located in a rack-mountable equipment rack.

Auditronics is looking ahead to the time when digital electronics can replace the analog circuitry in the Destiny 2000, and notes that a variety of customization and upgrades can be added to the system at a later date, via software changes.

Still in the design stage, Auditronics showed the Destiny 2000 at this year's NAB convention in the hope of obtaining the necessary industry feedback that will allow it to become a real product offering in the future.

With the wide variety of mixing consoles available to the broadcaster, needs ranging from those of the most complex post-production facility to the small market daytime AM station can be economically met with quality, reliability, and specifications that far surpass those of not so very long ago.

Tom Osenkowsky is a consulting engineer and occasional contributing writer for RW.

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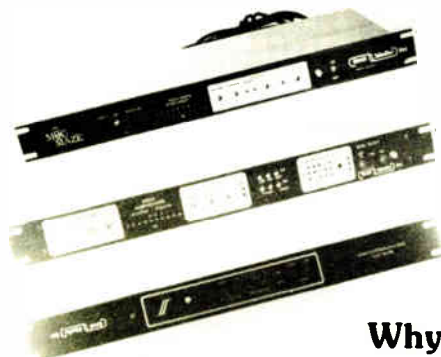
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New Business Deals

Atlanta GA In addition to the usual flurry of activity surrounding manufacturers and vendors at NAB convention time, a flurry of mergers, acquisitions and business dealings invariably surfaces as the show convenes.

In addition to news of a joint agreement between console manufacturers Wheatstone and Neve (see related, story, this issue) several other companies became part of the show's business news.

Studer's new ownership

From Baden, Switzerland came word that multi-conglomerate Motor-Columbus Group-owned SAEG Refindus Holding Inc. will acquire the total share capital of the Zurich-based Studer Revox Group.

Dr. Willi Studer, former company leader, will step down and a Board of Management formed by company President Dr. Leo Wehrli, Eugen Sporri and Bruno Hochstrasser will assume his duties.

SAEG promised operational independence to Studer Revox, manufacturer of professional audio equipment.

SAEG, a product of the merger between the Swiss-American Electric Co. and the Refindus Holding Inc., noted its goal to acquire technology-oriented companies. Its stock is traded at the Stock Exchanges of Zurich, Basle and Geneva.

Studer Revox currently employs approximately 1800 people throughout the world. Studer Revox exports about 90% of its products manufactured in Switzerland and in German factories.

Alpha Audio and Mid-Atlantic

In a domestic business development, Richmond, VA-based Alpha Audio announced that it had formed a manufacturing and marketing agreement with Mid-Atlantic Venture Capital to increase production of its DR-2 Hard-Disk Recorder, introduced at the NAB show.

The agreement was reached in the week just prior to the start of the convention, but not announced until a news conference on the exhibit floor.

The ownership and management of Alpha Audio Automation Systems Division and of its parent company, Alpha Recording Corporation, will not be affected in any way, according to President Nick Colleran.

Valley International in Chapter 11

Meanwhile Franklin, TN-based processing manufacturers Valley International Inc. announced that it had filed Chapter 11 reorganization 13 February as it mediates claims against a contract manufacturer, according to Valley President Norman Baker.

"This action became necessary to preserve claims which our company has against a contract manufacturer of Valley products and to protect new suppliers until this conflict can be resolved," he said in a prepared statement.

Valley entered into an agreement with the supplier to begin delivery of a substantial portion of the Valley product line effective July 1988, Baker said.

But he explained that the supplier failed to deliver the goods on time and in the quantities agreed upon. These actions forced Valley to fall behind in its deliveries and interrupted product flow.

After several attempts to remedy this

problem, Baker said Valley was forced to seek alternative sources of supply.

"Ironically, these unfortunate circumstances have served to heighten demand for our products," he said.

"We now have three independent sources manufacturing and delivering products to us so that we can catch up on existing orders and quickly return to normal delivery times."

Baker predicted "smooth and predictable product deliveries in the very near future."

Baker said Valley has moved into new facilities at 616 Bradley Court, Franklin, TN, 37064.



The new management group of Studer Revox: (from left to right) Dr. L. Wehrli (Chairman), Eugen Spörri, Hermann Stierli and Bruno Hochstrasser.

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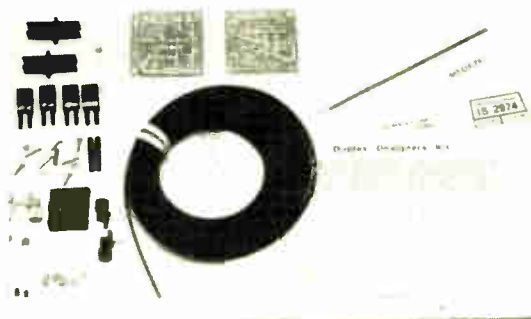
Microwave Filter Company, Inc., has recently introduced the Diplexer 5547.

The Diplexer 5547 allows the use of only one tower cable to connect ENG band and UHF radio equipment to their respective antennas.

This filter combines or separates the two frequency bands 0-500 MHz and 1990-2110 MHz.

Two diplexers are required. One diplexer combines antennas and one combines studio equipment.

For information, call Jean Dickinson at Microwave Filter Company: 800-448-1666 or circle Reader Service 66.



Fiber optic kit

The fiber optic designer's kit from Sintec is available in either a simplex or duplex version for single or bi-directional data communications.

The kit contains fiber optic emitters and detectors, printed wiring boards, ten meters of simplex or duplex cable and all necessary electronics.

For information, call Don Badore at Sintec: 201-996-4093 or circle Reader Service 16.



Broadcast recorder

The new Tascam BR-20 broadcast recorder is specially designed for use in busy radio broadcast production facilities.

The BR-20 has a shuttle control that allows smooth and accurate cue and review.

For information, call Gregg Hildebrandt at Tascam: 213-726-0303 or circle Reader Service 89.



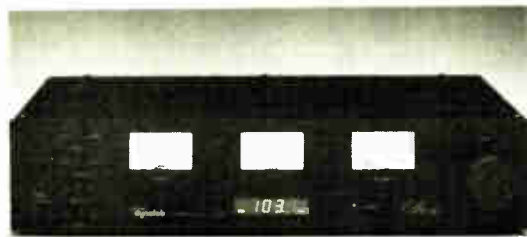
Portable conditioner

The Superior Electric Company announces the PPC Series Stabiline® Power Conditioners.

These portable power conditioners maintain output voltage at 120 volts $\pm 5\%$, 60 Hz over an input range of 95 to 132 volts.

The units provide 120 dB noise reduction and 60 dB noise attenuation.

For information, call Michael Miga at The Superior Electric Company: 203-582-9561 or circle Reader Service 74.



Broadcast monitor

The Dynalab Pro 101 FM tuner/monitor provides a wide band composite output for modulation peak monitoring and adjustable alarm outputs for both carrier and modulation.

The Pro 101 user-friendly panel meters provide the operator with a continuous readout of both RF input and relative multipath interference.

For information, call Marv Fouthscott at Dynalab: 716-684-0460 or circle Reader Service 40.



Studio switcher

Electron Processing Inc. has introduced the Studio Switcher, which switches up to four stereo audio sources to one stereo output.

The Studio Switcher uses sealed reed relays for audio switching.

For information, call John Martin at Electron Processing Inc: 616-228-7020 or circle Reader Service 61.

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RF Offerings Abound at NAB

by George Riggins

Atlanta GA Transmitters: Where would we be without them! The number one issue of RCA Broadcast News, October 1931 described the first 50 kW installation west of Texas, installed at KFI, Los Angeles, CA.

There were six cabinets on the second floor with the "auxiliary devices" located on the first floor. Outside was a small power sub station to provide the primary A/C power requirements.

The PA tubes were UV862s. Today the same power can be supplied by Continental, Harris and Nautel in the same or less space with lower total power requirements. Pick your method of modulation and take your choice.

Between the pre-sunrise and post-sunset low power levels that can be supplied by LPB or Kintronic Laboratories and the 50 kW levels, are several brands of equipment. These range from the all solid state transmitters of Nautel, Continental and Harris to the conventional tubed transmitters of Energy-Onix, Continental, Harris and TTC at almost all power levels.

Bringing back a familiar name

One of the more interesting developments in the AM transmitter market is the re-introduction of the Gates transmitter name. Yes, Harris introduced the new Gates series of AM transmitters.

This new transmitter series is all solid state and consists of three power levels: 1, 2.5 and 5 kW. They have a small footprint, and have the signal flow chart etched into the front panel with status lights to let us know what is or is not happening.

Harris claims "eye level" meters, but for me, the meters are much above my eye level. (Must have had a 7' person setting eye level.) For the international market, both Continental and Harris offer MW and SW transmitters up to 500 kW power levels.

In addition, Harris offers the DX lineup in solid state at 100 kW for the international market.

Nautel, which has made its name in solid state AM transmitters featured its line of the same.

New entries

On the FM side of the picture, in addition to all of the players in the AM market we find QEI, Broadcast Electronics and Bext offerings.

The latest entry in the FM market, Bext Inc., of San Diego, CA, offers low level FM transmitters and amplifiers from a 2 watt exciter up to 1 kW—without the use of tubes.

Above the 1 kW level, Bext produces the typical one tube transmitter up to the 20 kW level. In between the low power and the 1 kW level, Bext has combinations of exciters and amplifiers to fill almost any power requirement.

Continental and TTC both introduced new medium power level solid state "boxes" this year. Continental is rating its all solid state transmitter at 11 kW, while TTC has two "boxes": one rated at 4 kW and the other at 8 kW.

Both companies are using 45/46 inch wide cabinets for the higher power. TTC has managed to get the 4 kW into a 31

inch wide cabinet.

Broadcast Electronics still features the half wave folded output cavity, thus eliminating the plate blocking capacitor.

In other aspects, all the BE single tube transmitters have been upgraded to the new "B" model and contain the FX 50 exciter. By combining transmitters, BE as well as Harris and Continental offer FM transmitter outputs as high as 70 kW.

Other FM transmitter manufacturers showing their featured lines were CCA, QEI and Energy Onix. And in the CCA booth were a few offerings from a new company, Omnitronix, with AM transmitters designed for the overseas market.

Sunrise, sunset

One facet of the AM side we hear little about is the pre-sunrise and post-sunset power requirements. Two companies seem to be active in this part of the power spectrum.

Although taking different approaches, both LPB and Kintronics offer solutions to the problem.

LPB takes the approach of having a separate low power transmitter to provide the necessary power, while Kintronics takes the normal transmitter output and runs the RF through a power divider. Both methods require a switching unit in the transmission line.

The LPB approach apparently necessitates either splitting or switching the incoming signal between the two transmitters and an antenna feed line switch. The Kintronics method has the feed line switch built into the power splitter and seems to require no further switching activity.

At least there are alternatives for solving the requirement of providing a signal that will satisfy FCC pre-sunrise and post-sunset power requirements.

So we've touched on some of the entrants in the transmitter game. We still

need to get the RF from the transmitter to the antenna.

Myat, Inc. showed pictures of the transmitter combiner they are installing for KGUN in Portland, OR. The new installation in Portland puts most or all of the FM stations on one tower with a 9" line from the combining network to the antenna.

Myat seems to specialize in larger rigid

type FM antenna, the two main points being light weight and low windload.

Another item from the company was the Dielectric Universal Switch Controller. This switch is intended to control one or two coax switches.

Cablewave Systems had on display almost everything from the very flexible Flexwell foam cables to large rigid line.

Naturally, Cablewave can supply all of the installation accessories necessary for installation of coax, rigid line or waveguide antenna feeds. They also have FM and microwave antennas available.

Need an RF coax load? Electro Impulse has something available for almost everyone at every power level. According to the literature I was given, they can supply either convection or forced air loads up to 80 kW (up to 75 kW for FM).

Getting from here to there

Of course we need cables for getting an audio signal from one place to another. An interesting approach to identifying various cable was displayed by Canare.

The Canare approach to the problem of knowing which cable is attached to which microphone is to give us almost any color cable we would like to have.

Canare also manufactures microphone cables that range in size from the single two conductor to the monster 32 pair cable. Junction/break-out boxes and cable reel snakes with XLR type fittings are also available.

Need some 75 ohm cable? Canare has it in an RG59B configuration. For other accessories call your local cable distributor.

The venerable tube

Although we are seeing more AM and FM transmitters sans tubes, many boxes either still employ an older tube type

(continued on page 42)



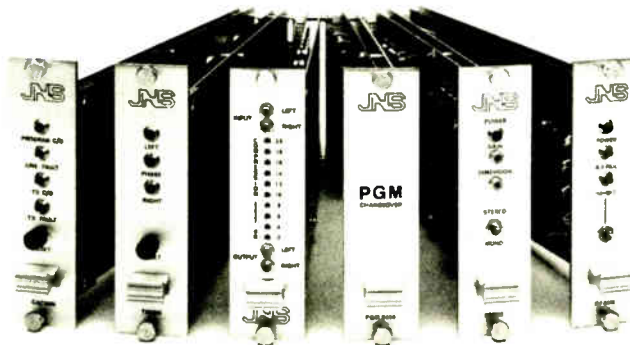
Harris revived the Gates name with its solid state AM transmitter line.

line and other specialized line and/or combiner situations.

Other manufacturers of feed line present at the NAB convention were Dielectric Communications and Cablewave Systems. Although not talking much about the feed line, Dielectric was very anxious to tell me about the new DCPC

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Spanning the Spectrum in RF

(continued from page 41)

or require such power that a tube may be the better choice for the installation.

Richardson, Thomson-CSF and Varian are still in the large tube business. All are of the opinion that tubes will be with us for some time to come.

All were asked the same basic question as to how tube life can be prolonged or catastrophic failure prevented. The answers were very similar: proper cooling, not trying to get more than the designed power out of the tube, and supplying the correct voltages and current requirements for the class of service involved.

All answers mentioned that continuous proper operation of a tube resulted in longer life than a tube that was subjected to many turn on and turn off cycles.

Acquisitions

Richardson has purchased the tube lines and European plants of Philips. The facilities that were in the Netherlands will be combined with those located in France in a new plant to be located in France.

Even though we might not be using many tubes in the US, there are still large requirements in other parts of the world.

In fact, Jim Aurund of Eimac says that he does not contemplate the complete replacement of tubes for quite some time in the future.

On the historic side, John Sullivan, president of Econco has a few antique tubes. Perhaps in the future we can convince John to make a small display of some of the really historic tubes that many of us have only heard about.

Odds and ends

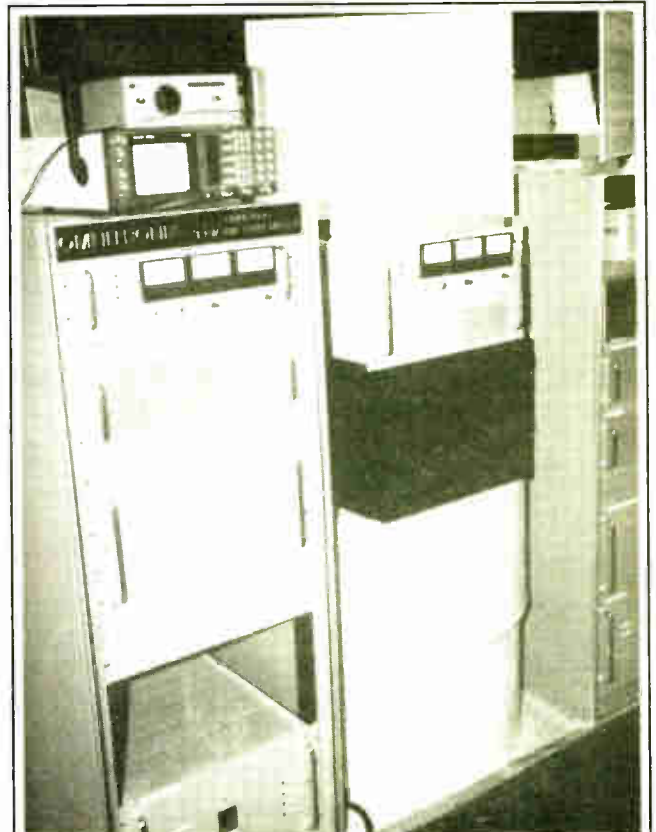
Steve Kravits of Motorola was on hand to extol the virtues of AM stereo. If you did not get a list of the receivers available for receiving AM stereo, give Steve a call.

According to a coverage map Steve had, the East is at least 90% covered with a receivable AM stereo signal, while we are a little thin in the Rocky Mountain area.

As far as the open spaces of one or two

western states where it is tape time anyway, probably 95% of the population has an AM stereo signal available—perhaps not the programming preferred, but at least a signal.

George Riggins is RW's Old Timer columnist.



Solid state AM broadcast transmitters were on display at the Omnitronix exhibit area.



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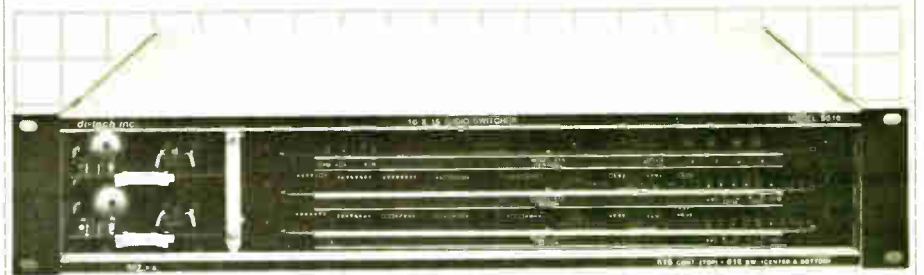
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Telco, STL Options Available

by Dee McVicker

Atlanta GA The word on STL, RPU, telco and remote control gear at NAB '90 is that there are now more innovative options.

In the face of STL congestion especially, with rumors of frequency reallocation and a more likely probability of stricter specs and power on the horizon, this comes as welcome news.

promise of translating over to conventional STL sites.

The TFT Reciter, developed as a booster STL receiver and FM exciter in one housing, is still in field testing for this application; the theory is that it will offer better S/N and THD specs on the receive side of composite STLs.

Whereas the conventional composite STL receiver is typically 0.2% THD—the weakest link in broadcast systems—the

new narrowband channels.

Like current TFT and Moseley STLs, Marti STLs are specified according to

digital encoding/decoding system, so engineers looking for digital transparency with virtually nonexistent audible delay should give this system serious consideration.

On the telco front, there was a full lineup of hybrids and frequency extenders. Both Gentner and Comrex

T1 data service could be an up-and-coming alternative for stations looking to link studios and transmitters . . .

Moseley Associates' PCL 6000 STL series, for instance, was showing for its third NAB but gained considerable attention this year due to its frequency agility (the unit is field tunable) and its ability to be jumper-selectable between 15 kHz monaural baseband or wideband composite stereo.

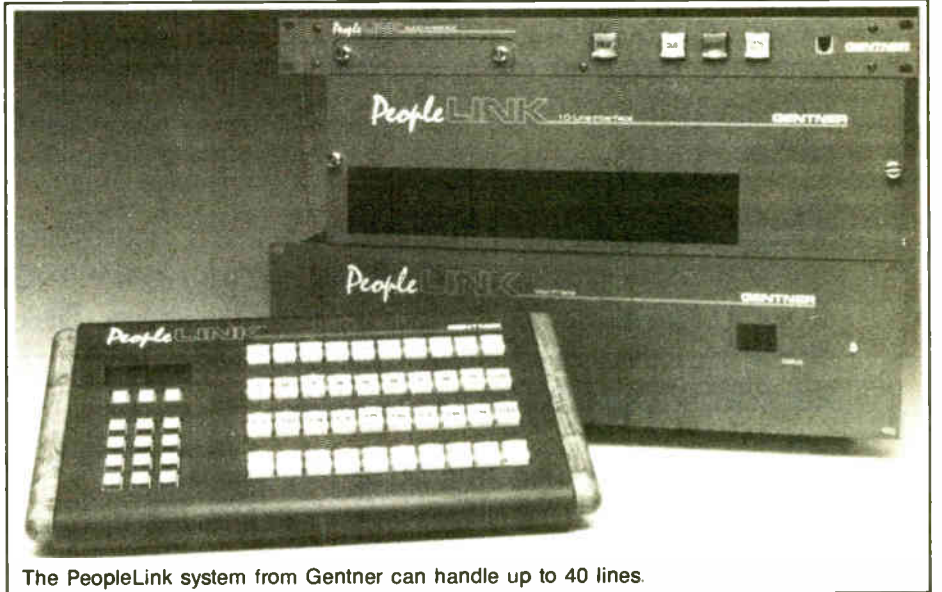
PCL-606 advocates also will be glad to know that Moseley had this STL on display and the product will continue to be available.

Meanwhile, at the TFT booth, a spin-off from booster technology showed

Reciter, because of its combined exciter and STL receiver functions, would obsolete demodulation and re-modulation of the baseband signal. The device would ideally offer THD on an order of magnitude better than STL receivers currently on the market (the Reciter is specified at .02% THD).

TFT also showed its 8600A Aural STL, 8300 Composite Aural STL, and 7700B STL.

Elsewhere on the STL front, Marti Electronics displayed its STL-23 system and STL-10 system, now available for



The PeopleLink system from Gentner can handle up to 40 lines.

FCC rule 74.550 to meet spurious emission levels and a .005 frequency tolerance for the 944-952 MHz band.

T1 service shows merit

QEI's CAT-LINK, the subject of much interest last year, again held some interest at this year's show. The CAT-LINK's merit is its ability to multiplex a composite signal as well as four auxiliary channels over telco T1 service.

T1 data service could be an up-and-coming alternative for stations looking to link studios and transmitters in areas where microwave hops are not feasible.

CAT-LINK systems also can be used as direct links for 18 GHz or 23 GHz microwave, satellite up/downlinks, IR, twisted pair, or fiber optic cable. It's a real-time

showed their analog hybrids and analog hybrids with frequency extenders.

Both companies also showed their new and/or enhanced digital hybrid wares, which were a bit pricier than their analog counterparts but definitely paid off in better null specs.

Gentner also introduced a full-function, multi-line telephone system dedicated exclusively to broadcasters.

Intended as either a standalone telephone system, or to work with any electronic business system, Gentner's new PeopleLink is microprocessor-controlled and does such automated functions as call screening, recording, conferencing and cueing contest callers.

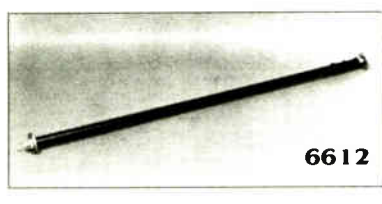
Meanwhile Comrex forged ahead in

(continued on next page)

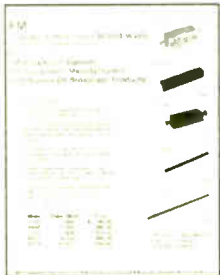
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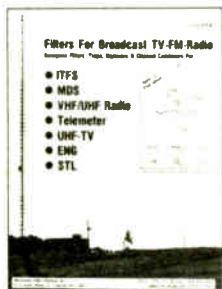


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Exploring Telco Alternatives

(continued from previous page) another direction with its introduction of a new system intended to reduce noise by transporting audio over fiber optic cable.

Called the Pro-Audio-Fiber, the new system effectively converts audio signals to fiber optic signals and is expected to be in production by the third quarter of this year.

Teeing off with Telos

At the Bradley Broadcast booth (where a good game of golf was always shaping up!), Telos Systems displayed its telephone hybrid systems and a new phone interface module.

The new unit, the Telos 100 Direct Interface Module, now allows the Telos hybrid system to be directly connected to Central Office lines without an intervening PABX or key system.

On the RPU front, Marti's RPT remote transmitter series was demonstrated with its compander option, the MCS-800. Marti's relatively new 4' parabolic dish was also of interest to engineers wanting to keep RPU budgets in line.

A broadband for the 940 to 960 MHz STL band, the PA-48 is priced at almost \$500 less than other similar dishes. Its drawback is that it only takes windloads up to 565 pounds. But for a \$1000 savings—\$500 savings each for the send and receive side—this drawback probably can be overlooked by most engineers.

Both Moseley and Marti introduced new multiplexers for piggybacking signals on STL channels.

The Marti Mux and the Moseley DigiMux, which is a fully synthesized digital system, both carry at least six full duplex program channels.

Marti's Dan Rau speculates that multiplexing signals on STL channels will be a viable alternative for station owners wanting to deliver programming feed from one station to another.

Remote control expands

Remote control of transmitters was also drawing crowds at the NAB. Hallikainen & Friends recently streamlined the multiple site DRC 190 for more mainstream use of single-site control.

It also streamlined the price; the new DRC 200 is expected to sell for \$2500 total, and is expected to be available this fall.

Moseley, meanwhile, expanded its MRC 1620 remote control software to handle multiple sites more effectively.

The new software, released six months ago, now offers user-selection of input channels between status and telemetry functions with 48 additional status lines.

For the more computer literate, Moseley introduced a software upgrade to its MRC 2 remote control. Engineers can now write their own control strategies through a "back door" program called SMARTS.

All terms used in SMARTS are based on transmitter control terms, so it promises to be easy to understand and use.

National Supervisory Net-

work, meanwhile, demonstrated its off-premises remote control system to NAB goers for the first time. This newcomer to remote control circles offers on-line intervention of transmitters by engineering personnel in Avon, CO.

Remote control is done via satellite service and in addition to eliminating the 2 AM call rousing engineers out of bed to

troubleshoot transmitters, it also provides other perks such as on-line local and national weather service, engineering and FCC information and the *M Street Journal*.

Burk Technology remote control products, which are compatible with the National Supervisory Network system, were demonstrated with new software enhancements.

Computer interface to the ARC 16, which can be configured for multi-site control, is now full function to offer remote automatic transmitter supervision; including auto-logging and full access to ARC 16 control functions.

The company also displayed the standalone DSU (Digital Speech Unit) for touch-tone phone access to remote transmitter sites.

Dee McVicker is a free-lance writer and regular contributor to RW. To inquire about her writing service, call 602-899-8916.



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World Radio History

AM Bill to Take Off in House



Matthew Rinaldo (second from left) predicted fast progress for a previously stalled AM improvement bill in the House of Representatives.

by John Gatski

Atlanta GA After a year of near-stagnation, a key congressman predicted that a stalled AM improvements bill is now likely to move quickly through the House of Representatives.

Rep. Matthew Rinaldo (R-NJ) the ranking Republican on the House Telecom-

munications and Finance Subcommittee, told an NAB audience that the Radio Quality Improvements Act, HR 2714, now has the support of subcommittee chairman Rep. Edward Markey (D-MA).

The bill includes provisions requiring AM stereo on receivers with FM stereo, restriction of FM translators and man-

dates the FCC to seek interference reduction remedies.

The bill was expected to move through the hearing process following the congressional Easter recess.

According to Rinaldo, Markey has agreed to push the legislation with amendments codifying the radio FCC's abuse of process regulations that were enacted to stem third party pay-offs during the licensing process.

Originally, the AM improvement bill was an accompanying bill to HR 1136, separate legislation introduced to stop pay-offs during the licensing process.

The radio renewal bill did not move very far, in part because lawmakers believed it was unnecessary after the FCC revealed that its abuse of process regulations were working.

Because of AM radio's technical plights, lawmakers were sympathetic to HR 2714 and those who wanted radio renewal are likely to support an amendment to it, codifying the FCC's regulations, Rinaldo said.

"It doesn't mean you are going to get everything you want with regard to renewal," Rinaldo said. "But you're getting three-fourths of a loaf instead of a full loaf."

Although a supporter of HR 1136 and HR 2714 as separate bills, the NAB decided in February to back the technical bill with the amendment because it would have a better chance of passing through Congress.

Rinaldo acknowledged that the technical bill has its detractors, including receiver manufacturers who do not want to be forced into equipping receivers with AM stereo.

But those concerns can be worked out as a bill progresses through the House, he added.

Console Agreement

by Charles Taylor

Atlanta GA Wheatstone Corp., which manufactures a full line of consoles and console furniture for the radio industry, has announced a joint agreement with another console maker.

Siemens-owned Neve, which has been producing audio-for-video consoles will distribute broadcast on-air and production consoles in Canada for Wheatstone Corp., based in Syracuse, NY. The move will give Neve a greater presence the North American broadcast markets, according to company President Barry Roche.

"The agreement to distribute the Wheatstone product line gives us the type of resources necessary to strengthen our position in broadcast with the aim of achieving a position similar to the one we now occupy in music recording," Roche said.

Wheatstone products that Neve will offer to the Canadian market are: the A-500, A-32EX and A-20EX on-air produc-

tion consoles; the SP-5 and SP-6 stereo TV and radio production consoles, and the TV-500 live TV console developed for fast-paced live TV production and complex audio sweetening projects.

In addition, Neve will distribute Wheatstone's premium grade broadcast furniture, a building block system with custom fabricated countertops.

Wheatstone President Gary Snow said his company would benefit by Neve's Toronto sales office. It "has the personnel and the expertise necessary, on site, to provide our Canadian clients with the first class support that Neve is known for throughout the world.

"I have to say that Neve is the best partner that Wheatstone could possibly wish for," he said.

In addition Neve also signed an agreement with Orion Research of Cleveland, to manufacture, sell and service that company's audio consoles for the TV broadcast, production, remote and video post markets.

AM Antenna Briefing

by John Gatski

Atlanta GA Antenna computer modeling and the anti-skywave antenna testing schedule were highlighted in an update on NAB AM antenna projects during the convention.

ABC Radio Engineering VP Al Resnick, project coordinator, said the computer modeling search for an effective low profile antenna has led to calculations of various top-hat length and counterpoise ground system height combinations for the optimal VSWR and field measurements.

ADL Inc. of Pacific Grove, CA, is doing the computer work.

The latest low profile version, known as the Smith-Musselman antenna, is believed to hold the greatest promise, Resnick said.

Based on NAB-prescribed limits, a low profile antenna must be no higher than 50' or exceed a 50' radius. It also must have a VSWR of 2:1 and meet minimum bandwidth (20 kHz) requirements.

"The tower that was chosen was an unloaded, sparse, Smith-Musselman proportionally-fed antenna," Resnick said.

The computer work now centers on the top hat length and counterpoise height to get the best performance, Resnick said.

Through field strength calculations, Resnick said increasing the height of the counterpoise improved bandwidth, but field strength was reduced.

"The continuation of this project will be to seek the best combination of counterpoise height and top-hat length for maximum bandwidth and a matching circuit to connect a 50 ohm coax," Resnick said.

Skywave performance estimates also are being done with the computer, he added.

After nearly a year of delays, the NAB's anti-skywave antenna testing was slated to begin in April or May, according to NAB Science and Technology Staff

Engineer Kelly Williams.

The 190' antenna, designed by Ogden Prestholdt, was constructed in a rural area in Prince George's County Maryland. Proponents of the antenna are hopeful it can effectively tune out the skywave signal in one direction, to minimize nighttime interference.

Some of the recent delay has come from longer-than-expected testing of a counterpoise system, Williams said.

Once underway, performance testing should be concluded by July or August, he added.

The tests will be made using a 5 kW transmitter (400 W typical during the test) on 1600 kHz, according to the NAB.

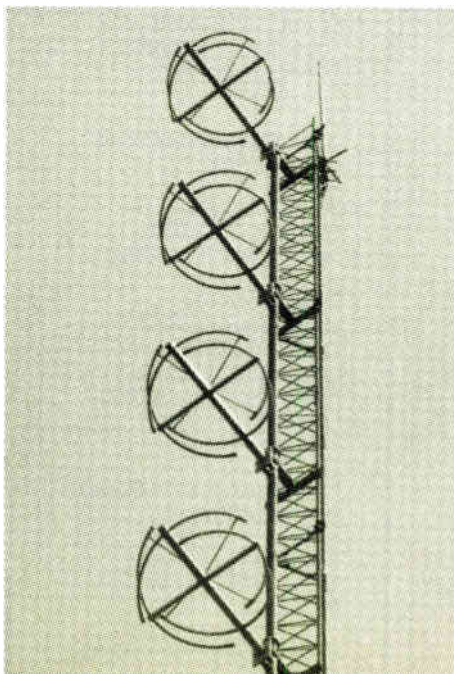
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Closer Look at AM Remedies

by Lex Felker

Washington DC At its 12 April, 1990 agenda meeting, the FCC took several sweeping actions that could have a profound effect on the shape of the AM broadcast service.

Regrettably, the actual texts of the various decisions and proposals were not immediately available; it now looks as though they will probably not be released until sometime after this column is published. Nevertheless, based on the Commission's presentation and press conference, it is apparent that several new ideas will be surfaced by the FCC.

This month's column considers three such ideas, which may receive the most discussion in the industry—expanded band licensing, nighttime interference calculations and nighttime operation for daytimers.

Expanded band licensing

"Improved quality" has been a consistent theme in all of the Commission's AM efforts. Unfortunately, however, the fixed amount of frequency spectrum has often forced the FCC into playing a "zero sum game": Improving the quality or coverage of one station has only come at the expense of some other station.

The allocation of ten expanded band channels (1605-1705 kHz) has altered

the terms of the game somewhat by providing additional capacity that can be used to relax some of the congestion in the present band. And that is exactly what the Commission says it intends to do.

Despite the fact that many constituency groups are seeking special licensing treatment in this band, the Commission evidently intends to offer these channels first to those existing stations that create the greatest amount of interference.

Because it seeks to achieve the greatest amount of interference reduction with the limited number of vacant channels available, the Commission's proposal would appear to be right on the mark, conceptually. Its practical effects are less certain, however, and won't be known completely until the actual text is studied closely.

It may turn out, for example, that most of the stations eligible for the Commission's expanded band licensing preference will be established, regional facilities whose service areas have eroded over several decades. It is unclear how of many of these stations' licensees will be anxious to trade in their present model on a new, expanded band facility.

Nighttime interference scrutinized

The new AM technical proposals will also include a new means of computing

nighttime interference. Previously, for all but the clear channel stations, the Commission has accounted for the cumulative effect of multiple interfering transmitters by computing their root sum squared (RSS) field strengths.

FELKER'S FORUM

The permitted level of interference has gradually increased over the years, however, because a substantial portion of the interfering signals have been ignored pursuant to the 50% exclusion rule.

Now, apparently, the Commission intends to scrap this procedure and evaluate all proposed facility changes on a single signal basis. This change is intended to reduce the amount of actual interference. Here again, however, the practical effects of this proposal are unclear and await study of the actual Notice.

If the proposal disregards the cumulative effects of multiple interferers, however, it is quite possible that actual interference levels could increase.

Daytimer "enhancements"

It will also be interesting to see how the Commission proposes to introduce what it referred to in its press release as "nighttime enhancement for daytimers." In an earlier rulemaking, the FCC offered to improve some stations' nighttime operations by authorizing sub-

standard (i.e., low power) facilities on a secondary basis.

Such an approach would not appear workable in a tightened interference environment, however. Nor would this tactic appear consistent with the agency's apparent desire to specify minimum coverage areas.

All in all, providing daytimers with additional (or any) nighttime operation would seem to be a most difficult proposition. Clear channel licensees will especially want to examine this aspect of the proposal carefully.

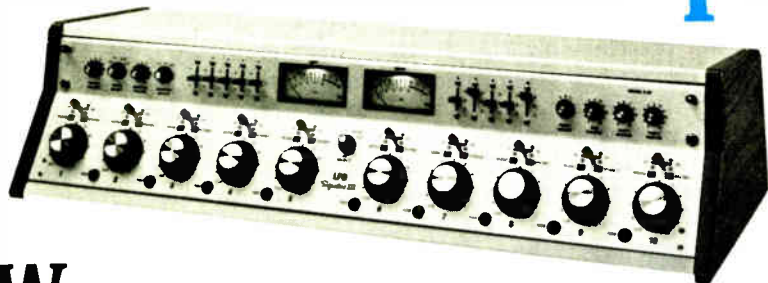
The Commission has also indicated that it will be considering a variety of non-technical inducements to entice licensees into improving their operations and contributing to a lower level of interference.

It has, for example, suggested that under certain circumstances tax certificates might be available and that relaxation of the duopoly restrictions might be authorized. It has also suggested that AM/FM simulcast operations might be banned altogether.

Clearly, in its quest for meaningful improvement in the quality of the AM service, the Commission has demonstrated a willingness to dispense with prior conventional wisdom and consider a variety of imaginative options. The agency's proposals deserve, and will almost certainly receive, careful scrutiny and reaction from every corner of the industry.

Lex Felker is a technical/engineering consultant with the law firm of Wiley, Rein & Fielding, Washington DC, and former FCC Mass Media Bureau Chief. He can be reached at 202-429-7000.

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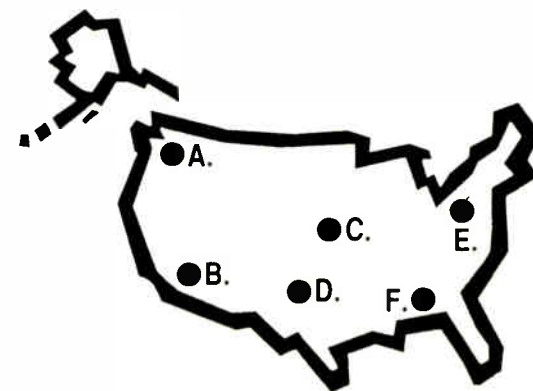
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Developments in DAT and Disc

by Mel Lambert

Studio City CA I'm sure that all of us who made the annual pilgrimage to the NAB convention were left with little doubt that radio's immediate future has "digital" written all over it.

With affordable, user-friendly workstations now finding their way into a growing number of stations throughout the country, it cannot have escaped anybody's attention that digital is, most definitely, here to stay.

In this month's column, I'd like to focus attention on some specific developments in the fields of DAT technology and recordable compact disc systems that were shown at the Atlanta World Congress Center.

New DAT products

Four major manufacturers—JVC, Sony, Panasonic and Tascam—unveiled new DAT recorders at April's NAB convention.

The new JVC DS-DT900 timecode-capable machine, shown in prototype form at the AES convention last fall in New York, will be shipping within three months, and has a suggested price of approximately \$6000.

Currently, the machine is designed for direct interface with an Adams-Smith Zeta-3 timecode synchronizer via the unit's 34-pin remote interface port. I understand that in the near future additional interfaces also will be made available for other controllers and synchronization systems.

No details were available during the NAB convention regarding DAT editing systems, or direct control from workstations. However, the new DAT is designed to serve as a component in the firm's existing DAS Series Digital Audio Mastering System. The system includes a series of PCM processors and companion videodecks, an all-digital mixer, and a RAM-based controller for defining precise edit locations and crossfade profiles.

Stolen thunder

Sony Corporation appeared to steal the thunder of its competitors by unveiling three new timecode-capable DAT recorders, and a companion two-machine editing controller.

The PCM-7000 Series is comprised of the PCM-7010, PCM-7030 and PCM-7050, which differ from one another in terms of operational flexibility.

The base model, PCM-7010, is intended for relatively simple on-air applications, while the 7030 and 7050 are designed for use as a player and recorder, respectively, within a full-function editing configuration.

Various options are also available for the new Sony DAT machines, including the DABK-7030 and DABK-7010 timecode reader/generators; DABK-7000 Series AES/EBU-format at SDIF-2 digital I/O ports; and the DABK-7033 and DABK-7013 RS-232C serial interface for external computer control.

Of particular interest for radio and production applications is the DABK-7032/7012 digital memory expansion, which allows 4 Mbit of RAM to be added to any recorder. The expansion provides instant start without the normal delay from either Stop or Pause-Play mode exhibited by existing DAT players.

(In essence, the first fraction of a second of audio is buffered into RAM and ready for instant start; the deck then plays "catch up" with digital data being replayed in real time from the DAT cassette.)

Prices for these next-generation Sony DAT machines are still being finalized, although I understand that the PCM-7010 is expected to sell for between \$5000

DIGITAL DOMAIN

and \$7500. The PCM-7030 may sell for \$8500-\$11,000; the PCM-7050 for \$11,750-\$17,000 and the RM-D7300 two-machine editing controller for around \$5000. Deliveries are scheduled to begin by early next year.

Non-timecode compatible DAT

Panasonic Communications & Systems unveiled a new duo of non-timecode capable DAT machines: the SV-3700 and SV-3900.

I understand that the company declined to show any new developments in the portable and studio "technology prototype" DAT machines demonstrated at last year's NAB convention. The IEC has yet to fully ratify the proposed timecode format for DAT; any showing of hardware before that decision is reached would be "premature," the firm concluded.

Designed for a wide range of applications within radio and production facilities, the two Panasonic machines utilize the same basic transport and electronics package, which includes a horizontal cassette drawer and 400-times fast-forward/rewind and search speed (to provide high-speed access to any point on a two-hour DAT tape within 30 seconds).

Redesigned analog inputs with four-stage, one-bit Delta-Sigma A-to-D converters are also featured, with proprietary Quad 18-bit DACs that are said to dramatically reduce zero-cross distortion and enhance linearity at low signal levels.

The SV-3700 features a front-panel shuttle wheel, with 0.5 to 15 times speed range and push button fade-in and fade-out functions (for providing automatic level-change ramps at the start and end of a recording). In addition, an infrared wireless remote controller offers remote operation of virtually every front-panel function.

Digital I/Os comprise both AES/EBU-format and IEC Type II (S/P DIF compatible). These now carry Start and Skip ID information within the subcode area for true digital cloning of DAT cassettes.

Serial control interface

The SV-3900 is provided with few front-panel controls; instead, a fully implemented serial control interface provides external remote operation of every transport function and programming mode.

A standard 9-pin RS-422 serial port can be switched to follow ES-Bus or P-2 protocols, making the new Pro-DAT transport compatible with virtually all editing controllers and automation systems, in addition to conventional PC-based controllers.

An optional, full-function Remote Controller, SH-MK360, features a standard keypad for entering PNO and Start

IDs, plus dedicated buttons for all transport modes and a shuttle wheel with a speed range from 0.5x to 15x play speed.

A single controller can also be set up, via the keypad, to address any one of 32 different SV-3900 machines connected on an ES-Bus Local Area Network. All 32 machines can be selected to respond to Stop/Start and other transport commands simultaneously from a single SH-MK360 controller.

No prices were available for either the SV-3700 or SV-3900.

Carving a niche

The new Tascam DA-30 looks set to carve a useful niche of its own, if for no other reason than its low pro-user price of under \$1900, complete with wired remote control.

Shipments are expected to begin by mid-Summer.

Like the new Panasonic offerings, this new Tascam model lacks timecode. It does, however, incorporate some high-power features and specifications: Delta-Sigma A-to-D converters running at 18x oversampling, coupled with 18-bit DACs with 8x oversampling; AES/EBU-format digital I/Os; balanced +4 dB and unbalanced -10 dB analog inputs/outputs.

One extremely neat feature offered by

the DA-30 allows the operator to "nudge" the location of Start IDs at the head or within a music/sound cue until they are positioned correctly to allow tight replay cueing.

Rather than commit to a Start ID location and then have to erase and re-record it to shift the cue point, the DA-30 allows the user to hit "Position" and then perform a trial Play from that Start ID.

If the ID location is too early or too late, single taps of the Rewind or Fast Forward buttons will shift its position in either direction by 150 milliseconds.

Recordable CD schemes

Ingenuity personified! Two companies were showing systems for recording CDs in the comfort of your production studio.

Gotham Audio's SPOT 90 comprises a modified Sony DTC-1000ES DAT machine coupled via a standard IBM-compatible PC to a Yamaha WORM (Write Once/Ready Many) recorder.

The complete system, which sells for \$42,500, allows fully compatible CDs to be made of station IDs, PSAs, jingle packages, commercials, promos and other material recorded on DAT.

Media costs are currently around \$60-70 per pre-grooved single-sided WORM

(continued on page 51)

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Obey the Rules or Pay the Price

Whether It's Station IDs or Transmitter Readings, Listening to the FCC Will Prevent Costly Fines

by Harold Hallikainen

San Luis Obispo CA I've just returned from the NAB convention in Atlanta. As usual, it was very interesting.

INSIGHT ON RULES

I especially appreciate all the feedback on this series of articles. In this installment, I'll review a couple of the items that came up in discussion at the NAB.

Station identification

It appears that some program consultants are suggesting that stations not run the legally required ID at the top of the hour. Instead, they suggest a "20 minute music sweep" that starts at ten to the hour.

FCC rule 73.1201(a)(2) requires a station identification "hourly, as close to the hour as feasible, at a natural break in program offerings."

Whether the ending of one song and the beginning of another represents a "break" in the programming is open to

question. I would not expect a station to stuff the ID between movements of a major classical work.

Purposely arranging your programming so that an ID never occurs close to the hour seems to be violating the intent of the rules. I'm not convinced that running an FCC-required ID once an hour is all that harmful to a station's ratings.

Other than this legally required ID, the station is free to identify itself as it wishes.

I agree that there is some promotional value in having the station identification include the station frequency, so the listener thinks of the station in terms of dial position.

The rules allow the insertion of the frequency, channel number or licensee name between the call letters and city of license during a required ID.

However, it's probably more valuable to include the promotional identification before or after the required identification. Examples I've heard include: "Sly-96 is KSLY, San Luis Obispo," "US-98 is KKUS, San Luis Obispo," etc.

Other than the top of the hour, the stations are identified and promoted using the audio logo (Sly-96 or US-98). The

typical listener identifies the station through this logo, which, fortunately, tells her/him where to find the station.

Market identification

The top of the hour ID is for the FCC's benefit. Many stations wish to be identified with a nearby major market.

The FCC did have various rules regarding dual city identification and rules prohibiting any ID or promotional announcement that attempts to mislead the listener as to the city of license (73.1201(b)(3) in the 1980 rules).

The rules also required each station to maintain the main studio in the city of license (73.1125 in the 1980 rules).

1988, the FCC issued 14 violation notices for ID violations.

Several were for stations not running any ID. Others did not list community of license immediately after the call letters. Another was cited for running the ID eight minutes past the hour when a break in programming would have allowed it to run on the hour.

One station was cited several times because the legally required portion of the ID was inaudible compared with the "promotional" ID.

Extension meters

Another NAB attendee asked about extension meters that are more than 30.5m from the transmitter, more than one floor from the transmitter or in a different building than the transmitter.

Extension meters are not allowed to exceed these limits (73.1550). You can,

Purposely arranging your programming so that an ID never occurs close to the hour seems to be violating the intent of the rules.

The Commission did grant various stations waivers of the studio location rule ("Arizona waivers") and eventually decided that a station could put the main studio anywhere in the "principal community contour" (5 mV/m daytime for AM, 3.16 mV/m for FM).

The station must retain a toll-free telephone number in the licensed community. Currently, stations are allowed to identify with other communities provided the licensed community is listed first.

An example is "KCBX, San Luis Obispo and Santa Barbara Counties." The station is licensed to San Luis Obispo (a city), but has translators covering San Luis Obispo County and Santa Barbara County.

So, listen to your IDs and compare them to the requirements of 73.1201. In

however, use "extension meter technology" (a wire pair for each meter and a wire pair for each control function) to get "remote control," which is governed by 73.1400 and 73.1410.

Standard remote control systems trade higher equipment cost for lower line cost, making one communications pair serve several functions (through time and frequency division multiplexing).

There are many cases where line costs are very low (the station owns lines that go throughout a building or between buildings). In these cases, it may be advantageous to use the less fancy technology of extension metering to get remote control. Note that if the installation does not meet the extension metering distance limitations, it is considered remote control.

The Commission must be notified within three days of the initial use of a control point that is other than the studio or transmitter (unless responsible personnel can be reached at the studio or transmitter when the station is in operation).

In 1988, several stations were cited for not making provision for the operator to observe the transmitter parameters from the normal duty position.

These violations ranged from a studio/transmitter building constructed with the transmitter downstairs and the studio upstairs with no extension metering, to having paper taped on windows blocking the view of the transmitter, to the transmitter operator routinely sitting at a desk in the office where the transmitter parameters were not visible.

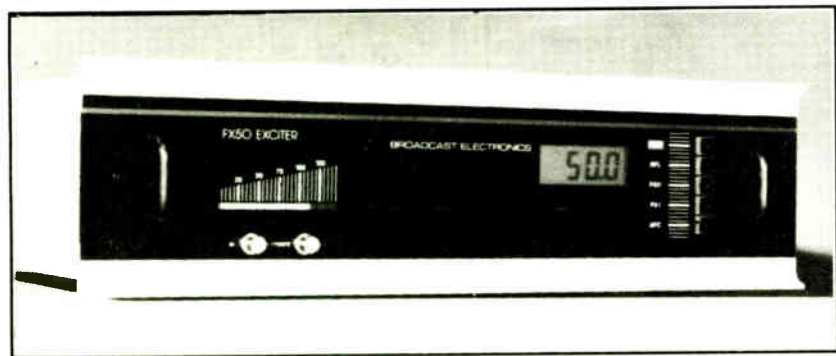
Make sure your operators can observe transmitter parameters from the normal operating position.

Next month we'll continue trying to come up with a routine schedule for the chief operator to inspect various portions of the station.

In addition, we'll review the tapes of the NAB sessions regarding FCC rules. I'll look forward to your comments.

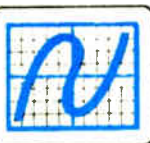
Harold Hallikainen is president of Hallikainen & Friends, a broadcast equipment design, manufacture, sales and installation firm. He can be reached at 805-541-0200.

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Survey Evaluates NRSC Efforts

by John Gatski

Atlanta GA Although the recently adopted NRSC standard was drafted to help the ailing AM band, the standard will create new problems including increased receiver interference, according to an anonymous survey of current and past receiver designers.

Radio engineering consultant Almon Clegg recently conducted the survey of 11 designers and gave a report on his findings during NAB in an AM Systems Engineering session.

Clegg said the NRSC standard including the preemphasis/deemphasis characteristic is a "first step" in getting better quality AM broadcasts, but acknowledged that radio designers do have some concerns.

The NAB and the Electronic Industries Association (EIA) are promoting the voluntary standard to receiver manufacturers under the tag, "IQ."

In revealing the survey results, Clegg found that nine of the 11 respondents believed that voluntary NRSC standard radios (with a 50 Hz to 7.5 kHz audio response and 10 kHz bandwidth) will sound better.

According to their comments, however, a wider audio band-

width also means signal-to-noise ratio increases and more atmospheric and adjacent channel interference.

The noise increase would result in a loss of fringe listeners, the designers noted.

Other problems associated with the NRSC standard include the long-used AM ferrite antenna's incompatibility with wider-band radios, Clegg said.

Designers also commented that a low-high bandwidth

switch will be necessary to cope with interference, which was an option the NRSC once considered for its AM standard. Other technical remedies that were suggested included noise blanker circuits, 10 kHz low-pass filter and improved AGC.

All these remedies will contribute to an increased cost in producing the radios, perhaps as much as \$5 per unit, which would be significant for low-cost portable radios.

Six of the 11 said the NRSC "overlooked" these technical considerations when deciding on the standard.

Also of note, seven of the designers said the AM radios built 20 to 40 years ago sounded better than today's AM receivers.

In survey questions relating to FM, Clegg said the designers were very critical of audio processing, which they said has degraded the sound of an otherwise audibly excellent band.

"It is incumbent on the broadcasters to reduce audio processing and provide cleaner sound," a designer commented.

Trends in DAT, CDs

(continued from page 49)

disc, although these prices are expected to fall dramatically in the near future, as the format becomes more widely accepted.

A similar system was being demonstrated by Sonic Solutions, whose Sonic System digital random-access recording, mixing and editing system can now be interfaced directly with the START Laboratories' CD Maker unit.

Basically, audio program material (analog or digital formats) is input to the Sonic System, recorded to hard disk, mixed, edited to length and timed and then output directly via a custom encoder to the WORM recorder.

Again, the finished product is fully compatible with all existing CD players.

A basic Sonic System costs \$23,000 (plus the cost of a Macintosh workstation/controller); each encoder and WORM recorder is priced at \$25,000.

Up to 32 additional recorders, costing \$15,000, can be added to a master encoding unit, for small-scale duplication applications by music syndicators, production libraries, etc., or for making multiple copies of the same ID package, and so on. Media costs are currently running at \$40 per blank WORM disc.

■ ■ ■

Mel Lambert has been intimately involved with the production and broadcast industries on both sides of the Atlantic for the past dozen years. Now principal of Media&Marketing, a consulting service for the professional audio industry, he can be reached at 818-753-9510.



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when addressed from within a 120-degree "window of acceptance" centered at the front of the microphone. AMS mics not addressed from within this angle remain off. So the number of open microphones is kept to a minimum automatically, with no need for manual control.

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Shure AMS the best system to use in multiple-mic situations, from panel talk shows to game shows to hearings on Capitol Hill. More and more broadcast engineers are discovering the advantages of having broadcast-quality multiple-microphone



audio without the headaches of manual mixing or the time-consuming setup of so-called automatic mixers.

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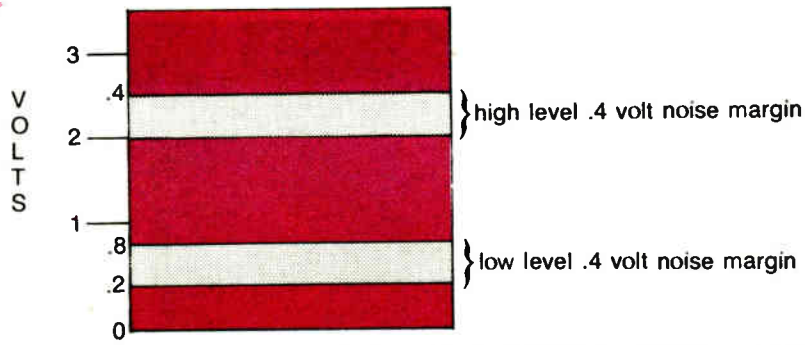
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Specifications for Integrated Circuits

This is the ninth in a 12-part series called An Introduction to Digital Electronics. Northern Virginia Community College will offer 1.3 CEUs (continuing education units) to registered students who successfully complete the course and an examination mailed at its conclusion.

Successful completion of the course and the final exam also will earn 1.3 professional credits toward recertification under the maintenance of certification provisions of the SBE Certification Program. To register, contact the Director of Continuing Education, Annandale Campus, 8333 Little River Turnpike, Annandale, VA 22003, or call 703-323-3159. The fee for the course is \$20.

Figure 1.



by Ed Montgomery

Part IX of XII

Annandale VA The increased use of digital electronics has produced "families" of devices designed to interface with each other. TTL family devices can be connected to other TTL devices without the addition of external parts.

TTL—or transistor-transistor logic—is identified by the first two digits of the device's number. The 74XX indicates a TTL IC that meets commercial specifications operating within 0 to 70° Celsius while 54XX are devices meeting military specifications and are operable between -55 and +125° Celsius. Letters following these numbers identify a subfamily of the IC. This is illus-

Figure 2.

device	fan out		fan in	
	high	low	high	low
TTL	400µA	16mA	40µA	1.6mA
Low Power Schottky	400µA	8mA	20µA	400µA
Advanced Low Power Schottky	400µA	8mA	20µA	100µA

device	fan out		fan in	
	high	low	high	low
CMOS 4000 series	400µA	400µA	1µA	
CMOS 74HC00 series	4mA	4mA	1µA	

trated in Table 1.

Most digital circuits operate with transistors in cut-off or in saturation. To achieve higher switching speeds, non-saturated transistors must be used. This operation is achieved with Schottky devices. Low or high power for these devices is determined by how much current the ICs can safely handle.

Positive and negative logic

In the United States, TTL high levels are usually represented by "1" and low levels as "0." This is known as positive logic. High levels can also be indicated

The voltage in between these two levels is considered to be undefined. Voltages in the undefined area should be avoided because they produce unpredictable results at the output of the device. Figure 1 is an illustration of typical TTL input and output voltage levels.

CMOS (Complementary Metal Oxide Semiconductor) logic is also used in digital technology. The defined high and low levels for the 74C00 series are also illustrated in Figure 1.

CMOS ICs are low cost and consume very little power. They operate on a wide range of voltages and have low heat dis-

Table 1.

no letters	—	standard TTL
LS	—	Low Power Schottky
S	—	Low Power
ALS	—	Advanced Low Power Schottky
AS	—	Advanced Schottky
F	—	Fairchild Advanced Schottky
		TTL (fast)

by a "0" and low levels by a "1." When this is the case, negative logic is said to be in place.

It is important to define the characteristics of high and low levels. Low input levels are usually any voltage between 0 and .8 volts. High levels are defined as being between 2 and 5.5 volts.

However, they are slower at switching than TTL ICs. CMOS devices also must be protected from static electricity buildup. Their junctions can be destroyed by the touch of a finger charged with static electricity.

Differentiating signal and noise

CMOS has an advantage of determining the difference between signal level and noise. This is identified as noise immunity or noise margin. The noise margin for TTL and CMOS devices is illustrated in Figure 1.

Noise is defined as unwanted voltages created from induction on the circuit or from strong radio frequency signals such as near a transmitter. The results of noise are erroneous signals fed to the logic circuitry.

The IC's ability to send its processed information to other circuitry is its drive capabilities. Its fan-out is the number of standard inputs that can be driven by an output. A typical TTL fan-out is 10. Low Power Schottky fan-out is 20. CMOS fan-out can reach 50.

The load or demand required by an individual gate is defined as the fan-in. Typical fan-out and fan-in values are illustrated in Figure 2.

The currents listed in Figure 2 illustrate the electron flow the device can handle at high and low levels.

Ed Montgomery currently is an electronics teacher at Thomas A. Edison High School in Fairfax County. He has taught broadcast engineering at Northern Virginia Community College and worked as broadcast engineer for several radio stations.

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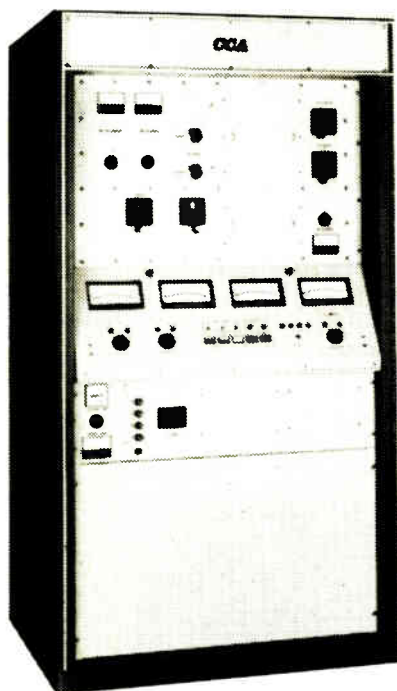
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AMPLIFIERS

Want to Sell

ATI P100 stereo preamps (2) Encore series w/manual, \$125/ea. J Glogowski, 107 N Kenwood, Levittown PA 19055. 215-547-6199.

McIntosh MC-2500 unused, \$2975; MC-240, \$1175; MC-40, MC-225 (2), \$575/ea. R Katz, 15015 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

QRK Ultimate II stereo preamp, separate PS & preamp cabinets, excel cond, \$125. T Crockett, Box 10501, Blackburn VA 24060. 703-953-0222.

QSC 1400 stereo pwr amp, 300 Wchnl at 4ohms, 200 Wchnl at 8ohms, mono bridging, fan cooling, octal accessory plugs, \$425. R Ross, 88 Sherman St 2nd Fl, Brooklyn NY 11218. 718-965-2420.

Ampex Mod-A-692 (2) ampspeakers. Kinura Records, 377 Westward Dr, Miami Springs FL 33166. 305-887-5329.

Straight Wire Audio UA-2 amp cards, \$55/ea. G Wachter, 631 N 1st Ave, Phoenix AZ 85003. 602-258-6161.

Bogen CHB-35A 35 W, \$50. Clark, Secor Road, Hartsdale NY 10530. 914-693-2400.

Nakamichi 620 audiphile pwr amp 100 Wchnl, mint cond, w/circuit documentation, \$350. K Heyne, 415-664-0163.

Ampro TP-5 TT preamps (2), (3) Sparta Top 35, (2) Shure M64, all worked when removed from service, \$50/ea/BO. M Black, Hobart William Smith College, Geneva NY 14456. 315-781-3456.

Crown PSA-2 500 W stereo power amp, rack mtg, excel cond, \$650/BO. W Laughlin, 753 Ruth Ln, Hurst TX 76053.

Crown IC-150 pro stereo preamp, rack mountable, excel cond, \$125. W Laughlin, 753 Ruth Ln, Hurst TX 76053.

Dynakit Stereo 70 gd tubes \$100/BO or swap for MKIII w/70 V out or MKIV; also PAS preamp, \$35/BO or swap. K Smith, Box 579, Gorham ME 04038. 207-854-3079.

Macintosh MC40 mono tube amps (2), excel cond, \$1000/BO. J Zeligner, 4401 Sunset Blvd, Los Angeles CA 90027. 213-667-9310.

Opamp Labs 360 BM mic preamps (8) plus additional line amps & mono amps, \$25/ea/BO. J Zeligner, 4401 Sunset Blvd, Los Angeles CA 90027. 213-667-9310.

Amps including Hafler DH500, Macintosh 250, API 705, Yamaha M40, SCS 2350, Soundcraftsman A2801 & Sunn Concert, call for details & prices. E Boucher, EAB Recdg, POB 958, Lewiston ME 04243. 207-786-3476.

LEL DA-8 dist amp, never used, \$125; Gates Courier 70 2-chnl remote amp w/AC pwr supply, needs work; Gates Attache 70 3-chnl remote amp w/AC pwr supply, needs work. L Wilson, 409 Hillaire, Hopkinsville KY 42240. 502-886-1678.

McIntosh MC-2500, sealed, \$2975; MC-240, \$1175; MC-40, MC-225 (2), \$575 ea. R Katz, Allegro Snd, 15015 Ventura, Sherman Oaks CA 91403. 818-377-5264.

Scott 121-C preamp, mono, mint cond, minor input modification, \$75. B Leslie, Pro Recording Svcs, 13709 Maple Leaf Dr, Cleveland OH 44125. 216-662-1435.

Telex MC Series record amps (2), mono. M Young, WJON, St Cloud MN. 612-251-4422.

Want to Buy

Western Electronic amps, mixers, speakers, turntables, arms, mikes & literature. R VanDyke, Squires Ave, E Quogue NY 11942. 516-728-1327.

Tube amps, all models preamps & amps by Marantz. D DeForest, 7441 Wayne Ave 10-D, Miami Bch FL 33141.

Tube amps & remote mixers incl RCA OP-6, OP-7, BN-2 BA series, 80 series, etc. W Davies, 5548 Elmer Ave, N Hollywood CA 91601. 818-761-9831.

RCA, WE & Aitec tube amps, mixers, mic's, turntables & recorders. R VanDyke, 2 Squires Ave, E Quogue NY 11942. 516-728-1327.

Scully '100' recorders, record/play amplifiers, 8, 16, 24 track heads. Sequoia Electronics, 1131 Virginia Ave, Campbell CA 95008. 408-866-8434.

ANTENNAS & TOWERS

Want to Sell

Harris/ERI FMH series 10 bay centered 'Rototiller' type at 92.3 MHz, gd cond, \$3950. G Wachter, 631 N 1st Ave, Phoenix AZ 85003. 602-258-6161.

Gates-ERI 3 bay CP FM antenna on channel 240 95.9 MHz 2.21 kW in 3 kW ERP, w/tower brackets and deicers, \$3500/for trade for 350 Carousels. F Vobbe, Box 5031, Lima OH 45802. 419-228-4199.

Cetec FM 2 Bay, power gain of 1.00, freq 95.9 MHz, true circular polarization, plus 20 radomes designed for this antenna. H Beam, Box 5588, Princeton WV 24740. 304-425-2151.

ERI CPS-G1E single bay tuned to 96.5 MHz, 8 months old, \$2500. R Jesse, 3645 South, Springfield MO 65807. 417-887-9650.

ERI 12 bay circular tuned to 98.5 available Feb 1990, BO. J Stanford, 2228 Gravier, New Orleans LA 70119. 504-822-1945.

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Shively 6810 8 bay circular w/radomes, new, tuned to 100.3, BO. J Stanford, 2228 Gravier, New Orleans LA 70119. 504-822-1945.

Harris/ERI 3 bay 'Rototiller' Class A type on 95.9 MHz. M Beasley, 300 W Reed, Moberly MO 65270. 816-263-5800.

World Tower 429' solid rod, 1 yr old, ERI 95.7 two bay antenna, lights & lines. B Carr, 1201 Fremont Pike, Woodville OH 43469. 419-837-9696.

Jampro JCP FM elements w/heaters tuned to 107.3, (3) connecting cables w/ power divider, \$1500/all/BO. R Shroyer, Box 1460, Yakima WA 98907. 509-248-1460.

Phelps Dodge 3 bay at 105.5 MHz w/radomes, \$1300. R Martin, Box 5668, Colorado Springs CO 80931. 719-392-4219.

Rigid line 3 1/8", 440'; 20' sections, some hangers & 90° sections, \$4000. C Haynes, 1850 Lynch, Jackson MS 39203. 601-948-1515.

Jampro JSCP antenna bays (5), no heaters, gd cond, orig 105.9 MHz, also inter-bay line avail, \$1000 ea/BO. G Ogonowski, 213-465-3171.

ERI FMCP-10 recently removed, 10 bay on 101.1 MHz, BO. M Cooney, 610 N Kiwanis, Sioux Falls SD 57104. 605-336-2706.

Hughey & Phillips TI-2035 3500 W isolation transformer, 115/230 V primary, 117120 V secondary, \$900. N Winter, 210 W Cota, Shelton WA 98584. 206-473-3462.

Rohn 14" face, 200'; on ground, \$500; Jampro JLPC 3 bay 98.3, \$600; Andrews 1 5/8" air dielectric, 200', \$800. D Crisp, Box 1280, Seaford DE 19973. 302-629-6636.

LeBlanc & Dick tower 1329', 7' face, designed for 2 TV & 5 FM ant's w/comm level 9 1100' that will support 12 2 bays, wind load 65lbs/ft 2 RS 222 specs includes EEG high intensity strobes & red lighting, right light contactor & strobe status controller included, BO. M Fields, 6760 Corporate Dr #340, Colorado Springs CO 80919. 719-548-1528.

Phelps Dodge CFM LP-2 2 bay FM 94.5, complete, ready to ship; dummy load 50 kW RCA type 6000 & coax reducer, 3 1/8 to 4 1/16 w/gas pass & blocking rings, BO. L VanDam, WUPCO, Newberry Ave, Newberry MI 49868. 906-293-8522.

FM antenna, 500'; 12 bay wide-icers, 98.7 MHz, 4 bay FM, 95.1 MHz. J Stevens, WLAU, 601-649-1840.

Shively 4-bay w/radomes, tuned to 103.1, 3 yrs old, perfect cond, \$1400/BO. T Cranford, FM97, POB 1465, Grand Island NE 68802. 308-381-3697.

Cablewave FCC15850J air dielectric cable, 320' of 1 5/8", in gd cond, have connectors to sell w/cable, on spool & in easily accessible location for pick up, \$800/FOB. D Rozek, 475 South Ave, Beacon NY 12508. 914-831-8000.

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Scala HDCA-10EB yagi antennas, 75 ohm, 104.1 & 106.9 MHz. D Leinen, Independent Resources, POB 23498, Oklahoma City OK 73213. 405-728-2525.

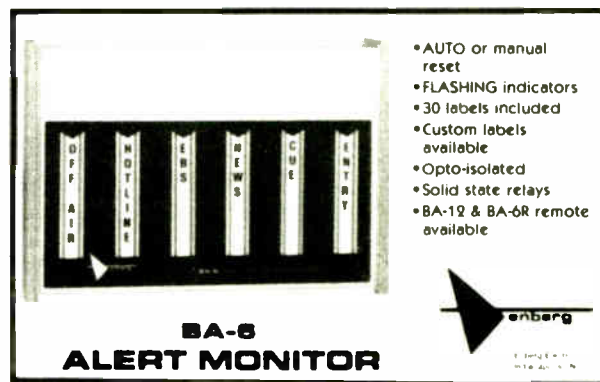
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Rohn 65G 90' in 4-20' sections & one 10'; complete w/guy wire, insulators, bolts, anchors, will sell or trade for self-supporting tower. C Freinwald, KBSG, 1739 Minor, Seattle WA 98101. 206-343-9700.

Phelps Dodge CP 2 2 bay CP, 100.9 MHz, gd cond, \$1000. A McCartney, KUIC, Fax: 707-446-0122.

RCA 10 bay tuned to 92.9, approx 900' of 4" coax, both on ground ready to ship, will sell separately, \$12,000/BO. M O'Brien, KTGL, 3201 Pioneers Blvd Ste 208, Lincoln NE 68502. 402-483-6814.

Cablewave HCC 158 1-5/8" coax, 75', no connectors, \$8/foot. R Biever, KDOM, 1450 N Highway 60, Windom MN 56101. 507-831-3908.



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Phelps Dodge CP-1000-4 4-bay, circular, 102.3, all connectors, just removed, freq change. T Donnelly, KRJH, 111 N Main, Hallettsville TX 77964. 512-798-4333.

Rohn 65G 300', 3 yrs old, guys, bolts, beacon, side lights, on ground in 20' sections ready for shipping, \$12,000. M Blakemore, WCVF, Peachtree Central, Murphy NC 28906. 704-837-2218.

ERI FMHH GS-4 4-bay, high power horizontal only 4 bay antenna tuned to 94.5 MHz +/- 3 MHz. Available in Eugene, OR. Contact Chris Reid Murray, CE, KMGF. 503-484-9400.

Want to Buy

Two-bay lightweight FM broadcast antenna for emergency use, tunable to 91.7 MHz, about 1 kW pwr capacity. E Goetsch, 303 W Prospect, Rhinelander WI 54501. 715-362-6000.

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Class A 3-bay on 98.9 plus or 2 chnls; also need a 10 kW FM xmtr in gd cond w/ 6-bay antenna on 98.9 MHz. J Maxton, KGGF, POB 1087, Coffeyville KS 67337. 316-251-3800.

Self-supporting tower, 100'; ERI 2-bay rototiller, low pwr antenna. E Sutton, WOKI, 1900 Winston, Knoxville TN 37919. 615-531-2000.

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AKG BX20E very gd cond; Marantz tube amplifier Mod-8; Marantz tube preamp Mod-7. Kinura Records, 377 Westward Dr, Miami Springs FL 33166. 305-887-5329.

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Studio Sound S-305 passive filter sets (2), matched pair, rack mount, very rare, \$250 ea/BO. R Katz, 15015 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

Howe Phase Chaser, like new cond, \$500; Heath 10-104 15 mHz oscilloscope, \$200; McMartin AM-25 AM noise meter, works gd, \$50. G Barnett, Broadcast Centre, Palm Springs CA 92263. 619-328-1104.

Klarik-Teknik DN 405 EQ new cond, never rack mounted, \$350. R Hull, 8236 E 71st Suite 133, Tulsa OK 74133. 918-254-0464.

Audi-Cord 132R network delay recorder; Gates 994-6543-001 Solid Statesman AM limiter; Harris 994-6631-006 Solid Statesman FM limiters (2), black face; Harris 994-6631-006 Solid Statesman FM limiter, grey face; Gates M6214F Cartridge Tape II stereo cart R/P; (2) Gates M6212C stereo PB cart machines; Maze rack mounted reverb, all equip operational. B Hopkins 501-863-6126.

Bdct equipment; Orban 111B dual reverb, \$600; dbx 140A Type II noise reduction (2), \$400; ITC Delta I stereo cart machine, \$2200; CRL SEP-800 4 band stereo compressor, \$1250; CRL SPP-800 stereo AGC, \$1250, all prices negotiable. H Ginsberg, 45 Roosevelt Hwy, Colchester VT 05446. 802-655-9530.

dbx Model 140A 2 chnl NR unit, use w/any video or audio tape recorder, provides 30 to 50 dB of NR, \$400. A Romanoff, 374 N Ridgewood Place, Los Angeles CA 90004. 213-467-1700.

Orban 536A De-Esser 2 chnl, excel cond, BO. Falk Recdg, 7914 Fegenbush Ln, Louisville KY 40228. 502-239-1010.

Symetrix T-101 Telephone interface never used (2), BO. D Eressey, 508-945-4855 am.

Sony PCM-F1 (2) digital audio processor in gd cond w/pwr supply, use w/any VCR, \$1000/ea. P Christensen, 3101 University South, Jacksonville FL 32216. 904-721-9111.

Eventide H-969 Harmonizer, \$1500. B Glasser, Box 9917, Canton OH 44711. 216-456-7166.

Eventide 1745M 3 separate delays on output & pitch ratio, excel cond, \$600. F Virtus, 1618 N Broad, Philadelphia PA 19121. 215-763-2825.

Lexicon 224 version 4.4 just back from factory w/complete check out, like new, \$3250. F Virtus, 1618 N Broad, Philadelphia PA 19121. 215-763-2825.

Lexicon 1200 mono, audio time compressor/expander, excel cond, \$700/BO. J Zeligner, 4401 Sunset Blvd, Los Angeles CA 90027. 213-667-9310.

Tascam PE-40 4 band, 4 chnl parametric EQ unused, \$250. D Lerner, 115 W 23rd, New York NY 10011. 212-463-0795.

AKG BX 20E reverb w/remote, excel cond w/spare 2nd unit for pils, custom modified for smoother decay, \$250. K Heyne, 415-664-0163.

Allison Kepex noise gates (2) w/pwr supply, \$100/BO. J Zeligner, 4401 Sunset Blvd, Los Angeles CA 90027.

Orban 111B stereo reverb, brand new, BO. R Sundell, POB 734, Upland CA 91786. 714-985-0701.

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Harris ME-1 modulation enhancer, rack mount w/manual, \$125. L LeBlanc, WKX..., POB 875, Concord NH 03301. 603-225-5521.

Ramko DA280 10x8 dist amp in rack mount w/pwr supply, \$400/BO. J Zeligner, 4401 Sunset Blvd, Los Angeles CA 90027. 213-667-9310.

Eventide H-949 harmonizer, changes pitch & has prod effects built-in, \$2250. W Waldron, KSOS, Lafayette Hills Mall, Layton UT 84041. 801-546-1722.

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Studio Sound S-305 passive filter sets (2), matched pair, rack mount, very rare, \$250/BO/ea. R Katz, Allegro Snd, 15015 Ventura, Sherman Oaks CA 91403. 818-377-5264.

ART DR1 digital reverb w/remote, MIDI. S Wyts, 165 Linden, New Britain CT 06051. 203-224-1811.

Rane ME-15 stereo 2/3 octave graphic EQ, new cond, \$250. M Osborne, WKSQ, POB 9494, Ellsworth ME 04605. 207-887-7573.

Shure M63 EQ, filter, \$50. M Maciejewski, WMUS, 3565 Green St, Muskegon MI 49441. 616-744-1671.

Various pieces of equip including ITC RP R/P cart machine; (2) 47" equip racks; 5 element Yagi antenna; (3) Switchcraft 96 jack patch panels; SMC 521 PB cart; MCI JH-110 & (3) Ampex AG600B R-R's; (5) RCA BFC antenna bays w/radomes; Heath GC1000 most accurate clock; (2) Marti RPT1150K xmtrs; Scala PR-450U paraflector. M Young, WJON, St Cloud MN. 612-251-4422.

Shure M610 graphic mic EQ, \$75. M Maciejewski, WMUS, 3565 Green St, Muskegon MI 49441. 616-744-1671.

Dolby 361 A NR (2), \$450/ea plus shipping. M Holwin, Anamnesia Studios, 49 S Oxford, Brooklyn NY 11217. 718-852-7630.

Orban 674A stereo para-graphic EQ, \$575. M Maciejewski, WMUS, 3565 Green St, Muskegon MI 49441. 616-744-1671.

Want to Buy

Tube limiters compressors and EQs, Fairchild 660 & 670, Teletronix LA2A, LA3, any Pultec EQs, Lang EQs, etc; also other vintage tube signal processing equip. J Kreines, 5330 Kennedy, Millbrook AL 36054. 205-285-6179.

Eventide BD955 broadcast digital delay with 15 kHz bandwidth & 6 second delay, must be in excel cond. M Byrnes, 4400 Massachusetts NW, Washington DC 20016. 202-885-1030.

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Symetrix SX201 parametric EQ. B Tidwell, POB 336, Valdosta GA 31603. 912-244-5180.

Symetrix 511A noise reduction. B Tidwell, POB 338, Valdosta GA 31603. 912-244-5180.

WE/RCA speakers, amps, mixers, mics, TT's, on-air lights, equip magazines, catalogs, manuals & any tube equip. R Van Dyke, Caffrey House, Squires Ave, E Quogue NY 11942. 516-728-1327.

Marshall Electronics AR-300 tape eliminator all analog tape delay simulator. A Gregory, 3003 20th, San Francisco CA 94110. 415-285-1953.

Digital delay unit for talk format or combo digital delay & production unit. A Roycroft, POB 1602, Hilo HI 96720. 808-935-6858.

Amps & preamps w/tubes; speakers; Aetec 604E's, JBL drives etc; EQ's & other processors by Pultec, Langevin, Brook. D DeForest, 7441 Wayne Ave 10-D, Miami Bch FL 33141.

AUTOMATION EQUIP

Want to Sell

Broadcast Electronics Control 16-X latest software version, 4 reel to reels, network delay, triple cart, 3 Go Carts, will install, setup & train, \$27000. W Keeney, 863 Benner Pike, State College PA 16801. 814-238-5334.

SMC 352 stereo Carousels (2) RSC-50 random controllers (2); SMC AS-16 switcher; SMC SSP-3060 programmer; SMC LA-2465 stereo line amp; SMC PDC-3 clock; SMC PSA-230 pwr supply; SMC 772 dual play stereo cart; TS-25 tone sensors (2); RC-10 remote controller 2/40 cable; (2) ITC 250 Series stereo R-R's; Revox A77; Otari ARS 1000 M; SMC green equip racks (3), prefer sale as system, removed Oct/Nov '89. B Hopkins, 501-863-6126.

Used, Demo, Returns, Trade-in's, Overstock, Scratch and Dent— Limited Quantity, First Come, First Served Terms: Payment with Order

AKG D1200E MIC	\$125
AKG D190ES MIC	85
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BENCHMARK DA 101 DIST AMP	250
BENCHMARK mda101 DIST AMP	275
CRL SGC-800 STEREO LIMITER	1400
EV SENTRY 100A SPEAKERS	195
EV PL10 MIC	150
EV PL20 MIC	354
EV RE15 MIC	225
EXCALIBUR CD-1 AUDIO	
INTERFACE	77
JBL 4312 SPEAKER	225
JBL 4401 SPEAKER	115
LUXO COPY STAND	55

MICROTRAK 10P	95
MICROTRAK TELEFILE	125
MOD SCI CP-803 COMP PROC	1025
MOD SCI SCA 186 SCA GEN	2800
MOD SCI MODMINDER	2155
MOSELEY ICU-3A ISOCOUPLER	275
OMNIMOUNT 101-SWA	37

OTARI MTR 12-1 1/2" 4 CH RECORDER	8900
OTARI MX5050 MKIII-2 (minor damage)	3295
OTARI CTM 10 CARTRIDGE PLAYER	1850
OTARI CB109 REMOTE CONTROL	1225
OTARI ARS1000DC TAPE PLAYER	900
RADIO SYSTEMS DA-8 AMP	275
REVOX B77 TAPE RECORDER	1895
REVOX PR99 R/R ROLL AROUND STAND	350

RUSSCO STUDIO PRO TT	325
SANSUI CDX701 CD	410
SANSUI CDX711 CD	695
SHURE SM7 MIC	350
SHURE 330 DEMO MIC	140

SONY CD5 PROII CASSETTE RECORDER	650
SONY TCD-D10PRO PORTABLE DAT RECORDER	2200
SONY C48 MIC	700
STRAIGHT WIRE AUDIO DA CARDS	195.00 PWR SUPPLY
TAPCO 4400A REVERB	125
TASCAM 112R CASSETTE RECORDER	595
TECHNICS SP 15 TT	490
TECHNICS SP10MKII TT	795
TECHNICS SLP 550 CD	195
TECHNICS SLP1200 CD	935

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TECHNICS SLP 200 CD	600
TECHNICS SLP 3 CD	400
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TECHNICS SLP770 CD PLAYER	350
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TECHNICS SL1200MK2 TT	340
TELEX WIRELESS MIC FMR-2	925
TELEX PH75 HEADSET	85
UREI SRI RACK MOUNT	20

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Harris 9000 complete stereo, (6) Scully reels, (2) Instacart 48's, CRT, CPU, all manuals, BO. B Harmon, PO Drawer J, Plant City FL 33564. 813-754-9191.

IGM 700 w/monitor control, audio chassis, network switcher, programmer, automatic logger w/thumbwheel cart encoding electr, rack mount access, manuals, cables, as is, \$300/all. M Meyer, Box 70, Madison WI 56256. 612-598-7301.

Gates 25 Hz tone detector & R-R controller (3), \$75/ea. E Moody, 216 N Main, Bentonville AK 72712. 501-273-9039.

IGM Basic A automation system, all or part, Audicord network delay, (5) Revox PR-99 PB's, (4) 24 cart Carousels, (3) Audicord cart PB's, logging, BO. C Gustafson, 590 W Maple, Kalamazoo MI 49008. 616-345-2101.

IGM EC Controller w/IGM 48 tray Instacart, gd cond, \$7000. B Croghan, KCEE/KWFM, POB 5886, Tucson AZ 85703. 602-623-7556.

BE 1600S stereo sequencer, 16 event w/books; (2) SMC TACtime announce control, BO. L VanDam, WUPQ, Newberry Ave, Newberry MI 49868. 906-293-8522.

Wegener 1601 mainframe inc all audio, tone decoding & receive translating cards for SMN Starstation affiliates; Harris 6529 sat video rcvr, \$1300/BO. H Bundrick, 1115 Washington, Natchitoches LA 71457. 318-352-9696.

Cetec/Schafer 903E 19 sources & 4 random access sources & RAS manual control, program console, pwr supply & rack, missing memory otherwise complete, \$2000/BO. B Glenn, 11 S Benton, Kennewick WA 99336. 509-586-4165.

Harris System 90 brain, switcher & (2) IGM 42 tray Go-Carts, will sell together or in parts, BO. R Lafore, Box 1327, Valdosta GA 31603.

Gates KSP10 & RA10 automation programmer, sub programmer, clock, source cards & cables, gd for parts, \$500. E Moody, 216 N Main, Bentonville AK 72712. 501-273-9039.

BE Control 16 totally computerized system w/network join, 4 reels (2), Otari fixed carts, (3) Carousels, remote start, gd cond, \$12000/BO. A Sutton, POB 1380, Moultrie GA 31776. 912-985-0980.

Sono-Mag RAS Pro, (4) 350RSB Carousels, racks, power supply, remote control, audio switcher, memory, clock, extender cards, spares for all, complete books, \$7K. D Duns-moor, KRRZ, 216 S Bdwy, Minot ND 58702. 701-852-4646.

Sono-Mag SMC RP-1000 brain, DS-20 switcher, PDC-3A timer flag unit, pwr supply, TS-25 tone snesor, (4) Otari ARS-1000, (4) BE auto rewinds, (4) SMC 350-RSB Carousels, (3) racks w/doors, manuals, spare parts, \$14,000. D Denton, 405 E Norman, Montgomery City MO 63381. 314-564-2275.

SMC DPI-C automation system complete, includes: (4) 350 RSB Carousels, (4) SMC/Otari R-R PB decks, SMC dual cart, single play deck, (4) matching equip racks, logging w/X-tel printer, digital programmer w/brain & remote encoder w/monitor, all manuals, D Kugel, POB 886, Carroll, IA 51401. 712-792-4321.

Sono Mag DP-2, DS-20 (6) 350 stereo Carousels, (4) AR1000 Otari R-R, DS 20 switcher, DP2 brain w/upgrade card in gd cond, \$14,000. P Swint, 2620 Dogwood, Joplin MO 64801. 417-624-1310.

IGM dual 25 Hz tone detector. H Kneller, 813-639-1112.

Sono-Mag Carousel, worked when removed from service, \$600/BO. A Lane, WEHB, POB 2892, Grand Rapids MI 49501. 616-451-9904.

ATC fade start unit w/manual, \$20; Gates ATC time announce control mdl TA w/manual, \$15; ATC 55A silence sensor w/manual, \$35. J Feasel, W64BG, 13549 Morse Rd, Pataskala OH 43062. 614-927-2592.

Colorado Magnetics NS-200-B Translar network switcher, mint cond, w/fanout board & instruction manual, \$600. N Allebaugh, WICE, 100 John St, Cumberland RI 02864. 401-725-9000.

Want to Buy

BE Sat-16 satellite program controller system A or B with or without printer. L Maierhofer, 101 Army Blvd, Lewisburg PA 17637. 717-523-3271.

250 or 350 Carousel or similar type multiple cart machine any type, mono or stereo, will pick up. F Vobbe, Box 5031, Lima OH 45802. 419-228-4199.

Any commercial video insertion system, small to mid-range tape capacity, prefer 3/4" or 1". J Worrall, 4618 Gabriel Dr, New Orleans LA 70127. 504-241-6634.

CAMERAS (VIDEO)

Want to Sell

Norelco PC70 3 tube color studio camera systems (20) w/21-210mm studio lenses, CCU's, all cables, complete, Ampex 3 tube color studio camera, Hitachi 3 tube color studio camera, both w/CCU's, studio lens & cables, BO. J Krepol, 6147 Walker, Philadelphia PA 19135. 215-624-1050.

JVC KY2000/RS (2) cameras sat type recently retubed w/14:1, w/optional CCU & 50' cable, clean, \$6000. R Krangle, 660 Haines NW, Albuquerque NM 87102. 505-842-1418.

Sharp XC-700 3 tube, retubed, case & accessories, \$1800/BO; (2) JVC 562-U tube color camera, \$400/BO. T Quinn, 208 Cherry, Capitola CA 95010. 408-475-0423.

JVC KY210 3 tube w/access, like new. J Jones, 920 Main St N, Southbury CT 06488. 203-264-3666.

Hitachi FP-60 complete chains (2), w/lenses, viewfinder, RCU's, CCU's, etc, just taken out of service Jan 90. BO. R Shriver, Marietta College, McKinney Mass Media, Marietta OH 45750. 614-374-4802.

Hitachi KP-C100U color chip CCTV w/16mm auto iris Rainbow lens, lw hrs, \$300. P Ruse-sell, Bowdoin College, Sills Hall, Brunswick ME 04011. 207-725-3066.

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Audio Video Research

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JVC BY-110 3-tube camera w/S-VHS upgrade, Fuji 16X lens, MK50 shotgun mike and KAM-50 mic grip, A/C adapter/charger, (2) DC11U NiCad batteries, VF400 4" B&W viewfinder, studio zoom & focus controls, (2) cables, custom case, service manual, high resolution & top quality performer, like new cond, \$3495. B Hines, IPS, RD 1 Box 413A, Export PA 15632. 412-468-4115.

Panasonic WV 6000 2/3" high band tube, 420 lines hor resolution, 2 line vert enhancer, 12X servo zoom lens, RCU w/cable, \$1000. W Watrous, 739 S Orange, Sarasota FL 34238. 813-366-3316.

Ikegami HL-79D 3-tube camera ENG configuration w/Canon J13x9BIE lens, w/(3) NiCad batteries, (3) chargers, hard case, AC adapter, (2) cables for power & Sony 4800 recorder, \$1800. N Lindquist, POB 14920, Columbus OH 43214. 614-888-4788.

RCA CC002 single tube color camera w/case & AC pwr, \$150; Panasonic WV RC 30 Panasonic remote control unit for Panasonic 777 color camera, 50' of cable, \$800. D Hurd, Box 853 Station A, Searcy AR 72143. 501-279-4658.

Panasonic WV 360 P/BW camera, pushrod zoom, \$100. D Hurd, Box 853 Station A, Searcy AR 72143. 501-279-4658.

JVC KY 2000B 3-tube color camera, case, AC pwr supply, Anton Bauer battery bracket, mic holder, multipin cable for EFP, 10-100 Tamron zoom, \$1000. D Hurd, Box 853 Station A, Searcy AR 72143. 501-279-4658.

Sharp XC-800 3-tube bdct color camera, Fuji 12X lens w/2X ext, 2L image enhance, road case, etc, excel cond, \$3600/BO. R Jensen, Racine Telecable Corp, 5812 21st, Racine WI 53406. 414-632-3131.

Panasonic WVCD 20 B/W security camera, new, w/25mm & 8mm lens (2), \$1900. D Hurd, Box 853 Station A, Searcy AR 72143. 501-279-4658.

Ikegami 305 w/24-400mm lens, CCU, cables, gd tubes, BO. A Weiner, 14 Prospect, Yonkers NY 10705. 914-423-6638.

Phillips PCP-90, minicam, complete w/back-pack CCU, lens, set-up panel & camera support harness, (3) 1" plumbicons, BO. G Spoiler, BES Teleproductions, 6829 E Altmore, Richmond VA 23225. 804-276-5110.

Panasonic WV 340 P/BW camera, pushrod zoom, \$100. D Hurd, Box 853 Station A, Searcy AR 72143. 501-279-4658.

JVC KY 1900 3-tube color camera, case, EFP AC pwr supply 10-100 Tamron zoom, \$900. D Hurd, Box 853 Station A, Searcy AR 72143. 501-279-4658.

Want to Buy

RCA Dumont iconoscope & image orthicon cameras, tubes, tripods and parts. A Weiner, 14 Prospect Dr, Yonkers NY 10705. 914-423-6638.

JVC BY-110U & any related access, in particular, lens & mic access, send item & parts list. R. Lawrence, Moonshadow Video, 4280 Reston, Roseburg OR 97470. 503-679-8966.

Old Norelco, RCA, Bendix, Ikegami portable cameras, HL-33, HL-35, PCP-70, PCP-90, etc. A Weiner, 14 Prospect Dr, Yonkers NY 10705. 914-423-6638.

ITC Premium SP (2), mono, gd cond, new steel cases, \$625 ea; Audicord A Series (2) single play mono, fair/gd cond, \$300 ea; Audicord A Series side by side RP, (2) play slots w/record module in middle, gd cond, needs record amp cards, 550. B Lunderville, Radio New England, 75 Gardner, Hingham MA 02043. 617-749-1304.

ITC 750 stereo R/P, \$500; ITC 850 stereo R/P, \$500; Scully 280 mono R/P, 7.5/3.5 ips, \$450; Ampex 350 transport/Novonics electr, \$450; Teac 7030 stereo R-R, \$200; Wollensak 3M portable R-R, gd cond, \$120. G Wachter, 631 N 1st Ave, Phoenix AZ 85003. 602-258-6161.

Tapecaster 700S (5) (2) R/P, (3) P only, just removed from service, spare sec cue electronics, \$600; BE cart winder, virtually no mileage, BO. D Sparano, 518-382-6187.

ITC RP Series stereo R/P, excel cond, \$1800. G Aycock, Rt 11 Box 458 A, Longview TX 75603. 214-757-5633.

BE 2100 stereo RP, brand new, BO. R Sundell, POB 734, Upland CA 91786. 714-985-0701.

Audicord A (3) side by side in 19" rack, mono, gd cond, BO. C Gustafson, 590 W Maple, Kalamazoo MI 49008. 616-345-2101.

ITC PDII (2) players, (1) recorder, mono, gd cond; Ampco CT2501 player, \$100ea/BO. J Zelinger, 4401 Sunset Blvd, Los Angeles CA 90027. 213-667-9310.

Tapecaster 700 RP mono RP in gd cond, \$300. J Morris, 3911 S First, Abilene TX 79601. 915-676-7711.</

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Audi-Cord A Series dual R/P cart machine, working order, BO. R Meadows, Southeastern Sports Prod., 1203 Seaton Ste 117, Durham NC 27713. 919-544-1366.

MEI Digisound digital hard-disk cart recorder, great for automation, inc (2) 332 meg hard disks, (2) remote keyboards, tape drive, software & manual. System configured for 15 kHz stereo/mono, 76 minutes of stereo, 152 minutes mono storage or any combo, fully functional, low hrs, \$10000. J Addie, WFMT, 312-565-5033.

Want to Buy

Playback & record units in good working order. A Moil, 828 S Getty, Valde TX 78801. 512-278-1102.

Sparta Century, will purchase cart machines, prefer mono, reasonable prices paid. B Mayben, 137 McMurtree Ln, Huntsville AL 35806. 205-721-9393.

ITC 3-D or equiv, 3-stack stereo cart machine w/record amp, 3 tone; ITC ESL-IV splice locator/eraser or equiv. H Kneiler, 813-639-1112.

Stereo R/P in gd working cond, BE, Tapeaster, ITC preferred. H Bunderick, 1115 Washington, Natchitoches LA 71457. 318-352-9696.

R/P cart machine w/tones, mono preferred, will trade for 6' equip racks. A Lane, WEHB, POB 2892, Grand Rapids MI 49301. 616-451-9904.

CASSETTE & REEL-TO-REEL RECORDERS

Want to Sell

Superscope C-207 LP professional CR, like new, 3 heads, servo control, EQ & bias adj, limiter & more, \$165. D Zimmer, 3055 N Tyndall, Tucson AZ 85719. 602-623-2933.

Tascam 42B R-R 4 months old, like new, \$2100, \$25 shipping & insurance. E Q Peluso, 2880 E Flamingo, Ste E, Las Vegas NV 89121. 702-732-2200.

Ampex 351 w/Inovonics amps, \$800; Scully 280B w/amp, \$500; Ampex ATR-700, \$1700; Ampex AG-600 w/carrying case, \$100 & MCI JH-110B w/Russ Lang cabinet (2), \$2600/ea. Clark, Secor Road, Hartsdale NY 10530. 914-693-2400.

Sony PCM-F1 (2) digital audio processor for recording onto any VCR w/pwr supply in gd cond, \$1000/ea. P Christensen, 3101 University South, Jacksonville FL 32216. 904-721-9111.

Telex 235 & 300 series duplicating equipment, BO. Falk Recdg, 7914 Fegenbush Ln, Louisville KY 40228. 502-239-1010.

Fostex 8753 interface, control any Sony Type 5 recorder w/Fostex synchronizer, \$300. A Romanoff, 374 N Ridgewood Place, Los Angeles CA 90004. 213-467-1700.

Fostex 3040 outboard Dolby C NR units (2), each provides 4 chnl of NR, \$400/ea. A Romanoff, 374 N Ridgewood Place, Los Angeles CA 90004. 213-467-1700.

Denon DN 950F CD's (3); Denon CD cases (220); rack mount kit, will sell as is for \$2699. J Hansen, Box 699, St Cloud MN 56302. 612-253-9600.

Ampex AG-500-2 portable case, mic/line mixing, BO. M Saddy, 141-60 64 Rd 3E, Briarwood NY 11435. 718-846-2062.

Otari MX5050-85D 1/2" 8 trk low hours, mint cond, calibration tape & xtras, \$3000. C Volpe, 540 Stemmers Run, Balto MD 21221. 301-391-6927.

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AKAI 4000D stereo 3 3/4 - 1/2 ips, no manual, \$75. L Spivey, Highway 231 S, Hartford KY 42347. 502-298-3268.

Sony PCM-701ES digital processor/recorder, never used, \$1250. B Foid, Box 1052, El Granada CA 94018. 415-726-4786.

Otari 4050 audio duplicator cassette, 4 yrs old, \$900. J Jones, 920 Main St N, Southbury CT 06488. 203-264-3666.

Pioneer RT-707 R-R R/R works, \$150. M Meyer, Box 70, Madison WI 56256. 612-598-7301.

Ampex AG-440 2-track stereo PB only w/Shafer electr, \$600/BO. G Barnett, Broadcast Centre, Palm Springs CA 92263. 619-328-1104.

Ampex 440-B (2) in roll-a-bout consoles, low hrs, excel cond, stereo 2 trk, \$1750 ea; Scully/Metrotech slow loggers (2), gd cond, on air use thru April, \$395 ea. B Lunderville, Radio New England, 75 Gardner, Hingham MA 02043. 617-749-1304.

Studer Revox port case for A77 w/mon spkrs & pwr amps, exc cond, \$275/BO. R Katz, 15015 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

Studer Revox HS-77 Mk IV FT mono, 15/7.5 ips, wood case, mint cond, \$675/BO. R Katz, 15015 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

Pioneer 1020L 10 1/2 R-R, 3 3/4 - 7 1/2 ips complete w/10 reels of tape, wall edit supplies, \$400. B Foid, Box 1052, El Granada CA 94018. 415-726-4786.

Ampex AG-350 FT mono (2); AG-350 1/2 trk stereo; AG-440 1" 4 trk; AG-440 1" 8 trk; AG-350 1" 4 trk; PR-10 1/2 trk stereo; PR-10 FT. Kinura Records, 377 Westward Dr, Miami Springs FL 33166. 305-887-5329.

Teac V-530X several cassette racks, gd cond. L Magnuson, 2000 Indian Hills Rd, Sioux City IA 51104. 712-239-2100.

Ampex AG-440 stereo decks (3), very clean, working, good heads, two chnl w/Ampex electr, \$750/ea or BO. G Barnett, Broadcast Centre, Palm Springs CA 92263. 619-328-1104.

Revox PR-99 2 speed PD, excel cond, BO. K Diebel, 1207 Louisa, Rayville LA 71269. 318-726-4915.

Otari MX-5050B II (2), \$2000/ea; Otari MX505 BQ, \$3000. C Monk, 1301 Atlantic, Atlantic City NJ 08401. 609-344-2020.

Sony PCM-F1 2 trk digital processor, 14 & 16 bit, A/C pwr supply, batteries, Kiwi case, excel cond, \$1500. S Rosenthal, 3145 Geary Blvd Ste 344, San Francisco CA 94118. 415-584-5614.

Ampex AG-440B 1" 8 trk multitrack, roll-around console, gd cond, BO. R Kaufman, POB 462247, Garland TX 75046. 214-271-7625.

Scully 270 reproducers (2) stereo, gd cond, \$200/BO; Scully 270 reproducers (2), stereo, gd for parts, BO; Magnecord 1024 stereo (2), \$150ea/BO. R Fess, POB 250, Macomb IL 61455. 309-833-5561.

Automation starter set ITC 770 PB (4), gd cond, \$700 ea or \$2400/all; ITC 770 R/PB w/custom rack, gd cond, \$1700, or all for \$4000. J Torsitano, KNIS, 6363 Hwy 50 E, Carson City NV 89701. 702-883-5647.

ITC deck stereo 3 yrs old, gd cond, \$1350. J Arzuaga, POB 980, Quebradillas PR 00742. 809-895-2725.

Inovonics 375 (3) R/P elect, solid state for Ampex recorders, \$150ea/BO. J Zelinger, 4401 Sunset Blvd, Los Angeles CA 90027. 213-667-9310.

Fostex Model 80 8 trk, 7" R-R, 15 ips Dolby C, gd cond, \$1200. S Wytas, 165 Linden, New Britain CT 06051. 203-224-1811.

Ampex 440C w/servo, 1/2 trk, roll around cabinet, vgc, \$1500. S Rosenthal, 3145 Geary Blvd Ste 344, San Francisco CA 94118. 415-584-5614.

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3M M79 4 trk, 1/2" ATR, excel cond, w/resolver, \$750/BO. J Zelinger, 4401 Sunset Blvd, Los Angeles CA 90027. 213-667-9310.

Scully 280 automation PB's, gd cond (2), \$750/both. B Watson, 1551 E Amar Rd, W Covina CA 91792. 714-949-6249.

Nagra IV-S sync pilot tone, 7" reel case, leather case, A/C pwr pack, handle, strap, excel cond, \$4800; Nagra QGB 10 1/2" reel adapter, excel cond, \$750. S Rosenthal, 3145 Geary Blvd Ste 344, San Francisco CA 94118. 415-584-5614.

MCI JH-110 4 trk stereo w/remote gd cond (2), \$4000/ea or \$7000/both. B Watson, 1551 E Amar Rd, W Covina CA 91792. 714-949-6249.

Otari ARS 1000, (2) P/B decks, very little use, \$1200. A Baxa, WAVV, 11800 Tamiami Tr E., Naples FL 33962. 813-775-9288.

Rusling R-R roll around wood consoles (3), \$150/ea. R Shroyer, 215 N 4th St, Yakima WA 98907.

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Fostex 4030/4035 external synch for any R-R w/remote, mint cond, \$1000. S Wytas, 165 Linden, New Britain CT 06051. 203-224-1811.

Ampex ATR-700 10", 2 trk, 7 1/2", 15 ips, \$995. B Mountjoy, POB 1240, Elizabethton TN 37644. 615-543-5349.

Ampex 602 FT gd cond, \$200. D Ibel, 2600 N Highway, Spencer IA 51301. 712-262-1240.

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Ampex AG 350-2 PB electr, 3 3/4" - 7 1/2" speeds, \$350 inc shpg & manual, tube PB fully functional. G Meloon, 28 W Scribner, DuBois PA 15801. 814-371-1330.

Marantz C0207LP like new, 3 heads, \$165/BO. R Zimmer, 3055 N Tyndall, Tucson AZ 85719. 602-623-2933.

Tascam 32, 2 trk 7 1/2-15 ips in excel cond, some head wear, \$500. R Smith, 3407 W Olive #108, Burbank CA 91505. 818-367-6335.

Nagra IV LE FT portable, 7.50 ips w/crystal sync & resolver, case, ATN pwr supply & manual, recently overhauled, \$2800/BO. R Barwig, Barwig Recording, 5254 W Agatite, Chicago IL 60630. 312-283-2820.

Sony PCM-2500A, PCM-2500B R-DAT, used very little, \$5000/BO. T Noordyk, WSHN, POB 190, Fremont MI 49412. 616-924-4700.

Studer Revox HS-77 Mk IV special fact order FT mono, 15/7.5 ips, only 10 hrs use, wood case, mint cond, \$575/BO. R Katz, Allegro Snd, 15015 Ventura, Sherman Oaks CA 91403. 818-377-5264.

Pioneer 1020L 3 3/4" - 7 1/2" ips, 14" 2 chnl lots of 10" reels of tape included, w/editing supplies, \$400. B Ford, POB 1052, El Granada CA 94018. 415-726-4786.

Presto 800/908 7.5-15 ips professional plus rack, pick up in NYC, \$1000. B Rose, Program Rec, 228 E 10th, NY NY 10003. 212-674-3060.

Tape recorders including Otari MX7800, Teac 3340S, Scully 280, Revox A77, Hitachi D-E10, Nakamichi 550 & Sony TC124, call for details & prices. E Boucher, EAB Recdg, POB 958, Lewiston ME 04243. 207-786-3476.

Telex CD2M & CD2S slave unit, 2 mos old, like new, duplicates 5 tapes at a time, \$1700. R Meadows, Southeastern Sports Prod, 1203 Seaton Ste 117, Durham NC 27713. 919-544-1366.

Tapesonic stereo 2 trk 10.5 reels, 3 speed, \$350; Crown 5X844 4 chnl R/P, 3 speed, mint cond, \$700; Teac A4010S (2) 1/4 trk stereo, auto reverse, gd cond, \$200 ea or \$350/both; Telex 1422 2 trk stereo plus 1/4 head for PB (2), \$350/both. J Parsons, 10375 Cannas, No Huntingdon PA 15642. 412-863-9590.

Scully 270 (4), PB only, \$300 ea. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

Studer A80 operation/service-parts manual for 14 to 21" versions, \$60 pls shpg. R Cannata, Cantrax Recorders, 2119 Fidler, Long Beach CA 90815. 213-498-6492.

Otari MX 5050 BII, less than 1 yr old, perfect cond, complete w/llt back sides, buyer pays freight, \$2200; Otari MX 5050 4 trk 1/4" older unit but in great cond, heads like new, left brake needs slight adjustment, complete w/dbx NR, pre-wired, buyer pays freight, \$2200. B Hanson, Reel Trax Prod, 209 E El Cortez, Columbia MO 65203. 314-449-8433.

Tascam FP 70 ft SW for 3440 & 40 Series machines, \$25; Tascam 44-480B extender service board, new, \$20. R Cannata, Cantrax Recdrs, 2119 Fidler, Long Beach CA 90815. 213-498-6492.

Pioneer 1020L 3.75-7.50 ips, 14" 2 chnl, lots of 10" reels of tape included along w/editing supplies, \$400. B Ford, Turbo Sound, POB 1052, El Granada CA 94018. 415-726-4786.

Studer Revox port case for A77 w/mon spkrs & pwr amps, excel cond, \$275/BO. R Katz, Allegro Snd, 15015 Ventura, Sherman Oaks CA 91403. 818-377-5264.

Sony PCM 701 ES, 14/16 bit, 2 chnl processor, turns any VHS/Beta recorder into a 2 chnl digital audio recorder, \$1400/BO. B Ford, Turbo Sound, POB 1052, El Granada CA 94018. 415-726-4786.

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Ampex AG-350 FT in console, 7.50 & 15 ips, gd heads, service manual, vgc, \$600/BO. R Barwig, Barwig Recording, 5254 W Agatite, Chicago IL 60630. 312-283-2820.

Telex 3 plus 1 high speed portable cassette duplicator, duplicates 3 cassettes at a time, \$450. R Meadows, Southeastern Sports Prod, 1203 Seaton Ste 117, Durham NC 27713. 919-544-1366.

Roberts 720 1/2 & 1/4", vgc w/case, \$90 plus \$10 S&H. P Salois, KPCR, POB 1 Hwy 54E, Bowling Green MO 63334. 314-324-2283.

Century 21 Auto Seque for CD players, like new cond, works great, \$3250; Revox PR-99 PB units (2) w/25 Hz tone detectors, \$900 ea. W Waldron, KSOS, Layton Hills Mall, Layton UT 84041. 801-546-1722.

Duplicators including comp Kaba cassette duplication system, Recordex DUP II, Pentagon C4322 7 Wollensak 2770AV, call for details & prices. E Boucher, EAB Recdg, POB 958, Lewiston ME 04243. 207-786-3476.

Ampex 351-2 2-trk, mint cond, one has original tube electr, other has Inovonics, both in roll-around, one walnut, one plywood. R Nelson, Tropical Bdct, 14093 SW 142 St, Miami FL 33188. 305-238-5024.

Fostex 4030/4035 audio-for-video synchronizer, mint cond, \$1000/BO. S Wytas, 165 Linden, New Britain CT 06051. 203-224-1811.

Want to Buy

Roll-around matching set suitable for housing two Revoxs. D Sparano, 1-518-382-6167.

MCI JH110 B or C 14" 2 track, 7.5-15-30 ips; MCI JH110 B or C 12" 4 track, 3 3/4-7.5-15 ips. Kinura Records, 377 Westward Dr, Miami Springs FL 33166. 305-887-5329.

Inovonics 355 & 900 pwr dual channel record-play electronics, must have sync xformers on repro cards. L Beigel, Box 85042, Los Angeles CA 90072. 213-466-3596.

Technics RS1500 or 1520 must be in gd cond. S Pai, 1100 Rancho Conejo Blvd, Newbury Pk CA 91320. 805-373-7777.

Teac/Tascam 3340/80-8 remote controls; foot or console top operation. J McCallum, 3311 E Bruce Randolph Ave, Denver CO 80205. 303-388-8548.

2-chnl electronics for Scully 280B R-R. R McDonald, 5231 Horton, Mission KS 66202. 913-722-2677.

Nakamichi 480 2 head, non-monitoring version preferred. J Lauria, 1153 38th, Brooklyn NY 11218. 718-633-3010.

Ampex AG500 for parts. D Ibel, KICD, 2600 N Highway Blvd, Spencer IA 51301. 712-262-1240.

ATR100 taperecorders for parts. Circuit cards, heads, motors, machine parts, or electronic parts. Call 818-907-5161.

MCI/Sony capstan & reel motors, any cond., recd heads, most mfgs, machines, new, used. Relapped then sold. Amp Services, 224 Datura St No 614, W Palm Beach FL 33401. 800-826-0601, in FL 305-659-4805.

CONSOLES

Want to Sell

Cetec 2008 mixing console, great cond, just taken from service, BO. D Sparano, 1-518-382-6167.

Quantum QM8 eight chnl, 4 output audio board, \$1100. G Aycock, Rt 11 Box 458 A, Longview TX 75603. 214-757-5633.

Gates Stereo Producer 4 chnl audio board, stereo, gd cond. L Magnuson, 2000 Indian Hills Rd, Sioux City IA 51104. 712-239-2100.

Gates Producer, 4 chnl mono, gd cond, \$110; Gates Producer, 4 chnl mono, as is, \$65. G Wachter, 631 N 1st Ave, Phoenix AZ 85003. 602-258-6161.

Tascam M312 12x4x2 audio board, BO. R Hiett, Box TV3, Harrisonburg VA 22801. 703-433-9191.

Sound Workshop 1280 12 channel board w/super parametric EQ, exc cond, \$2000. C Volpe, 540 Stemmers Run, Baltimore MD 21221. 301-391-6927.

CCA Futura Six 6 chnl slide 'ader board, fair cond, \$500/BO. D Sparano, 518-382-6167.

Altec Mod-1589B mixer-amp. Kinura Records, 377 Westward Dr, Miami Springs FL 33166. 305-887-5329.

Speck 16 inputs, 8 busses, outboard ps, easily port. exc cond. \$775/BO. R Katz, 15015 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

Gates Gateway II (2) w/pwr supplies & extra I/O modules, on air till end of April, fair/gd cond, \$575 ea. B Lunderville, Radio New England, 75 Gardner, Hingham MA 02043. 617-749-1304.

Quantum QM-8 8 inputs, 4 busses, quad & stereo mon, lrg triad input xfrms, audiophile snd, Duncan linear faders, exc cond, \$775/BO. R Katz, 15015 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

CONSOLES ... WTS

Autogram AC-6 excel cond, \$2400/BO; AC-8, excel cond w/limiter, \$3400/BO; Sparta A-15B 5 chnl mono, gd cond, \$400. J Swett, 4025 Lugano Way, Flagstaff AZ 86004. 602-526-1975.

Teac 144 4 trk portable cassette, excel cond, \$250/BO. R Fess, POB 250, Macomb IL 61455. 309-833-5561.

Fostex 450 8 in 4 out production mixer, excel cond for production sound reinforcement, \$500. R Smith, 3407 W Olive #108, Burbank CA 91505. 818-367-6335.

Sparta AS-30B stereo/mono, 4 chnl w/pwr supply, gd cond, \$350/BO. M Black, Hobart William Smith College, Geneva NY 14456. 315-781-3456.

8BEM100 dual-chnl mono, 8 mixers, gd cond, some updated 3600 series electr, \$850. B Hayes, POB 429, Siler City NC 27344. 919-742-2135.

RCA BC-6B early 60's tube-type workhorse, mint cond, used in educational TV station & in storage 15 yrs, \$500. B Hayes, POB 429, Siler City NC 27344. 919-742-2135.

Harris M-90, Audionics 110 Grandson, mono & stereo inputs, 4 or 2 chnl outputs, max 18 modules, test osc, stereo 8 pos, input sel, plus much more, BO. J Georgiades, WRR0, 216-373-1440.

Ampro AC-8D dual-bussed mono, 8 chnl, 4 inputs per chnl, 32 inputs, manuals, \$955. B Mountjoy, POB 1240, Elizabethton TN 37644. 615-543-5849.

Sparta A-20 solid-state mono, 8 chnl, w/manual, fair cond, \$500 plus shping. M Hagans, 218 W Hampton, Mesa AZ 85210. 602-964-3100.

BE Spotmaster 8BEM100 8-chnl, dual-bussed mono, w/Daven step-attenuators, 16 inputs, \$695. B Mountjoy, POB 1240, Elizabethton TN 37644. 615-543-5849.

Sound Workshop 1280-B 12 in 8 out recording console, vgc, 8x2 stereo mix w/8x1 musicians mix, 3 band EQ, tri-light LED, complete w/wires, \$1500. P Zeleniuch, Tapes Inc, 5733 S Park Blvd, Parma OH 44134. 216-886-6679 aft 5PM.

Harris Stereo 53 mic inputs, 9 stereo line level inputs gd cond, BO. R Lafore, Box 1327, Valdosta GA 31603.

LPB Alpha series 8 chnl, 24 input console w/3 inputs set up for mic level, program & mono mixdown output busses, in board monitor amp, in board pwr supply, 3 yrs old, \$2500/FOB. D Rozek, 475 South Ave, Beacon NY 12508. 914-831-8000.

Tascam 10, 12 in 4 out, \$550. A Weiner, 14 Prospect, Yonkers NY 10705. 914-423-6638.

Quantum QM-8, 8 inputs, 4 busses, quad & stereo mon, etc, excel cond, \$775/BO; Speck 16 inputs, 8 busses, etc, excel cond, \$775/BO; Snake, 16 phantom-pwrd inputs w/xt ps, 250' Belden 19-pair cable w/mil connectors & stainless-steel strain reliefs, etc, excel cond, \$750/BO. R Katz, Allegro Snd, 15015 Ventura, Sherman Oaks CA 91403. 818-377-5264.

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Studiomaster 16 input mike chnls 4 or 2 output chnls, BO. L Shew, Techni Sound, 9731 Acacia No 14B, Garden Grove CA 92641. 714-530-9490.

Audionics Series 110-4 6 input mod 4 output comes w/3' prod table, 2 trk Scully 260, all working, BO. J Caracciolo, WORE, 1600 Stewart, Westbury NY 11590. 516-832-9400.

Sparta A-10B mono 4-chnl board, excel cond, w/manuals. B Weiss, KJLA, 3435 Broadway, Kansas City MO 64111. 816-753-7707.

LPB S515A 8 input mono Signature II console, gd working order, \$950/BO. K Kushnr, Empire Comm, 2120 Bluebell Dr, Santa Rosa CA 95403. 707-545-8300.

Consoles including API 2042, Altec 250T3 & Damon 5200, call for details & prices. E Boucher, EAB Recdg, POB 958, Lewiston ME 04243. 207-786-3476.

Want to Buy

Gates/Harris Diplomat need spares, mic cards, pwr supply & transistorized program amp. D Burton, Box 453, Estherville IA 51334. 712-362-2644.

CCA-QRK Futura Six any cond, for parts, must have VU meter and 23 cards, some sl d pots too. G Erway, 3450 SE Martinique, Stuart FL 34997. 407-283-5871.

Gates Gateway, will purchase your console, preferably not working, also prefer in South. B Mayben, 137 McMurtrie Ln, Huntsville AL 35806. 205-721-9393.

Parts for McCurdy SS-8600 stereo console, faders, plug in preamps, etc. M Mathis, Box 426, Magee MS 39111. 601-849-2413.

Manual for RCA BC-6B Console, need block diagram & schematics for renovation. N Priest, 212-924-3119.

Gates Executive complete. D Ibel, 2600 N Highway, Spencer IA 51301. 712-262-1240.

Audionics 110, still need one mic input module w/EQ, Mdl 110-IME for Audionics 110 Grandson. D Payne, WZPL, 317-637-8000.

Sparta Centurian II stereo mixer modules, write w/price per module, will consider mixers which need work. D Proctor, WCPE, POB 828, Wake Forest NC 27587.

Literature, manual, schematic for RCA console BC-2B, 1952 mdl. B Leslie, Pro Recording Svcs, 13709 Maple Leaf Dr, Cleveland OH 44125. 216-662-1435.

RCA & WE tube consoles, mixers, amps, TT's, speakers, mics, on-air lights, literature. R Van Dyke, Caffrey House, Squires Ave, E Quogue NY 11942. 516-728-9835.

Harris Stereo 80, 994-6867-002 manual or copy. J Meredith, WYTH, Box 635, Madison GA 30650.

Gates Dualux II power supply. D Ibel, KICD, 2600 N Highway Blvd, Spencer IA 51301. 712-262-1240.

Howe 10,000 parts, cards, faders, new or used. A McCartney, KUIC, Fax: 707-446-0122.

DISCO & SOUND EQUIPMENT

Want to Sell

Binson PE603-TU fair cond w/case, \$75. C Volpe, 540 Stemmers Run, Baltimore MD 21221. 301-391-6927.

Community Light & Sound RS40 4-way speakers (1 pair) w/Community VB790 bass bins, in Anvil cases, excel cond, \$1800 plus shipping. J Kreines, 5330 Kennedy, Millbrook AL 36054. 205-285-6179.

Cooper Time Cube Mod-920-16. Kinura Records, 377 Westward Dr, Miami Springs FL 33166. 305-887-5329.

Eventide H-969 Harmonizer, \$1500. B Glasser, Box 9917, Canton OH 44711. 216-456-7166.

Pultec EQP-1 excel cond; Furman Sound Le Patch PB-40. Kinura Records, 377 Westward Dr, Miami Springs FL 33166. 305-887-5329.

Snake 16 phantom-pwrd inputs w/xt ps, 250' Belden 19-pair cable w/mil connectors & stainless steel strain reliefs, 10' Neumann XLR snake mates w/box or Belden snake, exc cond, \$750/BO. R Katz, 15015 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

UREI 529 room equalizer, excellent condition, \$400. F Virtue, 1618 N Broad, Philadelphia PA 19121. 215-763-2825.

Voice of the Theater speakers (2) A-7, w/cross-overs; Infonics cassette duplicator, RC-2; Magnetax tape duplicator, five copy mono & stereo heads, open reel. Kinura Records, 377 Westward Dr, Miami Springs FL 33166. 305-887-5329.

Klipsch La Scala speakers, horn, road cases, fiberglass finish, excel cond, BO. R Kaufman, POB 462247, Garland TX 75046. 214-271-7825.

Ampex-by-JBL unmounted 12ohm speakers (2) for Ampex 620, 620-F, 622 speaker-amps, ex cond, \$80/ea. J Newman, 401-848-7133.

Sony SB-200 echo adaptor, \$30; Lafayette DNR-50 Dolby stereo unit, \$50; Pioneer SR 202W stereo spring reverb unit, \$50; Shure M688 stereo mic mixer, \$100, all in gd cond w/manuals. P Zeleniuch, Tapes Inc, 5733 S Park, Parma OH 44134. 216-886-6679. Aft 5PM.

Roland TR-626 digital drum machine, programmable, mono/stereo/individual outputs, like new, \$250. M Osborne, WKSQ, POB 9494, Ellsworth ME 04605. 207-667-7573.

Alembic 2 ch guitar preamps (2), Hiwatt L100R & Music Man 210, call for details & prices. E Boucher, EAB Recdg, POB 958, Lewiston ME 04243. 207-786-3476.

JBL 4502, JBL C50SM & Earth B12HC, call for details & prices. E Boucher, EAB Recdg, POB 958, Lewiston ME 04243. 207-786-3476.

DOD/Digitech 831-C graphic EQ, 31 band, as-new cond, \$175. B Leslie, Pro Recording Svcs, 13709 Maple Leaf Dr, Cleveland OH 44125. 216-662-1435.

Keyboards including Arp string ensemble, Hammond C3, Hohner D6 clavinet, Fender Rhodes piano & Dubreq stylophone, call for details & prices. E Boucher, EAB Recdg, POB 958, Lewiston ME 04243. 207-786-3476.

Guitars including ESP strat copy, Hamer electric, Applause AA14-1 & Fender F230 acoustic 6-string, Royce banjo, call for details & prices. E Boucher, EAB Recdg, POB 958, Lewiston ME 04243. 207-786-3476.

Klipsch MCM-1900 3-way, \$1800/BO. J Flannery, 8395-A Shallowcreek Rd, Liverpool NY 13090. 315-622-9199.

EV, JBL or similar for prod room, limited space, ceiling mount preferred. L Maierhofer, 101 Armory Blvd, Lewisburg PA 17837. 717-523-3271.

JBL 4311B loudspeaker. R McDonald, 5231 Horton, Mission KS 66202. 913-722-2677.

WE & RCA speakers & tube equipment, disc recorders & reproducers & blank recording discs, catalogs, manuals, 16" transcriptions. R VanDyke, 2 Squires Ave, E. Quogue NY 11942. 516-728-1327.

LIMITERS

Want to Sell

Orban 418A stereo limiter (2), adjustable HF limiting & release time, auto bypass w/pwr off, excel cond, \$400/ea. M Byrnes, WAMU, American University, Washington DC 20016. 202-885-1030.

Broadcast Electronics AM400 compressor-limiter, w/manual, \$225. L Spivey, Highway 231 S, Hartford KY 42347. 502-298-3268.

Orban 8100A Optimod, mint cond, \$2400 plus shipping. L Dupree, 1115 Texas Ave, Alexandria LA 71301. 318-487-0347.

Harris MSP-90 units in good condition, BO. R Hines, 250 W Court 800E, Cincinnati OH 45202. 513-241-9500.

CBS Labs 411 FM Volumax, 2 mono units, use two for stereo, BO. M Saady, 141-60 84 Rd 3E, Briarwood NY 11435. 718-846-2062.

DAP 310 peak limiter in vgc, \$300. G Meyer, Box 623, Washington MO 63090. 314-583-5155.

Texar Audio Prisms, (2) new. S Mahalick, 22141 Cleveland Rd Suite 310, South Bend IN 46628. 219-674-5577.

Kepex Mod RM-160 rack mount card case. Kinura Records, 377 Westward Dr, Miami Springs FL 33166. 305-887-5329.

Harris MSP-90 AM processor in very gd cond, \$500. G Meyer, Box 623, Washington MO 63090. 314-583-5155.

Mod Science CP-803 composite clippers (2), like new, \$500/ea. R Jesse, 3645 South, Springfield MO 65807. 417-887-9650.

Collins 26V-I compressor limiter, gd cond, BO. M Black, Hobart William Smith College, Geneva NY 14456. 315-781-3456.

Spectra Sonic C complimiter, excel cond, \$250/BO. J Zelingier, 4401 Sunset Blvd, Los Angeles CA 90027. 213-667-9310.

Orban 8000A Optimod rebuilt, tune up & upgrade, \$1750. L VanDam, WUPQ, Newberry Ave, Newberry MI 49868. 906-293-8522.

CBS 4110 FM Volumax gd cond, recent cal to factory specs, \$300. G Ogonowski, 213-465-3171.

Orban/Optimod FM 8100 wking when removed, \$2500. L Selzle, Box K, Greeley CO 80631. 303-356-1310.

Volumax, Gates, Spotmaster all kinds of old processing, call for info. S King, 1703 Avondale, Amarillo TX 79111. 806-355-9777.

Orban 9100A Optimod perfect cond, \$1600/BO; Orban 9000A Optimod, like new, \$1500/BO. J Swett, 4025 Lugano Way, Flagstaff AZ 86004. 602-526-1975.

RCA BAGA tube compressors (2). R Robinson, 203-269-4465.

CBS Audimax III mono AGC; CBS Volumax FM 410 mono peak limiter; Harris MSP-90 AGC, stereo wide band; Harris MSP-90 Tri Band AGC, stereo; dual MSP-90 AM peak limiter, (2) mono units in one chassis. H Kneller, 813-639-1112.

Optimod 8000A worked perfect when removed from service 2/90, \$1700. M Cooney, 610 N Kiwanis, Sioux Falls SD 57104. 605-336-2706.

Volumax 400 peak controller, AM, \$100; Audimax III automatic level controller, AM, \$100; FM Volumax 411 stereo peak controller, FM, \$125. L Wilson, 409 Hillaire, Hopkinsville KY 42240. 502-886-1678.

Orban 8100ST studio chassis for Optimod 8100 dual STL configuration, gd cond, \$400. M Maciejewski, WMUS, 3565 Green St, Muskegon MI 49441. 616-744-1671.

CRL SGC800 AGC w/Dynafax NR, excel cond, \$1250. M Maciejewski, WMUS, 3565 Green St, Muskegon MI 49441. 616-744-1671.

CRL SMP 850 stereo limiter, current mdl, excel cond, \$1250. M Maciejewski, WMUS, 3565 Green St, Muskegon MI 49441. 616-744-1671.

Want to Buy

CRL SMP-800 any model, gd cond. L Maierhofer, 101 Armory Blvd, Lewisburg PA 17837. 717-523-3271.

RCA BA-GA or similar tube type limiter. A Weiner, 14 Prospect, Yonkers NY 10705. 914-423-6638.

Fairchild 660 or 670, Teletronix LA2A, LA3, other tube compressors & limiters; also other vintage tube signal processing equipment. J Kreines, 5330 Kennedy, Millbrook AL 36054. 205-285-6179.

Orban/Optimod 8100A in gd cond. M Cooney, 610 N Kiwanis, Sioux Falls SD 57104. 605-336-2706.

dbx 163X compressor/limiter. B Tidwell, POB 338, Valdosta GA 31603. 912-244-5180.

UREI LA-3A or LA-4 production compressor/limiters. R Kaufman, POB 462247, Garland TX 75046. 214-271-7825.

CRL SEP400 or SEP800. M Maciejewski, WMUS, 3565 Green St, Muskegon MI 49441. 616-744-1671.

MICROPHONES

Want to Sell

Electro-Voice DS-35 dynamic mic. Falk Recdg, 7914 Fegenbush Ln, Louisville KY 40228. 502-239-1010.

RCA SK-46 program velocity, new, in original box, \$235. D Miller, 11647 W 83 Terr, Lenexa KS 66214. 913-492-8822.

RCA, Electro-Voice & Shure, send for list. B Davies, 5548 Elmer, N Hollywood CA 91601. 818-761-9831.

Telefunken Tube CM-61 very rare, uses std plug-in tube, mint cond w/custom ps, BO. R Katz, 15015 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

Neumann KM-88 rare 3-pattern whickek capsule, hot-setup percussion mic, mint cond w/orig case, \$875/BO; Neumann KM-86 3-pattern, mint cond, \$675/BO; AKG D224E (2), unused, \$350/BO/each. R Katz, 15015 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

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RCA 77DX vintage ribbon mic, excel cond, BO. R Kaufman, POB 462247, Garland TX 75046. 214-271-7625.

Neumann U-67 vintage tube mic, excel cond, BO. R Kaufman, POB 462247, Garland TX 75046. 214-271-7625.

Neumann UB7, one pair, excel cond, \$1000 ea. G Heitmann, 914-266-4141.

Fostex M22RP MS stereo studio mic, excel cond w/aluminum carrying case, \$400. Don, 3142 Market Place, Bloomington IN 47403. 812-339-4446.

EV RE-20, never used, \$250. R Meadows, Southeastern Sports Prod, 1203 Seaton St 117, Durham NC 27713. 919-544-1366.

Telefunken tube CM-61, very rare, uses std plug-in tube, mint cond w/custom ps, BO. R Katz, Allegro Snd, 15015 Ventura, Sherman Oaks CA 91403. 818-377-5264.

RCA 77DX, needs repair, \$25. L Wilson, 409 Hillaire, Hopkinsville KY 42240. 502-886-1678.

Schoeps CMC-55U (2) Colette Series 48V condenser mics w/switchable cardioid/omni, matched stereo pair w/addl MK8 figure-8 capsule & suspensions for M-S recording, mint cond, \$2650. J Wayne, Silverdisc Prod, 405 Tarrytown Rd, Ste 444, White Plains NY 10607. 914-591-5240.

Beyer M-160 double ribbon mic in perfect cond, \$180. J Wayne, Silverdisc Prod, 405 Tarrytown Rd, Ste 444, White Plains NY 10607. 914-591-5240.

Neumann KM-88, rare 3-pattern whickel capsule, hot-setup percussion mic, mint cond w/orig case, \$875/BO; Neumann KM-86 3-pattern, mint cond, \$675/BO; AKG D224E (2), matched pair, unused, \$350/BO/ea. R Katz, Allegro Snd, 15015 Ventura, Sherman Oaks CA 91403. 818-377-5264.

RCA ribbon mics including (1) 44-BX; (1) 77-D; KU3A10,0001; BK-11; BK-5; SK-46; WE639A, will trade for other high quality condenser, dynamic, ribbon mics & audio equip. Tracy Eaves, 615-821-6099 (evenings).

Want to Buy

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RCA-77DX, Shure SM-5B, Shure SM-7, & Sennheiser MD421-U reasonably priced, gd cond. J Emmel, Box 750, Olyphant PA 18447. 717-489-0005.

RCA & WET, etc pre 1960 ribbon, carbon, condenser & dynm, mic's, have mic's & other equip to trade. R VanDyke, Squires Ave, E Quogue NY 11942. 516-728-1327.

Telefunken ELAM 250s or 251s any cond; AKG C12s and C24s, any cond. J Kreines, 5330 Kennedy, Millbrook AL 36054. 205-285-6179.

Vintage tube condenser mics especially Neumann/Telefunken/Schoeps/AKG; & classic ribbon mics. RCA 77s/44s. J Kreines, 5330 Kennedy, Millbrook AL 36054. 205-285-6179.

RCA 77-DX working model in nice shape, mount w/stand desirable. E Esser, 2000 Riveredge #797, Atlanta GA 30328. 404-953-9369.

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RCA 44's, 77's & other ribbons, working or not, WE 639 etc. W Davies, 5548 Elmer Ave, N Hollywood CA 91601. 818-761-9831.

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Jerrold SSE-200AN service encoder for cable application, Stardac series, \$50. R Anderson, 10 Court, Cynthiaia KY 41031. 606-234-1400.

Wang 2200VP computer complete, w/ CPU unit, CRT/keyboard, (2) 8" floppy drives, desk, CPU unit needs one new regulator transistor, like new. BO. G Barnett, Broadcast Centre, Palm Springs CA 92263. 619-328-1104.

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Paradyne DCX-825 12 chnl cable data modem w/manual, excel cond, w/2 external Bell type line drives, \$1500/BO. B Shaffer, 2923 S Western, Marion IN 46953. 317-668-5461.

Heathkit ID-4001 weather computer, gd cond, \$200; (4) RCA 7" equip racks, \$100/ea; Maxitel sports remote amp, gd cond, \$250/BO; Pulse Dynamics M-288 sports remote amp, average cond, \$100/BO; (4) Astrolite sport-scaster headset, gd cond, \$100/ea/BO; Audiobal TD-1A bulk tape eraser, gd cond, \$50/BO. J Swett, 4025 Lugano Way, Flagstaff AZ 86004. 602-526-1975.

Metal cart racks, mounts on wall, each holds 25 carts, appx 50, \$5 ea. L Selzie, Box K, Greeley CO 80631. 303-356-1310.

Broadcasting Yearbooks 1950's thru 1985. BO. A Wilkerson, POB 340, Lenoir City TN 37771. 615-986-7536.

Gates ACC-2 chassis, less pwr supply & speaker amps; Heath AR-15. H Kneller, 813-639-1112.

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Audio Engineering audio magazines, various issues 1947-1960. B Leslie, Pro Recording Svcs, 13709 Maple Leaf Dr, Cleveland OH 44125. 216-662-1435.

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Vintage equipment manuals, catalogs & related literature, especially want Fairchild, Langevin, Altec, etc & RCA broadcast equipment books. B Leslie, Pro Recording Svcs, 13709 Maple Leaf Dr, Cleveland OH 44125. 216-662-1435.

ARRL Radio Amateur handbook, 1948 edition, gd cond, will consider 1947 & or 1949. N Allebaugh, WICE, 100 John St, Cumberland RI 02864. 401-725-9000.

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General Radio 1931A & 1931B AM mod monitors. H Kneller, 813-639-1112.

TFT 753 AM mod monitors (2) gd cond, \$200/ea/BO; Potomac AM-19D digital antenna monitor, (2) towers, one pattern, gd cond, \$500/BO. J Swett, 4025 Lugano Way, Flagstaff AZ 86004. 602-526-1975.

Rust SFM-19 19khz signal & freq monitor, 107.9 Xtal; CCA AMM-1T mod mon, needs work. BO. L Wilson, 409 Hillaire, Hopkinsville KY 42240. 502-886-1678.

Want to Buy

McMartin TBM-2200 stereo monitor, must be serviceable cond. C Cooper, 4720 Radio Rd, Ocean Springs MS 39564. 601-432-1032.

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CE w/big production voice over 12 years hands-on engineering exp, seeks CE position w/production in competitive top 100 market. G Morgan, 704-563-8676.

Production wiz w/14 yrs exper avail for NY area, writer, producer, engineer, will relocate for reasonable offer. B Ranes, 718-526-6501.

Experienced, degreed professional seeking responsible career position in production/promotions, concept-to-completion experience, studio & remote, some Top-10, all offers considered. G Eaton, 4493 Major, Drayton Plains MI 48020. 313-623-1673.

SBE sr engr FCC 1st/gen 15 yrs audio, RF, digital exper CE, Electronics Instructor, tech writer. Write to: RW, POB 1214, Falls Church VA 22041, Attn: 90-04-01RW.

EMPLOYMENT SECTION

HELP WANTED: Any company or station can run "Help Wanted" ads at the flat rate of \$25 per listing per month (25 words max). Payment must accompany insert; there will be no invoicing. Blind box numbers will be provided at an extra charge of \$2. Responses will be forwarded to listee, unopened, upon receipt. Call 800-336-3045 for display rates.

POSITIONS WANTED: Any individual can run a "Position Wanted" ad, FREE of charge (25 words max), and it will appear in the following 3 issues of Radio World. Contact information will be provided, but if a box number is required, there is a \$2 fee which must be paid with the listing (there will be no invoicing). Responses will be forwarded to the listee, unopened.

Mail To: BROADCAST EQUIPMENT EXCHANGE
PO Box 1214, Falls Church, VA 22041

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High Quality Digital Audio * Up To 10 Incoming Phone Lines * Rotates Up To ?? Commercial * Easy Local Commercial Recording * Male or Female Voice/Foreign Languages Available * Hear Units On-Line At 601-587-4233 or 605-343-7300 * Orders Received Before 4/1/90 Prices Will Start At \$2995, Regularly \$3,495 * AUTOMATION TIME/TEMP ANNOUNCER ALSO AVAILABLE *

Information Or Order Call 800-658-5432
Time And Temperature Co. Of S.D.

MOVIE PROD EQUIP

Want to Sell

Sankyo 700 sound projector, record playback, mint, \$249; Super 8mm Sankyo XL-620 Superionic sound camera w/time lapse intervalometer mint, \$299. H Deans, 170 Grand, White Plains NY 10601. 914-949-5920.

Zeiss 16mm Moviscope w/magnetic sound reader, mint, \$299; Zeiss 16mm Moviscope needs lamp, chip on screen, \$125; Moviola 16mm 4 gang sync block, mint, \$250; Moviola Super 8mm 4 gang sync block, mint, \$200. H Deans, 170 Grand, White Plains NY 10601. 914-949-5920.

Sony 800B super 8mm full coat recorder, sync and crystal, mint, \$299; Uher 4400 Report monitor, R/R, case AC adapter, mint, \$599; Eumig jewel 8mm & super 8mm magnetic sound stripper, mint, \$99. H Deans, 170 Grand, White Plains NY 10601. 914-949-5920.

Bolex matte box, \$99; Bolex ESM crystal sync motor, \$399; Bolex Rex4 double super 8mm, Rex-o-fader, 8-36mm, 1.9 Switar auto exposure, 3 Switar primes, grip, mint cond, \$399. H Deans, 170 Grand, White Plains NY 10601. 914-949-5920.

Nagra III, internal xtal, rolloff filter, Sennheiser 805 w/KAT 15, leather case, ATN pwr supply, excel shape, \$1450; New B & H 70 DR w/Anvil case, 1" Comat, instructions, \$325. J Kreines, 5330 Kennedy, Millbrook AL 36054. 205-285-6179.

Auricon Super 1200 16mm sound, like new, complete w/(2) magazines opt & mag amp mic cases, cables, factory installed new mag head 12-120, zoom, \$2200; GBC zoom 1.8 15-90mm, \$175; Canon zoom 2.8 15-150, \$225; Spirotone Fisheye 1.8 12mm, \$90; Synchroizer 3 gang 35mm, new, \$95 plus shipping. L Meister, 321 River, Nutley NJ 07110. 201-667-2323.

Want to Buy

Mitchell 35/16mm cameras & access, other professional 16/35mm cameras; upright Moviolas, especially 35mm; Westrex 35mm optical recorders; Zeiss 9.5mm Distagon, reasonable, need not be mechanically inclined, mint cond. J Kreines, 5330 Kennedy, Millbrook AL 36054. 205-285-6179.

RECEIVERS & TRANSCEIVERS

Want to Sell

Will trade Scientific Atlanta 7300 dual 7.5 card for dual 15 card. P Posen, Box 291, Palm Desert CA 92260. 619-340-9383.

Sansui 4 channel/quad rcvr, 45 W per chnl, blown output devices, bored, \$50. B Foid, Box 1052, El Granada CA 94018. 415-726-4786.

Microdyne 1100-FFC satellite receiver, newly rebuilt by Microdyne, like new, unused, \$750. R Anderson, 10 Court, Cynthiana KY 41031. 606-234-1400.

Drake ESR 2240 satellite receiver, receives audio & visual signals, BO. P Baillon, 1218 Pioneer Blvd, St Paul MN 55101. 612-222-5555.

GE MUP radios (3) 25 W 2-way 450 MHz band, \$750. E Moody, 216 N Main, Bentonville AK 72712. 501-273-9039.

TFT EBS monitor w/FM receiver, Bet EBS monitor. Fine Tuning Assoc., 804-873-6832.

GE Century II 25 W single chnl VHF transceiver w/PL, \$75. P Russell, Bowdoin College, Sills Hall, Brunswick ME 04011. 207-725-3066.

HH Scott StereoMaster 387 AM/FM rcvr integrated amp 100 Wch, \$90 or will consider trade for classic mic. C Brennan, Brennan VCR Service, 661 Horseshoe Curve, Pike Road AL 36064. 205-272-0692.

Yamaha T760 digital AM/FM tuner auto search 10 pre sets, DX mode carton & manuals, excel cond, \$75 plus shpg. R Cannata, Cantrax Recorders, 2119 Fidler, Long Beach CA 90815. 213-498-6492.

Marti RR30-150 dual freq rcvr. M Young, WJON, St Cloud MN. 612-251-4422.

Motorola HT-220 VHF, single chnl, 2 W handheld w/built-in 2-tone pager, w/charger, \$125; GE Delta S UHF, mobile for parts, receiver OK, \$40. P Russell, Bowdoin College, Sills Hall, Brunswick ME 04011. 207-725-3066.

Harris 6550 satellite rcvr chassis, incl pwr supply & downconverter, no demod cards, gd cond, \$400. M Maciejewski, WMUS, 3565 Green St, Muskegon MI 49441. 616-744-1671.

Motorola MT-500 handheld radios, VHF band 150-160 MHz, 4 chnl w/scan, \$800/all. C Hoffman, 251 174th St #404, Miami Bch FL 33160.

Want to Buy

Scientific Atlanta 7325 7.5 kHz audio card. B Reece, North Road, Houlton ME 04457. 207-532-6587.

Johnson Electronics ST-4A subcarrier receivers, converted for 4800 baud data reception, 92 & 67 kHz. D Leinen, Independent Resources, POB 23498, Oklahoma City OK 73123. 405-728-2525.

Sony SRF-A-100 AM stereo radio, BO. J Stanford, 2228 Gravier, New Orleans LA 70119. 504-822-1945.

Telefunken multiband tube type auto radio. W Wilkes, Box 103, Brisbin PA 16620. 814-378-8526.

Sony SRA100 port rcvr, RCA on-air lights. K Anderson, 2358 S Main, Salt Lake City UT 84115. 801-466-3196.

Wegener mainframe equipped for Transtar service. M Maciejewski, WMUS, 3565 Green St, Muskegon MI 49441. 616-744-1671.

Motorola handheld radios UHF band, 460 MHz, models HT-600, MT-1000, or Radius P-200. C Hoffman, 251 174th St #404, Miami Bch FL 33160.

Motorola hand held radios, UHF band, 460 MHz, models HT-600, MT-1000 or Radius P-200. C Hoffman, 251-174 St, Ste 404, Miami Beach FL 33160.

REMOTE & MICROWAVE EQUIP

Want to Sell

Comrex PTLX 3-line xmtr (2), new, \$3000/ea. D Stephan, 219 McFarland, Cincinnati OH 45202. 513-241-6565.

Comrex single line PLX II transmit & RLX receive unit, \$990. G Wachter, 631 N 1st Ave, Phoenix AZ 85003. 602-258-6161.

M/A COM 23 CC microwave radio system, Hughes STX 141 xmtr, Scientific Atlanta 8350 AGC mtr mon, Lenco distribution amp, Ward Beck distribution amp, Videotek RF demodulator, sell as package or BO per unit. T Pelisero, 1069 Tenth Ave SE, Minneapolis MN 55414. 612-378-1254.

Micro Controls RCR-9 system perfect shape, set-up for one telephone pair, \$950/BO. V Richardson, 1024 College, Jackson KY 41339. 606-666-4946.

Marti AR-10 UHF mobile relay receiver, BO. P Baillon, 1218 Pioneer Blvd, St Paul MN 55101. 612-222-5555.

Sony PCM-F1 (2) digital audio processors for 23 GHz STL system w/pwr supply in gd cond, \$1000/ea. P Christensen, 3101 University South, Jacksonville FL 32216. 904-721-9111.

Moseley DRS-1 wireline, 20 chnl, digital remote control system w/extra spare parts & boards, \$1250. G Wachter, 631 N 1st Ave, Phoenix AZ 85003. 602-258-6161.

Gentner VRC-1000 control unit, fail-safe, command relay, cable accessory, cables, manuals, in use, like new, \$3000. D Denton, 405 E Norman, Montgomery City MO 63361. 314-564-2275.

Marti RPT-25R portable xmtr; Marti R-50450 RPT rcvr; xmtr antenna, base rcvr antenna, cables & manuals, \$1295/all. B Mountjoy, POB 1240, Elizabethton TN 37644. 615-543-5849.

Marti STL 10mono, 950 MHz, excel cond, \$2500. J Arzuaga, POB 980, Quebradillas PR 00742. 809-895-2725.

Harris 9100 facilities control full ATS, logging, 16 status, 3 calculations, 8 analog, 16 control, 1 studio & 2 transmitter units, BO. J Georgiades, WRR0, 216-373-1440.

Sine Systems

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"DIAL UP"

Remote Control
Complete systems starting at
less than \$1,400.00!

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Electronics
POB 7732
Charlottesville VA
22906
804-974-6466

Wegener 1601 mainframe w/1683-08, 1645, 1646 cards and PS, \$1500; Microwave Associates VR4XS, \$1800 plus shpg. M Hagens, 1705 N Queensbury, Mesa AZ 85201. 602-962-7130.

Moseley 505 STL stereo composite, tuned to 949.000 MHz, excel cond, \$3900. J Arzuaga, POB 980, Quebradillas PR 00742. 809-895-2725.

Advanced TC-8 remote control, xmtr/rcvr & antennas, 1 yr old, including manuals. B Carr, WRED, 1201 Fremont Pike, Woodville OH 43469. 419-837-4696.

Moseley PCL 6010 STL, xmtr/rcvr & antennas, 1 yr old, w/manuals. B Carr, WRED, 1201 Fremont Pike, Woodville OH 43469. 419-837-4696.

Equatorial rcvr w/2" dish & LNA electronics, BO. M Maciejewski, WMUS, 3565 Green St, Muskegon MI 49441. 616-744-1671.

Rust RC1000 telco model, recently removed from service, \$600/BO. A Lane, WEHB, POB 2892, Grand Rapids MI 49501. 616-451-9904.

Wilbert mast 7-30-357/367 heavy duty telescoping w/Dodge 150 custom van & 12 volt compressor, van interior customized w/deluxe RV front seats & carpeting, automatic transmission, cruise control, pwr steering, tilt wheel, AC, pwr heavy duty disc brakes, AM/FM stereo radio, all in gd cond, \$8000. S Garfield, WYED-TV, 919-553-1700.

Motorola MT-500's (3), VHF band 150-160 MHz, 4 chnl w/scan, \$800/all, write for info to: C Hoffman, 251-174 St, Ste 404, Miami Beach FL 33160.

MRC-1600 w/Moseley SCM-1 subcarrier generator. A Kord, WWRX, 401-732-5690.

Scientific Atlanta 4.5 meter C-Band satellite dish, \$1200. D George, WSSM, POB 4304, Madison WI 53711. 608-276-3541.

Gentner SPH-4 telephone hybrid, lots of features, looks great, stored for 2 yrs, \$450; Feat-Box telephone coupler, complete interface for bdcvt, works fine, \$150. D Doelitzsch, WDDD, 1 Broadcast Ctr, Marion IL 62959. 618-997-8123.

Comrex LXT, PLX, LXR, TLX, RLX, low freq extenders for cleaning up telephone transmission lines, \$400-\$800. R Meadows, Southeastern Sports Prod, 1203 Seaton Ste 117, Durham NC 27713. 919-544-1366.

TFT 2601 10 channel digital remote control, excel cond, just removed from service, \$1500. E Stokes, WCVR, POB 249, Randolph Ctr VT 05061. 802-728-4411.

Wegener electronics for Transtar radio satellite service including 1608, 1601, 1689, (2) 1610, (2) 1644 & 2046, \$3000. D Doelitzsch, WDDD, 1 Broadcast Ctr, Marion IL 62959. 618-997-8123.

Want to Buy

TFT 7615 status & control package for 7610 R/C system. J Stanford, 2228 Gravier, New Orleans LA 70119. 504-822-1945.

Marti late model solid state xmtrs & (1) rcvr 1616770, will trade our tube models or sell outright. L Maierhofer, 101 Army Blvd, Lewisburg PA 17837. 717-523-3271.

Pre 1985 STL 900-950 MHz to donate to missionary radio network which doesn't need FCC Rule 74.550 conformance. L Amstutz, 4526 Arlington, Fort Wayne IN 46807. 219-429-8366.

Cheap older non-type accepted STL transmitters & receivers in the 950 MHz range for ham radio public service project donations accepted. B Croghan, KCEE/KWFM, POB 5886, Tucson AZ 85703. 602-623-7556.

STATIONS

Want to Sell

1 kW AM in Shelbyville TN established in 1959 on 1580 kHz & still operating under original ownership, all real estate, inventory & equipment included in sales price of \$175K cash or reasonable cash offer. A Wilkerson, Box 340, Lenoir City TN 37771. 615-986-7536.

Top 80 Market C-I FM & adjacent market C-II FM, \$3.0 million, excellent western markets w/strong radio revenues. C Strandell, 221 Wilwood, Clinton MS 39056. 601-924-3087.

CP for AM 10,000 W Florence SC area, great potential as religious station, confidential, serious inquiries only, may work wright buyer to help build. D Moran, Box 1092, Salem VA 24153. 703-389-3631.

AM/FM combo 5000 W AM non-directional, 6000 W FM non-directional, Southeastern NC, low down payment, owner financing avail, \$585K. Wayne, 919-965-4906 (PM's).

Class B FM, stereo, Northern CA area, BE automation system, good money maker. R Trumbo, Box 117, Quincy CA 95971. 916-283-4144.

AM & or FM radio station in Central Arkansas, good area, excellent potential. Ask for Vivian, 501-470-1525 or 501-568-5448.

AM 1 kW, FT, ND single station market, includes nice studio/transmitter property near town, established by owner in 1970. R Hobbs, 2009 Cromwell, Nashville TN 37215. 615-373-2351.

AM station 10,000 W in Orlando FL market, original owner of 25 yrs is retiring, modern plant, 16 acres valuable land, masonry studio/xmtr bldg, twice the pwr of other Orlando AMs, priced to sell w/real estate. E Allmon, Box 555519, Orlando FL 32855. 407-425-0623.

Need interested buyer for 5000 W AM, we are bidding for the FM side of an AM/FM simulcast station, we may pay AM plus FM price to get the FM only, you could walk with the AM (license, studio, four towers, X'mitter, buildings & land) for practically nothing! While we marry up two traditional competitors, you can step in and steal the remaining AM for a song and give us a run for our money! Serious inquiries only to: Radio World, POB 1214, Falls Church VA 22041. 90-04-02 RW.

First time opportunity, owner/operator, 1000 W, 24 hr clear channel AM 540 in Central Utah, \$200K cash, \$225K terms, serious responses only. M Halloran, POB 636, Delta UT 84624.

FM CP
Northern Illinois
\$65,000
414-482-2638

AM/FM combo 5000 W, AM non-directional, 6000 W FM non-directional, Southeastern NC low down payment, owner financing avail, \$585K. Wayne, 919-965-4906 (nights).

LPTV CP's & troubled stations, buy, trade or joint venture, send details w/price & terms or call. J Worrall, 4618 Gabriel Dr, New Orleans LA 70127. 504-241-6634.

FM 100,000W station in Utah, for more info: Fax 1-801-673-1546.

FM CP, class C3, 25 KW ERP, Pine Bluff AR, \$55,000 or sell percentage. M Gottesman, Box 1957, Pine Bluff AR 71613-1957.

Sell your radio station. Pay no commission. Save thousands of dollars. Confidential notification of buyers nationwide. Call Broadcast Marketing Service, 205-734-4888 for details today.

Want to Buy

AM or FM's w/little or nothing down & owner financing, will consider other areas. L Haber, Box 136, Woburn MA 01801. 617-246-5634.

LPTV CP's & troubled station, buy or trade or joint venture, send details w/price and terms. J Worrall, 4618 Gabriel Drive, New Orleans LA 70127. 504-241-6634.

In Western Washington looking for FM or AM/FM, must be low priced, bankruptcy, problem stations, or daylights OK. Lord Broadcasting, 13313 SE 208th, Kent WA 98042. 206-631-2374.

Distressed or failing stations, can take over, no or little cash, let's deal, AM or FM. T Crockett, Box 10501, Blackburn VA 24060. 703-953-0222.

STEREO GENERATORS

Want to Sell

Modulation Sciences DSCA-188 data Sidelock SCA gen, 92 & 62 kHz. D Leinen, Independent Resources, POB 23498, Oklahoma City OK 73213. 405-728-2525.

Moseley SCG-8 subcarrier gen w/67 & 92 kHz cards, near new, \$500/BO. K Browall, Box 808, Riverton WY 82501. 307-856-2922.

Want to Buy

CCA FM 10DS stereo generator. T Barnes, KRIL, 2735 E 8th Ste 45, Odessa TX 79761. 915-332-6670.

SWITCHERS (VIDEO)

Want to Sell

ISI 821B 20 input master control switcher, \$4000. D Sturzenbacher, 3200 S Westport, Sioux Falls SD 57116. 605-361-5555.

Dynair mini split wipe and key gen, requires external sync gen, \$250. A Romanoff, 374 N Ridgewood Place, Los Angeles CA 90004. 213-467-1700.

Crosspoint Latch 611Z 8 inputs/2 ME, 5 encoded chromo key, auto fade, downstream keyer, \$2500. D Lahey, 17094 McGuffie, Salinas CA 93907. 408-663-5192.

Grass Valley 1400 2 M/E down stream key chroma key, \$895. B Clinger, 401 College, Ashland OH 44805. 419-289-5137.

Panasonic WJ 540 P 6-input B/W switcher w/2 25 " multiplex cables, \$200. D Hurd, Box 853 Station A, Searcy AR 72143. 501-279-4656.

Vital VIX-114-4A 3-M/E switcher w/all options & spare parts, built-in blackburst & color background, \$3500. D Bricchetto, 4700 Coster, Knoxville TN 37912. 615-688-3151.

Want to Buy

TAPES, CARTS & REELS

Want to Sell

Scotch Cart II AA, mostly 40 & 70 length, exc cond, will trade these 42 tapes for 50 Pro-Carts or similar, will also sell all 42 for \$84. B Gardner, Box 1069, Springerville AZ 85938. 602-333-2080.

Plastic modular cart racks each holds 10 carts & fit together to form wall of carts, enough to hold 8,000 carts or more, can also hold compact discs, \$350. B Russell, 1657 Hi Drive, Simi Valley CA 93063. 805-584-3890.

Trade 3.5 & 5.5 minute carts for 40's & 70's as is, \$50. L Spivey, Highway 231 S, Hartford KY 42347. 502-298-3268.

Fidelipac 300 series empty shells, (approx 500), unused, 40¢/ea. G Wachter, 631 N 1st Ave, Phoenix AZ 85003. 602-258-6161.

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Rebuilding/reloading, like new, all brands, any length up to & including 2.5 minutes, \$1.50 ea. FOB our plant, 48 hrs delivery.

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Twelve hours of music and life of Elvis, gd cond, 7" reels, BO. G Erway, 3450 SE Marlinique, Stuart FL 34997. 407-283-5871.

ScotchCart II dozens of new & gd cond mixed length, BO. Clark, Secor Road, Hartsdale NY 10530. 914-693-2400.

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We clean, load & pack. Serviced within 10 work days! Work guaranteed!
3380 Makely Ave., Eau Claire, WI 54701
(715) 835-7347

Capitol AA-4 music lengths 3 to 6 min, like new, \$2.25/ea. R Thomson, 1167 W Javelina, Mesa AZ 85202. 602-897-9300.

Fuji T30 1/2" videotapes, approx 400, ea w/bk hard-cover case, \$345 ea. D Murray, Murray Video Prod, 1918 Sloan, Latrobe PA 15650. 412-539-0465.

Audiopak A-2 carts (250), new & almost new, 40's & 70's. G Jablonski, WHMI, POB 887, Howell MI 48844. 517-546-0860.

Want to Buy

Music would like to buy 10 to 20 10" reels of big band era music. B Cupit, Box 1129, Vidalia LA 71737. 318-336-7466.

Audiopak A-2's suitable for reloading. E Ford, KBPK, 321 E Chapman, Fullerton CA 92634. 714-992-7418.

2 & 4 trk open reel pre-recorded music tapes 50's, 60's, 70's vintage. R McDonald, 5231 Horton, Mission KS 66202. 913-722-2677.

Vintage 7" tape cards & reels, tape not important, Scotch, Audiotape, Irish, Soundcraft, etc. Boxes must be clean & usable, prefer Pre-1960. Especially wanted are audio tape colored reels from 1950's. B Leslie, Pro Recording Svcs, 13709 Maple Leaf Dr, Cleveland OH 44125. 216

TRANSMITTERS . . . WTS

McMartin 1977 25 kW FM w/1980 Continental exciter, \$27500. C Porter, Box 498, Carthage IL 62321. 217-357-2170.

Gates BC-1F AM tuned to 1380 kHz, needs tubes but works on those included. BO. L Reding, 215 N Main, Pleasanton TX 78064. 512-569-2194.

LEASING AVAILABLE ON USED TRANSMITTERS
AMERICAN BROADCAST FINANCIAL CORPORATION
414-482-2638

Rotron main blower motor assy, new for CCA transmitter, \$100. G Wachter, 631 N 1st Ave, Phoenix AZ 85003. 602-258-6161.

Sintronc FM10 10W w/full metering & filters in cabinet 89.3 MHz, \$1000. Clark, Secor Road, Hartsdale NY 10530. 914-693-2400.

CCA 10,000DS & CSI 12,000E
414-482-2638

TTC UST 106A 100 W translator, currently ch 5 in ch 46 out, used 6 months, \$11000. D Sturzenbacher, 3600 S Westport, Sioux Falls SD 57116. 605-361-5555.

RCA 50 kW BTA-50H excel condition, PCB free, \$39500. C Stone, 234 E Meadow, Eden NC 27288. 919-623-9966.

Reliable FM RF amp 200-1000 W output on 20 W drive, w/schematics. E Goetsch, 303 W Prospect, Rhinelander WI 54501. 715-362-6000.

RCA BTA1M 20 yrs old, some spares, \$3000. C Porter, Box 498, Carthage IL 62321. 217-357-2170.

RCA 1964 10 kW FM w/1977 McMartin exciter, \$7500. C Porter, Box 498, Carthage IL 62321. 217-357-2170.

RCA 10 kW BTA-10H PCB free, completely rewired, on air, \$12500. C Stone, 234 E Meadow, Eden NC 27288. 919-623-9966.

Collins 831 D-1 FM 3 kW, excel cond, wall access & tubes, \$6000. P Cahill, POB 400, Wanchese NC 27981. 919-473-3434.

Sparta 680 solid state exciter on 96.7 MHz, used one time, excel cond, \$1200. K Diebel, 1207 Louisa, Rayville LA 71269. 318-728-4915.



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We're the leading re-manufacturer of transmitters worldwide.

Transmitters are available:

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- * Expedited Service available

Trade-Ins gladly accepted - **WE DELIVER!**
 See your choice in transmitters **WORKING in our huge new showroom BEFORE you take it home!**

**NO ONE ELSE OFFERS YOU THIS!
 SEE & TEST IT ALL YOU WANT!**

ARMSTRONG TRANSMITTER CORP.
 5046 Smoral Road (315) 488-1269
 Syracuse, NY FAX (315) 488-1365



Collins 820 D-1 AM, 1 kW, gd cond, inc all access & tubes, \$4000. P Cahill, POB 400, Wanchese NC 27981. 919-473-3434.

McMartin BF 25 kW FM, BO. J Stanford, 2228 Gravier, New Orleans LA 70119. 504-822-1945.

RCA BTA-521 on 1010 kHz; Collins 21E; Bird Wattwatcher, excel cond, \$10,000. S King, 1703 Avondale, Amarillo TX 79111. 806-355-9777.

Up To \$500 REWARD

For information leading to the purchase of used AM/FM Transmitters

- \$500 for most 20-30kW FM
- \$250 for late model FM's 5-20kW
- \$100 for any FM over 1kW & any AM newer than 1975

ARMSTRONG TRANSMITTER CORP.
 5046 Smoral Road (315) 488-1269
 Syracuse, NY FAX (315) 488-1365

Harris FM 10H clean, working, w/wo BX 15 exciter, BO/may trade. A Branch, Box 1979, Decatur GA 30031. 404-325-7847.

Will trade 5 kW FM xmtmr for 2 to 3 kW FM xmtmr. J Strongquist, 2816 Haghers, Duluth MN 55811. 218-722-3017.

Collins 830F 10 kW FM on 98.5, BO. J Stanford, 2228 Gravier, New Orleans LA 70119. 504-822-1945.



High performance at affordable prices.

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 San Diego, CA 92101
619-239-8462

Telex 229882 Fax 619-239-8474

QEI 675 FM bdct exciter w/changeable freq & companion stereo gen, \$1695/both. B Mountjoy, POB 1240, Elizabethton TN 37644. 615-543-5849.

Pomar Electronics

WANTS USED

TRANSMITTERS & EQUIPMENT

For the best deals call

Oscar Pomar
 1615 STA. MARIA AVE.
 LAREDO, TEXAS 78040

(512) 722-9437

FAX: 512-722-1795

RCA BTA-5T 5 kW AM, gd cond, BO. J Swett, 4025 Lugano Way, Flagstaff AZ 86004. 602-526-1975.

Collins 310Z-2 FM Exciter excel cond w/STL interface & extender, will tune to freq, \$2000. G Ogonowski, 213-465-3171.

CCA FM 10 DS power supply; CCA FM 10 DS equip rack for exciter & power supply. T Barnes, KRIL, 2735 E 8th, Ste 45, Odessa TX 79761. 915-332-6870.

Bauer 607A 1 kW w/660 exciter, needs work, complete gd spare xmtmr, BO. K Kushnir, Empire Comm, 2120 Bluebell Dr, Santa Rosa CA 95403. 707-545-8300.

Collins 831 1 kW FM, hybrid exciter, 4 tubes, excel cond, w/manuals, \$7500. W Waldron, KSOS, Layton Hills Mall, Layton UT 84041. 801-546-1722.

RCA BTA-56, 15 yrs old, supr cond, stable ampliphase, 5 kW AM, \$10,000; Collins 21-E 5 kW AM, \$4500. Smokey, KMMC, 1703 Al-londale, Amarillo TX 79106. 806-355-9777.

Rockwell Intl 528-0629-001 400 MHz RF amp, new, 80 W, uses 4631-S tube, less pwr supply but otherwise complete, \$50. J Cunningham, KEOR, Rt 2 Box 113B, Stonewall OK 74871. 405-265-4498.

CCA FM40E exciter, freq programmable, \$1600. M Maciejewski, WUMUS, 3565 Green St, Muskegon MI 49441. 616-744-1671.

Want to Buy

RF amp for amateur TV station, AM, 450MHz range, up to 1000 W. G Kirby, 13613 US 36, Marysville OH 43040.

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McMartin older B-910 FM exciter. C Goodrich, 11435 Manderson, Omaha NE 68164. 402-493-1886.

AM solid state I kW. J Frew, 1410 Hwy 411 NE, Cartersville, GA 30120. 404-382-1270.

Any 40-100 W VHF & 100-1000 W UHF xmtmr. J Worrall, 4618 Gabriel Drive, New Orleans LA 70127. 504-241-6634.

RCA BTE-10C schematic &/or service manual for exciter. J Woddell, 1412 Mohave, Parker AZ 85341. 602-569-2483.

RCA BTA 1S or similar AM xmtmr, for missionary radio station, gd cond. L Amstutz, 4526 Arlington, Fort Wayne IN 46807. 219-429-8366.

Translator any 10 W. J Strongquist, 2816 Haghers, Duluth MN 55811. 218-722-3017.

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For standby 1 to 2.5 kW FM. B Stuart, 3015 Johnsonville Rd, Susanville CA 96130. 916-257-2121.

AM transmitter 500 to 1000 W, will take old Gates, Collins, RCA. C Iannace, 239 St John's Ave, Yonkers NY 10704. 914-476-2172.

Modulation transformer 300 to 1000 W, pre-fer multimatch type similar to CVM-5. C Iannace, 239 St John's Ave, Yonkers NY 10704. 914-476-2172.

250-1 kW amp to go w/TE3 exciter, 93.1 MHz, old but in gd cond. K Browall, Box 808, River-ton WY 82501. 307-856-2922.

FM xmtmr, 250 W or less or FM RF amp w/100 W output, exciter/stereo gen not needed. M Ross, Box 550369-101, Dallas TX 75355. 214-348-2618.

Harris/Collins 5 kW AM, must be in gd cond. R Merrill, WZKY, POB 2639, Gulfport MS 39505. 601-832-5111.

AM, 2.5 kW in gd cond, will consider 5 kW. A Terry, WODY, Box 545, Bassett VA 24055. 703-629-5900.

Any 40-200 W VHF or 1-2 kW UHF xmtmr, top prices, finders fees. J Worrall, 4618 Gabriel Dr, New Orleans LA 70127. 504-241-6634.

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FM 20 or 25 kW. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

TUBES

Want to Sell

Penta Labs super premium output tubes w/increased plate dissipation, new, KT-88, \$18; EL-34, \$9. R Katz, 15015 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

Tubes, 1000's have receiving & amp number your looking for, some transmitter tubes too, \$2/most. A Branch, Box 1979, Decatur GA 30031. 404-325-7847.

Eimac 4CX1000A, new in box, \$500/BO. K Kushnir, Empire Comm, 2120 Bluebell Dr, Santa Rosa CA 95403. 707-545-8300.

Penta Labs Super Premium output tubes w/increased plate dissipation, new w/warr, individually tested, KT88, \$18; EL34, \$9, quantity discounts avail. R Katz, Allegro Snd, 15015 Ventura, Cherman Oaks CA 91403. 818-377-5264.

Eimac 4-500 A's for AM McMartin xmtmr, 1000 hrs, \$150 per tube; tube transformer for 4-500 A tubes in McMartin 1 kW AM, new. T Noor-dyk, WSHN, POB 190, Fremont MI 49412. 616-924-4700.

ELECTRON TUBES

Partial List: 6623, 23791, TH150, 6425F, 5604, 6696, 6697, 5681, 5682, 5671, 7804, 3CX10, 000H3, 3CX20, 000H3, 4CX5000A, 4CX35, 000C

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RCA 15GP22 CRT. A Weiner, 14 Prospect Dr, Yonkers NY 10705. 914-423-6638.

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REBUILT ELECTRON TUBES

Partial List: 6623, 23791, TH150, 6425F, 5604, 6696, 6697, 5681, 5682, 5671, 7804, 3CX10, 000H3, 3CX20, 000H3, 4CX5000A, 4CX35, 000C

Vacuum Tube Industries, Inc.

1-800-528-5014

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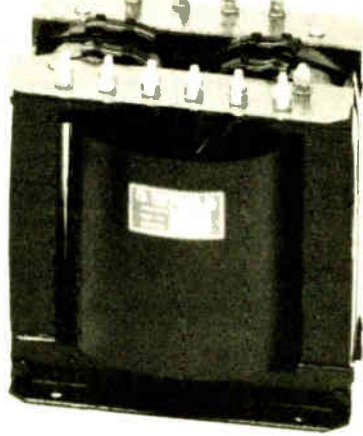
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Gates 16" TT w/arm, \$105; Gates 12" TT w/arm, \$65; McCurdy SA-136 stereo preamp, \$75. G Wachler, 631 N 1st Ave, Phoenix AZ 85003. 602-258-6161.

Russco Studio Pro Model B exc condition, \$350. C Stone, 234 E Meadow, Eden NC 27288. 919-623-9966.

Stanton 310B stereo phono preamp, brand new, BO. R Sundell, POB 734, Upland CA 91786. 714-985-0701.

Russco Studio Pro Model 1B (2) both w/Micro-Trak tone arms, \$200/ea. plus shpng. M Hagens, 1705 N Queensbury, Mesa AZ 85201. 602-962-7130.

Technics SL1200 MK2 (2) less than 2 yrs old, gd cond, incl Audio-Technics cartridges, \$250/ea, \$400/both. G Elliot, POB 2288, Huntington WV 25701. 304-525-7788.

QRK 12" TT's (2) w/new motors, Rec-O-Kut arms, Ramko preamps, \$100/ea; complete, (2) Technics SP-10 Mk II TT's w/EPA-500 tonearms & Ramko preamps, w/walnut finished double insulated sandboxes, \$700/ea. J Swett, 4025 Lugano Way, Flagstaff AZ 86004. 602-526-1975.

Sharp DX-100, Philips 212 & CCA CCA12-72. E Boucher, EAB Recdg, POB 958, Lewiston ME 04243. 207-786-3476.

Record recording amp for Presto cutter. A Weiner, 14 Prospect Dr, Yonkers NY 10705. 914-423-6638.

Stanton 681EE calibration standard cartridge/stylus & (3) new D6800EE replacement stylus assemblies, new cond, \$75. D Zimmer, 3055 N Tyndall Ave, Tucson AZ 85719. 602-623-2933.

Want to Buy

RCA, Presto, etc. 16" disc recorders, & recording blanks any size, recording needles any type, pre-recorded discs. W Davies, 5548 Elmer Ave, N Hollywood CA 91601. 818-761-9831.

WE, RCA, others, arm pickups, TT's, recorders, amps, blank recording discs, literature, 16" transcriptions. R Van Dyke, Caffrey House, Squires Ave, E Quogue NY 11942. 516-728-9835.

TV FILM EQUIP

Want to Sell

RCA broadcast film & slide transfer system TK27 3 tube color camera, TP7 slide island, TP55 multiplexer & (2) TP66 16mm projectors w/spare tubes, BO. J Krepol, 6147 Walker, Philadelphia PA 19135. 215-624-1050.

Retectron 427 film inspection machine, older model, in excel cond, w/cleaning access, \$500/BO. B Schommer, 5023 N 35th, Milwaukee WI 53209. 414-527-3330.

yasciences Steady-Cam 7" fluid bench system w/gyro stabs internal, 2 heads assorted mounting hardware, 1 charger, 2 batteries, fair cond, \$4000/BO. R Krangle, 680 Haines NW, Albuquerque NM 87102. 505-842-1418.

Spindler-Sauppe S-32B used on multiplexer, w/lens, mounting plate & manual, \$500/BO. P Wagenschlein, Baylor University Division Telecom, 1218 S Third BU Box 7368, Waco TX 76798. 817-755-1511.

16mm interlock system, B&H magloptical projector, (2) 16mm mag R/P, Selsyn drive system & racks, \$1500/BO. R Barwig, Barwig Recording, 5254 W Agatite, Chicago IL 60630. 312-283-2820.

Want to Buy

35mm telecine projector east coast area. A Weiner, 14 Prospect, Yonkers NY 10705. 914-423-6638.

VIDEO PROD EQUIP

Want to Sell

Vid Video Shuttle II converts VO5000 or 5600 to edit source deck, works w/RM440, Convergence, etc, \$500. A Romanoff, 374 N Ridgewood Place, Los Angeles CA 90004. 213-467-1700.

Sony edit cables (2) for Type 5/440, \$50/ea. A Romanoff, 374 N Ridgewood Place, Los Angeles CA 90004. 213-467-1700.

M1 format prod equip includes RCA Hawkeye Camcorder, Fuji 14x7 w/2 times extender, AU100S recorder adapter which converts recorder section for use w/any camera, \$2500. A Romanoff, 374 N Ridgewood Place, Los Angeles CA 90004. 213-467-1700.

CEL EFX IV DVE w/(2) TBCs, P152 touch screen controller, & P169V routing switcher, mint, must sell as complete package, well maintained & recently factory spec'd, \$12000/BO. R Lambros, There's Hope Ministries, 404-939-3182.

Convergence ECS 195 LM editor w/Type 5 interfaces, excel cond, \$6500. R Peterson, 1801 E 4th Ave, Olympia WA 98506. 206-754-7081.

Chyron VP-2 w/6 fonts, excel cond, \$3550. R Peterson, 1801 E 4th Ave, Olympia WA 98506. 206-754-7081.

HE1 edit controller w/cables, needs minor work, \$300. A Romanoff, 374 N Ridgewood Place, Los Angeles CA 90004. 213-467-1700.

Adda VW-2 frame synchronizer has freeze frame/field, gd cond, \$9000. T Pelissero, 1069 Tenth Ave SE, Minneapolis MN 55414. 612-378-1254.

Chyron IIIB character generator, \$1000. D Sturzenbacher, 3600 S Westport, Sioux Falls SD 57116. 605-361-5555.

Moving facility, variety of used equip avail, CDL production switcher, routing switcher, audio and video DA's etc. J Tillery, One North Wacker, Chicago IL 60606. 312-977-3838.

JVC/Abner 8250/5550 cables, monitor, mint cond, \$12,500. J Jones, 920 Main St N, Southbury CT 06488. 203-264-3666.

Unimedia 9" B&W monitor, \$100. A Romanoff, 374 N Ridgewood Place, Los Angeles CA 90004. 213-467-1700.

3M NTSC Encore Model CLR encoder RGB to broadcast NTSC color, full sync & color processing, Echo Lab SE-2 switcher/SEG, w/Sony sync gen, Tek RM529 waveform mon, color & mono monitors, cables & books, BO. J Krepol, 6147 Walker, Philadelphia PA 19135. 215-624-1050.

JVC CR8250 editor, \$3300, RM86 controller, \$900, excel cond, low hrs, B Healley, 618 Parkside, Buffalo NY 14216. 716-832-5339.

JVC CP-5000U 3/4" video player with RF output, \$595. B Hines, RD 1 Box 413A, Export PA 15632.

Quanta Microgen MG-100B SIO, 256 colors, 50 page memory, 9 speed rolls & crawls, RS-232 I/O port, character edging & much more, \$1595. B Hines, IPS, RD 1 Box 413A, Export PA 15632. 412-468-4115.

Sony DR-10 intercom headsets, excel cond, TRS Connector, \$60/ea. D Haggadone, 1039 Jenne St, Grand Ledge MI 48837. 517-627-4537.

Quanta Microgen MG-100B title generator, 256 colors, 9 speed rolls/crawls, 50 page memory, auto page sequencing, character editing, line by line color, RS-232 I/O port for computer hook-up, excel cond, \$995. B Hines, RD 1 Box 413A, Export PA 15632. 412-468-4115.

Sony VO5850, VO5800, ECS 90, BVU-800, BVW15. M Mehalko, 201-361-1917.

Otari EC-201 hand held time code reader, \$250. P Cibley, 138 E 38th, New York NY 10016. 212-986-2219.

Sony VCR-4 telecine adapter, high resolution unplexer for film to video transfer, gd cond, \$50; Froehlich 190-300 stereo video control center-interconnect, (3) VCR's & (4) audio sources, lighted passive switches, audio volume control, \$75. W Watrous, 739 S Orange, Sarasota FL 34236. 813-366-3316.

Sony FCG-700 frame code generator, new in box, \$1000; JVC LP-101 digital audio proc, \$1000. R Lawrence, Moonshadow Video, 4280 Reston, Roseburg OR 97470. 503-679-8966.

Sony SL-HF300, Panasonic BF-S1300 & MIT 2000. E Boucher, EAB Recdg, POB #58, Lewiston ME 04243. 207-786-3476.

3M 5110 & 5120 downstream keyer w/borders, outlines & matte generators for matte fills, BO. G Spiller, BES Teleproductions, 6829 E Altmore, Richmond VA 23225. 804-276-5110.

Sony AVC-3260DX B&W w/monitor viewfinder, \$100; JVC RM86U control trk editor/controller, \$850; Videotek KV1365 12" color video monitor, w/blue gun, \$250, plus shipping for each. M Holwin, Anamnesia Studios, 49 S Oxford, Brooklyn NY 11217. 718-852-7630.

Custom Design remote studio, w/(2) JVC 110 cameras, control units, multi-core cable, Panasonic switcher, (3) B&W monitors, Shure mixer & much, \$10,000. M Bacon, 216-467-3037.

Laird/ICM VC 2000P video processor, \$800. D Hurd, Box 853 Staton A, Searcy AR 72143. 501-279-4658.

Sony EVS-700V 8mm video/audio cassette recorders, gd cond. B Weiss, KJLA, 3435 Broadway, Kansas City MO 64111. 816-753-7707.

Sony PVM-8221, new 8" super fine pitch high resolution monitor, \$400. P Russell, Bowdoin College, Sills Hall, Brunswick ME 04011. 207-725-3066.

VIDEO TAPE RECORDERS

Want to Sell

JVC CR4400U 3/4 port recorders (4) w/access, \$800 ea/BO; (3) Sony RM-430 edit controllers, \$500/BO; JVC BR-6400U VHS recorder, \$1500/BO. T Quinn, Monte Vista St, 208 Cherry, Capitola CA 95010. 408-475-0423.

Panasonic NV9600 or NV9240 NVA-960 editor, \$1795. B Clinger, 401 College, Ashland OH 44805. 419-289-5137.

Ampex VR1200, 1200B parts, Mark X heads, audio & ctrl assemblies, erase assemblies, vacuum pumps, blower motors, reel shafts, air filters, manuals & more, BO. J Krepol, 6147 Walker, Philadelphia PA 19135. 215-624-1050.

Sony Betamax SL0320 industrial beta recorder, excel cond, BO. K Rubel, Box 46245, Chicago IL 60646. 312-929-0191.

NEC II 7000 1" VTR, low hrs, extra parts, \$6500. D Lahey, 17094 McGuffie, Salinas CA 93907. 408-663-5192.

JVC CP5000, CP5200 players, CR6060U R/P, Panasonic NV9100 players (7), Sony 1/2" EIAJ R/R AV3600 (2), AV3650 editors (2), Panasonic NV3020, NV3160 editor, case of new tape, BO. J Krepol, 6147 Walker, Philadelphia PA 19135. 215-624-1050.

Generic Designs (2) serial to parallel VTR interfaces w/time code reader, will allow Sony U-matic to work w/serial editor, BO. R Hiett, Box TV3, Harrisonburg VA 22801. 703-433-9191.

Sony VP1000, VP1200, VP2000 players, VO2630 NTSC-PAL-SECAM, VO2850 editor, VO3800 portable, RM400 controllers, BVU200B broadcast editors, BVE500A controllers, cables, tapes & books, BO. J Krepol, 6147 Walker, Philadelphia PA 19135. 215-624-1050.

JVC CR6600U 3/4", low hrs, nice shape, new drum, \$950. J Kreines, 5330 Kennedy, Millbrook AL 36054. 205-285-6179.

Sony VP-9000 SP 3/4" player, 200 hrs, like new, BO; Sony VP-9600 SP 3/4" recorder, 200 hrs, like new, BO. R Hiett, Box TV3, Harrisonburg VA 22801. 703-433-9191.

RCA HR2 edit recorders (2) w/built-in TBC's, \$2000/ea. A Romanoff, 374 N Ridgewood Place, Los Angeles CA 90004. 213-467-1700.

Marconi MK VII several camera heads, CCU's, encoders & pwr supplies, for parts or repair, \$100/ea. G Spiller, 6829-E Altmore, Richmond VA 23225.

JVC CR4400V 3/4" portable recorder, needs fuses, low hours w/pwr supply, \$500/BO. K Rubel, Box 46245, Chicago IL 60646. 312-929-0191.

AU220 portable M1 format recorder like new, less than 100 hrs, w/battery & (2) cases, \$2250. A Romanoff, 374 N Ridgewood Place, Los Angeles CA 90004. 213-467-1700.

Sony VO-2610 U-matic gd cond, \$600. A Alegria, 1380 Valley Forge, Lansdale PA 19446. 215-368-4444.

Ampex 1" VPR-20 w/AC power supply, battery charger, case, \$16000. N Lindquist, POB 14920, Columbus OH 43214. 614-888-4788.

JVC CR-4700U 3/4" portable recorder w/AAP47U AC pwr supply/charger, (3) NiCads, custom case, (20) KCS-20 tapes, excel cond, \$1895. B Hines, IPS, RD 1 Box 413A, Export PA 15632. 412-468-4115.

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JVC CR6600 3/4" R/P, BO plus shipping. M Holwin, Anamnesia Studios, 49 S Oxford, Brooklyn NY 11217. 718-852-7630.

Sony EV-S700U 8mm, PCM digital audio, low hrs, \$500. M Maciejewski, WMUS, 3565 Green St, Muskegon MI 49441. 616-744-1671.

Sony AV 3600 1/2" B/W R/R (2), \$200. D Hurd, Box 853 Station A, Searcy AR 72143. 501-279-4658.

JVC 4400-LU 3/4" portable deck, like new; (2) Sony 2860 3/4" decks w/RM-400 edit controller; (2) Sony SLO-323 Beta I industrial decks; RCA TR-22HB quad w/headwheel panel, BO. G Spiller, BES Teleproductions, 6829 E Altmore, Richmond VA 23225. 804-276-5110.

Sony VO6800 remote 3/4" w/Porta Brace case, excel cond, \$1800. M Bacon, 216-467-3037.

Panasonic NV 3020 1/2" R/R (3), \$300. D Hurd, Box 853 Station A, Searcy AR 72143. 501-279-4658.

Sony VO-2610 3/4" R/P, audio dub, excel cond, \$550; Sony VO-2600 3/4" R/P, audio dub, \$550. R Jensen, Racine Telecable Corp, 5812 21st, Racine WI 53406. 414-632-3131.

Want to Buy

RCA TR-3, TR-4 quad machine, east coast area. A Weiner, 14 Prospect Dr, Yonkers NY 10705. 914-423-6638.

Panasonic NV-9600 edit source deck, J Andrist, Box 273, Orem WA 98841. 509-826-3340.

RCA TR-4, Ampex VR-2000 to pick-up, East Coast area please. A Weiner, 14 Prospect Dr, Yonkers NY 10705. 914-423-6638.

Panasonic AG-7400A S-VHS portable; JVC BRS-410U dockable S-VHS recorder; S-VHS A Series editing system; 16:1 lens for JVC BY-110 camera w/ear controls. R Lawrence, Moonshadow Video, 4280 Reston, Roseburg OR 97470. 503-679-8966.

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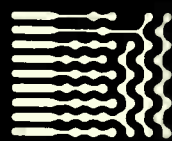
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