Radio Guide

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Pushing the Technology From Moonwalks to Digital Radio

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Page 4 – JFK said we would go to the moon before the end of the decade. As mid-1969 approached, the question arose as to whether it would all happen or not. In the end, it came down to hard work and improvisation by some intrepid engineers.

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Columns & Articles

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Lift Off

Everyone around in 1969, when the Apollo 11 made its way into the sky, remembers the images, the excitement, the sheer *concept* of a man standing on the Moon. The mind still reels contemplating that achievement, especially considering the technology available.

As you will read in our cover story, a lot of teamwork was necessary, but each individual contribution was important. The same is true today.

Our Technical Initiative, announced in the May issue of **Radio Guide** (see the box on page 26), is an effort to encourage a new level of sharing knowledge and experience at a time when fewer and fewer frontline engineers are doing more and more.

It was gratifying to have several submissions arrive within days of the issue reaching your mailboxes. Some of that material is in this issue of **Radio Guide**, and in the months to come you will see the names and thoughts of many folks who have not had the opportunity to be published before.

Nevertheless, we know you folks out there have many more ideas, topics of interest, ingenious Tech Tips, great pictures from your transmitter sites (or tower perches!), or projects that show off why you chose to be a radio engineer. Let us share.

However, even if you feel you do not have anything special to offer, communicate with us. Our mission is to provide a magazine that helps you do your job better. So, again, please write, call, email, send a carrier pigeon. (!) As we discuss your thoughts, it may well put some new topic or approach in motion that solves a problem for someone we have not yet met!

And when all is said and done, "putting something back" lifts us all upward. And that has to be good.

Camelot on the Moon

The Real Story of How We Managed to Fulfill Kennedy's Promise and Put a Man on the Moon

by Donald E. Kimberlin, NCE

JFK said we would go to the moon before the end of the decade. As mid-1969 approached, the question arose as to whether it would all happen or not. In the end, it came down to hard work and improvisation by some intrepid engineers.

Most people do not know the last possible launch window in the decade nearly closed in failure, saved literally at the last moment by an amazing effort. Thirty-five years later, the story is still exciting and intriguing.

[LANDIS, North Carolina - July 2004] John F. Kennedy's truncated presidency has often been called "The Camelot Era." There had been an unspoken feeling the U.S. had gone to sleep while Eisenhower presided. Expectations now grew that America had to do something spectacular, especially as the glow of victory in World War II continued to dim.

Meanwhile, the charismatic personae of the Kennedy family seemed to say, "these are the ones who will bring glory to the nation." Compared to previous Presidents, JFK's relative youth – his brother Robert as his close aide, combined with his beautiful spouse and young children – made every day potentially a harbinger of great news.

There had been great news – but not happy news – from the Soviet Union. The launch of Sputnik shocked Americans and gave many people reasons to worry, considering the tensions of the time. Indeed, the Evil Empire might be able to rain down destruction and ruin on the United States. Nikita Khrushchev had shown on television during his United Nations visit self-confidence to the point of arrogance. The USA was losing the race for dominance in space. The Missiles of October were to drag JFK into a global poker game like none before.

THE PROMISE IS MADE

Given the world situation, JFK's promise to put an American on the moon was well received; the country needed an effort to rally behind. Further, he promised it would happen before the end of that decade. One can probably say there has not been any other single event since that has brought as much solidarity across the entire American population, indeed perhaps the whole world. Best of all, this rallying point in history developed with the promise of a peaceful objective.

It was the sort of promise of the Sixties that people really wanted. It was The Promise of Camelot.

What many people do not know is that it all came very close being a failure. At the very last moment the last possible launch window for a lunar mission in the 1960's was nearly missed.

POTENTIAL DISASTER LOOMS

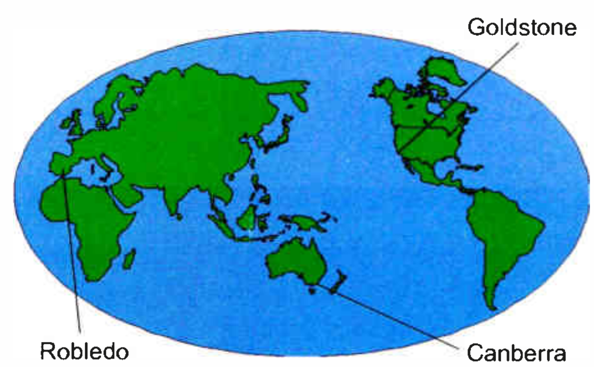
The near failure was not due to problems with rocket science or astrophysics or astronautics. Those had caused earlier program slippages, but had been solved. The ultimate problem that nearly ended this Final Tribute to Camelot was a telecommunications problem.

It was all related to the then relatively new technology of communications satellites. Only the massive efforts of telecomm people, contributing in ways we today might find impossible, actually made the mission possible. Some readers may know pieces of the story, but few have ever known the whole picture.

It all focused on NASA's Deep Space Network. The Deep Space Network was a subset of only three of the twenty-plus ground stations NASA built around the world for tracking and communicating with objects it launches. Most of the NASA stations were capable of communicating only with objects in earth orbit less than 100 nautical miles above the surface.

On the other hand, for the planned lunar mission, there was a need to construct three very large earth stations with 85-foot dishes that could sweep the horizon rapidly and track a point on the moon or anywhere between the earth and the moon.

These special stations were needed in order to maintain communication across the quarter million miles of space to the moon. The three were Robledo, Spain, about 37 miles west of Madrid; Goldstone, a ghost town in California's Mojave Desert; and Canberra, about 165 miles southwest of Sydney, Australia.



A look at the world map shows each is about one-third of the way around the earth. Of these three, only one at a time has a view of the moon for an eight-hour portion of each day. In order to maintain sufficient communication with the first humans to make the lunar journeys, all three stations would have to function perfectly and continuously during their eight-hour periods of lunar visibility.

THE FRAGILE TELECOM LINK

Humans had previously made occasional contact with the moon, bouncing radar off it as early as 1947. Radio amateurs later had made "moon bounce" communications demonstrations. However, maintaining a continuous link from the Earth to the moon for over a week had never been done before. Meeting the Promise of Camelot would require solid, secure communications for the entire mission.

The Deep Space Network was unique not only because of its stations' locations. The communications bandwidth required was larger than previously accomplished over such a distance. And networking the information together once it was back on earth was yet another new feat.

Intelsat was in operation and making intercontinental satellite communications available. However, there had been uncertainty about availability at the time NASA was planning the lunar project. Furthermore, the costs would be at levels beyond what NASA would prefer. And just to add one more level of complication: running a full color video baseband from the moon to earth with the electronics of the new discrete transistor era had not yet proved reliable.

All in all, a true technical challenge for the time.

THE ESSENTIAL LINK

Early in the lunar project, the decision was taken to combine all communications between the lunar module and earth into one 48-kilobit, multiplexed digital signal of video, speech communications, spacecraft telemetry and biomedical data using 2-gigahertz radio. That was the Deep Space Network's task.

Just getting that 48 kilobit stream created and transported back into NASA – and then put back out for the world to see – was in itself a risk. NASA called the link reaching those quarter million miles across space its Unified S-Band system. The combined signal would be fed through each Deep Space Station back to NASA's Communications Center at Greenbelt, Maryland for signal processing and distribution to the whole world.

It was critical for NASA to get the Deep Space Network built and any bugs shaken out. As the 60's passed, lunar launch opportunities frittered away one by one while various problems in the program were uncovered and solved. However, those slippages did allow time to make NASA's Deep Space Network operational.

BUILDING A 48 KILOBIT CONNECTION

Actually, until late 1968, the world's public telecom network did not have the means to transport a single data stream as large as 48 kilobits across the Atlantic or Pacific. The intercontinental state-of-the-art had reached only a maximum modem rate of 4800 bps. Intelsat was forecasting satellites that could provide whole 48-kilobit channels on which "wideband" analog modems could be used by the late 1960's, but NASA needed something sooner.

Meanwhile, NASA was not about to commit reliance on HF (shortwave) radio or submarine telephone cables across the Atlantic and Pacific. The cables themselves still had precious few channels in the late 1960's, prior to the digital fiber optic era. Integrated circuit devices to make tiny units with really low power consumption were only on the horizon; devices like micron-thick solid-state electronics were still *way* in the future. Indeed, vacuum tubes were really still more reliable in many uses than transistors had yet been proved to be.

NASA needed a rock-solid way bring lunar signals from Robledo, Canberra and Goldstone into the NASA communications center at Greenbelt. And that 48-kilobit path across the oceans had to be relatively proven technology – at least reliable enough upon which astronaut lives might be risked.

SCAMA

The interim method was called the Station Conferencing and Monitoring Arrangement (SCAMA). SCAMA included a form of inverse multiplexing (hyped as a recent development, the military already had employed SCAMA just after WWII). Telegraphers also had used inverse multiplexing on wire lines and HF radio for decades.

At least one NASA earth station achieved a 2400 bps digital link with Greenbelt using inverse multiplexing. (The serial data was converted into 24 parallel FSK streams riding on HF radio between Panama and Santiago, Chile; the portion from Greenbelt to Panama rode on submarine cable.) But that was only 2400 bps, and the lunar project needed 48 kilobits, especially if it was to give the world convincing proof of the lunar landing via live color video from the moon.

SCAMA was the largest inverse multiplexer built to date. It split the 48-kilobit data into twelve parallel paths of 4800 bps synchronized data for intercontinental transmission, and then recombined them into the original 48 kilobits at the receiving end. As you may imagine, the transport cost was enormous.

At that point in time, one analog voice channel across the Atlantic rented for $13,000 a month – and SCAMA used twelve. NASA was holding up a dozen circuits across each ocean all day and all night, just to be ready in case a launch window could be used. Of course, they also provided a test bed for the Deep Space Net-

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Camelot on the Moon

The Real Story of How We Managed to Fulfill Kennedy's Promise and Put a Man on the Moon

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work and the terminals that would go to the moon.

When not in mission use, Robledo and Canberra had a dozen telephone tielines back to Greenbelt. The "phone bill," approached a half million dollars a month (about $2.5 million per month in current dollars!), largely just to be ready to sustain the Promise of Camelot!

THE INTELSAT OPTION

When Intelsat's Series III satellites came into operational use in 1968, contracts were let to IT&T and RCA to provide 48-kilobit channels from Robledo and Canberra respectively back to Greenbelt. Goldstone was not such a serious problem, as it was in the U.S.

(With the satellites available, SCAMA could be relegated to "back-up" status. That would release a dozen sorely needed trunks across each ocean back to the world's telephone network. Dial telephone demand had soared far beyond capacity of the few cables installed to the time, and the released channels would immediately be given over to reach various nations from the U.S.)

It fell to me at IT&T to produce the system design for the first 48-kilobit circuit between Robledo and Greenbelt, while RCA took the contract across the Pacific a few months later. We used proved components from domestic "wideband data circuits" and rather routinely put it into operation. NASA achieved regular use immediately.

To our view, it was "business as usual." We foresaw no problems, and it appeared we at IT&T would have no concern whenever America launched an Apollo spacecraft. Our efforts turned toward other tasks. By late 1968, I was on a different assignment in Europe, knitting AUTOVON and AUTODIN into trunked networks reaching the U.S. from Europe – most on the new Intelsat satellite, some on cable.

CRISIS!

Everything seemed to work well until July 14, 1969, when Howard Briley from IT&T Geneva telephoned my office in Paris. He told me the lone Intelsat III over the Atlantic had suffered Intelsat's first failure in space. It had pointed its antennas out into space and would not respond to telemetry commands.

The circuit from Robledo was the most critical to the moon landing because it would be the Deep Space station facing the moon in those critical first moments when the astronauts would step on the lunar surface for the world to see. Making them wait eight hours to proceed with the mission once on the moon would deplete life support supplies dangerously. Lacking a link with Robledo, the Promise of Camelot would fail!

Several possible recovery efforts were being pursued. However, if they did not work, it would be necessary to try getting twelve voice channels across the Atlantic between Robledo and Greenbelt working as 4800 bps data circuits and pressing SCAMA back into use. I got marching orders for Madrid.

Meanwhile, the Early Bird satellite was considered, but it was questionable if the CTNE (Compania Telefonica Nacional de Espana) earth station at Buitrago, Spain had receivers to tune into its weakened signals. Early Bird's batteries were already running well down their power curve anyway.

Intelsat had one spare Series III satellite and launch rocket. It was rushed to a pad at Cape Kennedy to try meeting its one possible launch window before the last lunar shot window on the morning of July 16. Unfortunately, the satellite went into a huge looping orbit that would take more time than permissible to correct – plus using all its station-keeping fuel in the process. Thus, any notion of simply replacing the failed satellite in orbit was lost within minutes after launching the spare.

THE T-2 HOUR DEADLINE

Fortunately, there was an available commercial airline seat from Paris to Madrid, a rare commodity in European air travel at the time. The weather over Southeastern France and Spain on July 14, 1969 was sparkling clear. Even the cabin steward was impressed, pointing out land features and cities we passed over enroute, because they could be seen so clearly from six miles up.

Nevertheless, it was difficult to enjoy that scenery fully. My mind was on what orders awaited me at the Palacio de Telecomunicaciones, CTNE's rococo, modern Moorish reproduction HQ building. We knew the situation was critical, since Robledo's Deep Space station was the one that would be in view of the moon at the moment scheduled for an American to step onto the lunar surface.


Palacio de Telecomunicaciones - Madrid

Arriving in Madrid, I learned the NASA Mission Director had put a "hold and check point" in the countdown. He said the mission would be scrubbed if Robledo were not on line to Greenbelt by T minus two hours. I began to feel the pressure to make the mission succeed – it would live or die by what we accomplished in the next two days.

THE RACE AGAINST TIME ... AND RULES

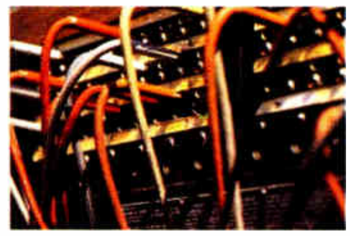
At the Palacio, Senor Luis Terol, CTNE's Manager of International Services updated me on the situation.

Buitrago was not having much luck establishing a link via Early Bird. Intelsat's replacement satellite had been launched – and lost. The last-ditch backup – pressing SCAMA into use – was the only hope of keeping America's lunar launch on schedule for its last chance in 1969.

As with all the other Europeans I spoke to in the months preceding the launch, Terol wanted Kennedy's promise to come true. The free world had bought into to seeing it happen the way JFK committed. Terol told me that AT&T, IT&T and CTNE executives had already been working personal contacts with PTT (Post, Telephone and Telegraph) agencies all over Europe. But that did not necessarily make our mission easy.

Normally, in the world of international links verbal orders were unheard of. Each and every circuit order is a documented transaction connected with the accounting department for the resulting circuit. There is no way a verbal order – no matter how urgent or convincing – can get a technician in France, for example, to stick a patch cord into a panel that will cut off a transit trunk between the U.S. and Switzerland.

Considering that we required a dozen trunks – one or two each from England, Belgium, the Netherlands, Denmark, Germany, Switzerland, Spain and Italy – disconnecting and rerouting the various cables on manual patches down into Spain took a lot of coordination. Each and every one of these informal agreements required the personal intervention of top telephone executives in the affected nations. They promised paper orders in detail would follow to every affected point.



A CTNE staffer would handle negotiating reroutes from each disconnect point. He knew the European infrastructure in considerable detail, and could lay out a plan for getting the circuits to Madrid with the least number of negotiations. Simultaneously, he minimized the number of links, to try keeping noise levels down. (This was a major consideration in building circuits approaching 5,000 miles in length.) We would have to eat into the noise ceiling by adding some equalization for perhaps six sets of channel banks.

Meanwhile, I was sent out to see if there was any last hope for use of Early Bird at Buitrago and then to set up shop at nearby Robledo.

WORKING BOTH ENDS – AND THEN SOME

We were trying to engineer some quiet, clean data channels on the fly, using a somewhat random assortment of circuits. We would have to do it in record time, too.

While the bosses worked the system from the top down, our CTNE staffer worked it from the bottom up. When he would get road-blocked by a lethargic technician a country or two away, he would get out his own little black book of names and numbers he knew in that country. He would talk a supervisor or manager into the spirit of the effort, and get that boss to motivate his people or even go down to the office himself.

Again, we worked through the night. Channels were patched through, which is no mean feat in off-hours anywhere in the world. I was on a connection with IT&T's Technical Operations Center at New York, setting up and equalizing circuits as they became available.

One by one, we got the circuits established. We used some pretty dirty tricks to leave them just a bit loose on equalization, but with smooth curves in order to keep noise lower. Meanwhile, the NASA folk were starting up SCAMA. They would first run pattern data with their modems then add each channel to SCAMA. This was to establish operation proving in the reliability for the Mission Director.

FIVE MINUTES TO SPARE

Finally – at T minus 2 hours and 5 minutes – NASA accepted the twelfth circuit, declared SCAMA operational, and the Mission Director removed the hold. The launch for the moon was "on!"

We stayed at Robledo to hear the launch get off on the afternoon (Europe time) of July 16, and headed back to Madrid for some sleep, after two days without. I checked into another famous Madrid landmark, the Palace Hotel, all Spanish oak, brass and tile. The Palace was Ernest Hemingway's home while writing about the Spanish Civil War. The hotel had not changed much, but I did stop to appreciate it. I went directly to bed.

Memories are blurred, but I must have slept most of two days because the next thing I remember clearly was a pounding on my door in the middle of the night. Someone on the hotel staff – apparently the best English speaker the hotel had – was calling me to come to the hotel's one TV set and see the Americans on the moon! They had landed some hours before, but now they were going to walk outside on the moon.

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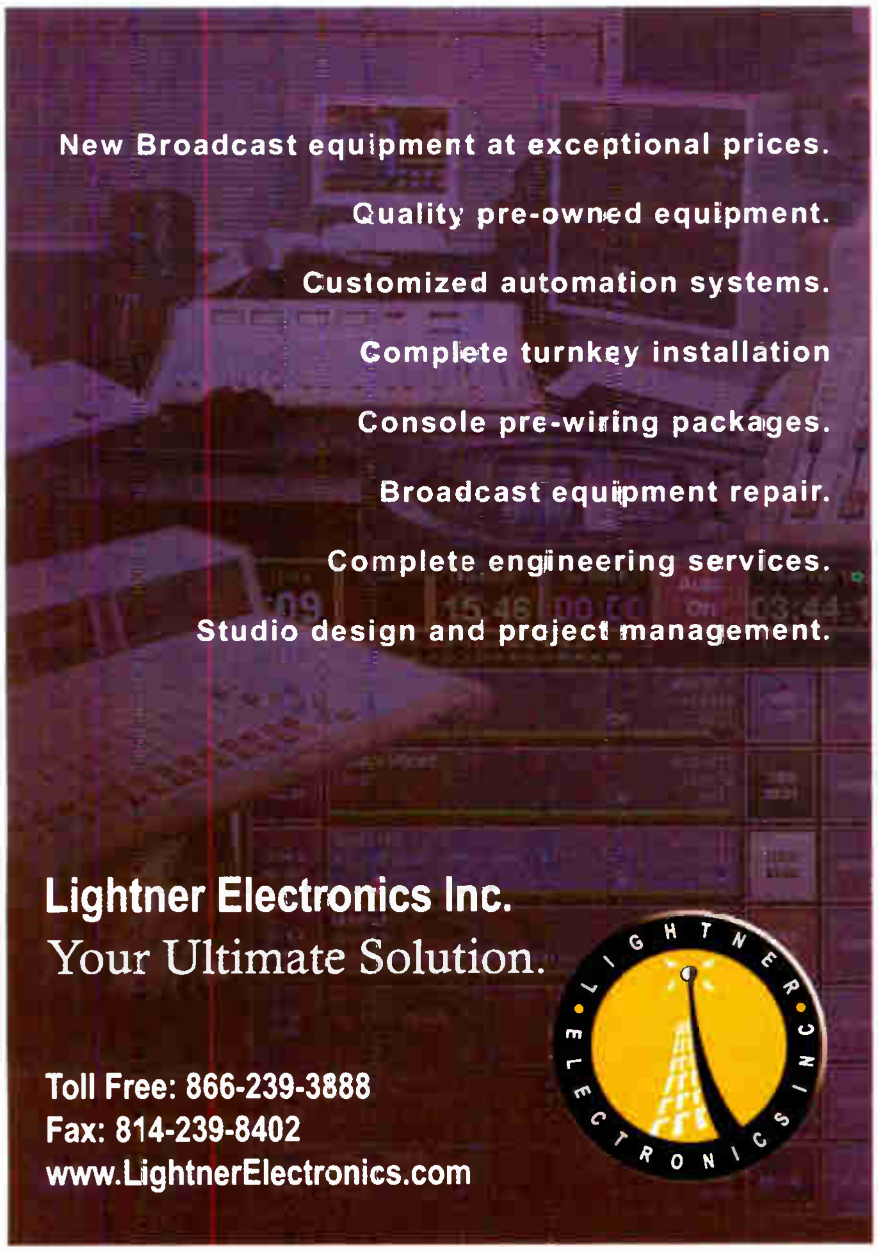
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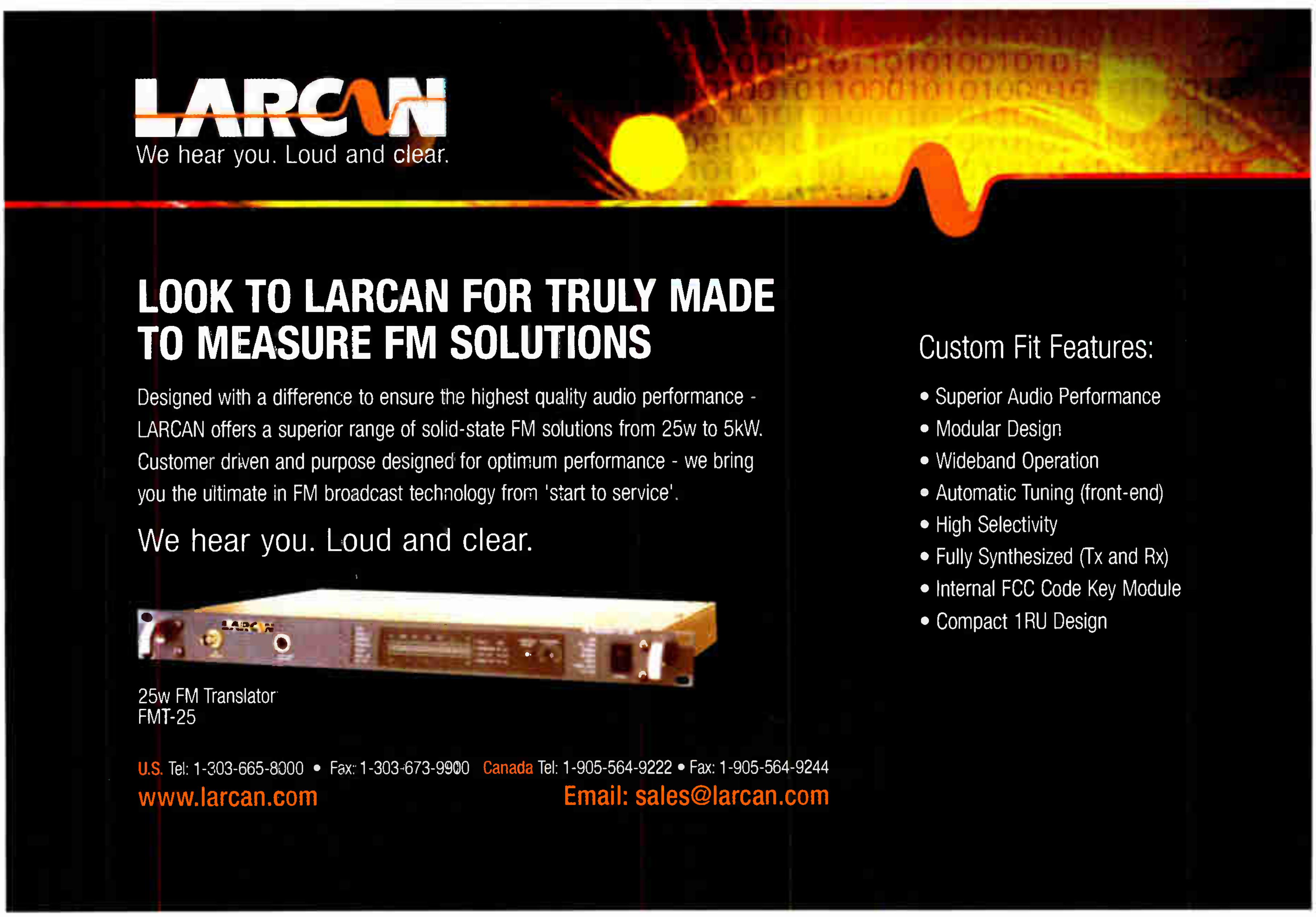
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The Canadian View

A Look at the Digital Horizon

by Barry McLarnon

As we struggle to understand exactly what digital broadcasts are doing, it is helpful to know something about the broadcast bandwidth. Barry McLarnon has the credentials to comment on this; his involvement in developing a digital radio broadcast standard for Canada, based on the Eureka 147 system, dates back to the late 1980's. As Project Leader, Radio Broadcast Systems, at the Communications Research Center (CRC) in Ottawa, Canada, he was responsible for research on new digital radio broadcast systems.

[OTTAWA, Ontario, Canada - July 2004] In Canada, we are already veterans of digital radio broadcasting, having hitched our wagon to the Eureka 147 system more than a decade ago. There have been many potholes along that road, but that is a story for another day. We are also watching the fortunes of IBOC (In Band, On Channel) digital radio with great interest. If it becomes successful, perhaps there could be a fork in the road, and Canadian broadcasters might seek to use IBOC in addition to Eureka DAB.

In the shorter term, however, there is a more pressing concern: what does the future hold in terms of increased interference to Canadian AM and FM stations from across the border?

FM DIGITAL IBOC

The FM system is the simpler of the two hybrid IBOC systems, at least in terms of the transmitted signal. The digital power is contained in a single pair of symmetrical sidebands that surround the analog signal. The subcarriers making up each sideband are even distributed from about 129 kHz to 198 kHz away from the carrier frequency.

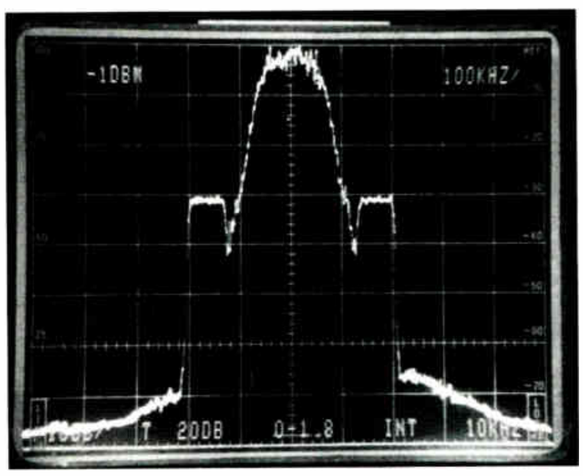
This means that 100% of the digital power falls in the first adjacent channels, so this system should be considered to be IBAC (In Band, Adjacent Channel) rather than IBOC. Since the total power of the digital signal is 20 dB down from the analog power (i.e., -20 dBc), it only increases the total power by 1% when it is added to form the hybrid signal. This may seem insignificant at first glance, but as the saying goes, the devil is in the details.

cerned. It is the bandwidth that contains 99% of the total power (averaged over a suitable interval), with the remaining 1% split equally outside the upper and lower limits.

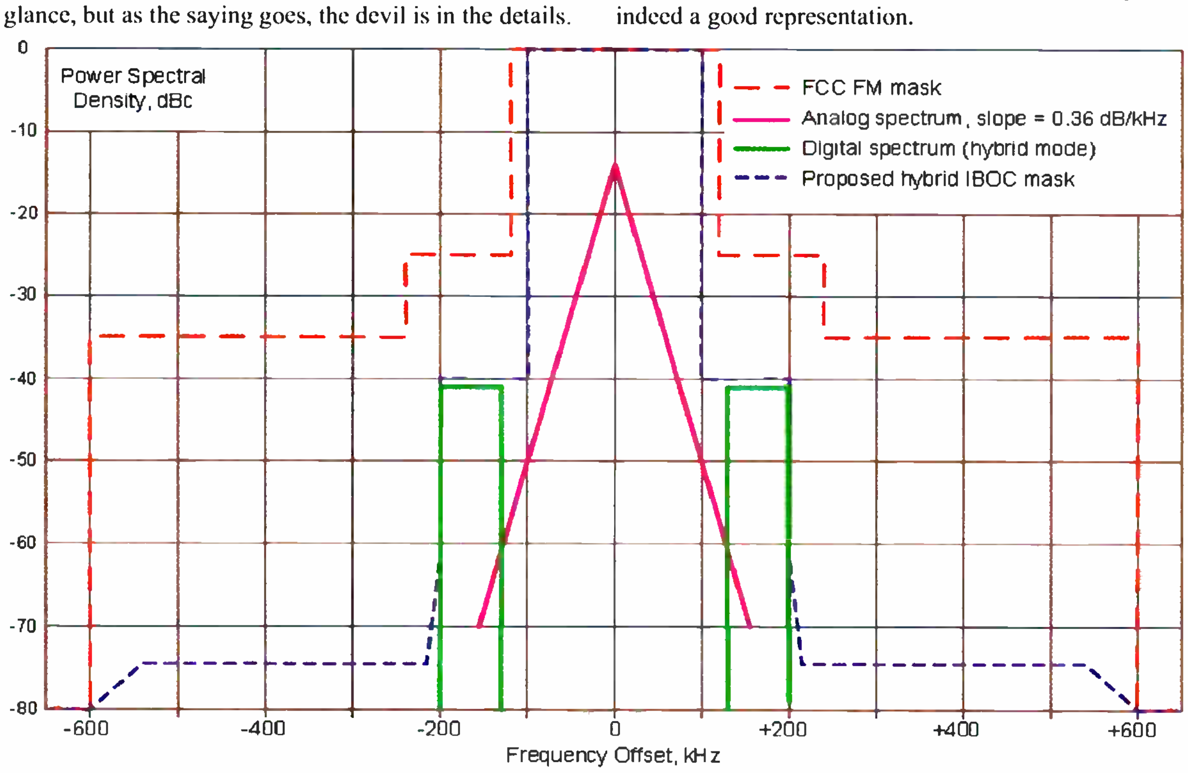
When symmetry about a center frequency prevails, as it should with most broadcast signals, we can dispense with the limits and simply talk about the occupied bandwidth as a single number. In order to calculate occupied bandwidth, we need a mathematical representation of the signal spectrum.

BASIC FM SIGNAL

Fortunately, there is a convenient model for the FM spectrum that is used in IBOC analysis. It dates back to the pre-iBiquity days, and continues to be used to this day. It was derived from observations of several FM stations in the Washington DC area, using a spectrum analyzer set for 1 kHz resolution bandwidth and five minute averaging.



In this model, the time-averaged signal has a triangular power spectral density when viewed on a logarithmic power scale, dropping off from a central peak at a rate of 0.36 dB/kHz. This was the average slope for the stations observed. I checked the power spectrum of all the local FM stations in my area, and found that the triangular shape was indeed a good representation.



Power Spectral Density for FM IBOC

One measure of what happens to the signal when the IBOC sidebands are added is the change to the occupied bandwidth. This term is used somewhat loosely at times, but it has a precise definition as far as the ITU (International Telecommunications Union) and the FCC are con-

A slope of 0.36 dB/kHz was also a reasonable approximation of the average, but there was a wide variation – I saw slopes ranging from 0.22 dB/kHz for heavily processed stations, to 0.70 dB/kHz for lightly modulated classical music and monophonic stations.

In any case, with a bit of calculus, it is easy to calculate the occupied bandwidth of such a signal, and it turns out to be very simple: if the slope is ß dB/kHz, then the occupied bandwidth is 40/ß kHz. This works out to be 111 kHz for the 0.36 dB/kHz slope that is said to be typical, and it ranges from 57 to 182 kHz for the stations I observed. In all cases, this is less than the nominal 200 kHz bandwidth of the FM channel.

ADDING IBOC

Now, let us recalculate the occupied bandwidth after a station goes IBOC. Because of those digital saddlebags now hanging on the FM signal, we have to take in considerably more of the analog signal before we reach the 99% total power point. For the "typical" FM signal with 0.36 dB/kHz slope, the new occupied bandwidth turns out to be 222 kHz. So, although it may seem counterintuitive, by increasing the total power by a mere 1%, we have increased the occupied bandwidth by 100%!

In fact, this doubling of the occupied bandwidth is independent of the slope, provided that the slope is 0.31 dB/kHz or higher. This certainly gives a hint that there will be increased interference to the adjacent channels, but we need to quantify this a bit further.

Again going back to the analog signal model and doing a bit more math, we can calculate the total power that is deposited into one of the first adjacent channels. It turns out to be very simple: -(100ß + 3) dBc (this is actually the total power in all of the adjacent channels on one side of the analog signal, but virtually all of it falls into the first adjacent). For the "typical" FM signal, this is -39 dBc, and is proportionately smaller or larger for the other cases.

When we add the digital signal (which, you will recall, is IBAC in disguise), we are dumping an additional -23 dBc into the first adjacent channel. This makes the total -22.8 dBc, or an increase of about 16 dB. Therefore, on average *adding IBOC to an FM station creates an increase of 16 dB in interference power that is co-channel to a first adjacent station.* For a lightly modulated signal with ß = 0.22 dB/kHz, the increase is a whopping 47 dB.

The spectral distribution of the interference is important, too. The analog interference power is highest at the edge of the first adjacent channel, and drops rapidly as its carrier frequency is approached. The digital spectrum, on the other hand, is flat, spanning the range from 2 to 71 kHz from the first adjacent carrier frequency. Therefore, it is likely to have an even greater impact than the 16 dB increase would indicate.

RECEIVER CONSIDERATIONS

This analysis helps to shed some light on the results previously published by iBiquity on "analog compatibility" of IBOC with several different FM receivers. For example, the Delphi car receiver continued to perform well when subjected to first adjacent analog interference at D/U (desired/undesired signal power) ratios as low as -14 dB. When IBOC was added to the interfering signal, however, reception became badly degraded at +6 dB D/U (the FCC protection ratio), and unusable at lower D/U ratios.

Similarly, in second adjacent interference tests, the Technics home receiver still functioned adequately at -40 dB D/U (the FCC protection ratio), but with IBOC added, it was unusable at D/U ratios below -30 dB. The latter situation is particularly interesting, since a second adjacent at -40 dB D/U creates a new first adjacent interference source at -17 dB D/U, which is 23 dB higher than the first adjacent protection ratio.

It should therefore come as no surprise that there are already reports coming in about stations losing fringe area coverage due to IBOC interference, and when IBOC becomes more widespread, coverage beyond the protected contours many stations now enjoy will largely be a thing of the past. Moreover, serious interference inside protected contours appears to be quite possible, which could prove to be interesting, even prompting some litigation.

AM IBOC

The AM IBOC system bears a superficial resemblance to the FM system, but it is different in several important respects. First, the transmitted spectrum is considerably more complex, consisting of three separate pairs of sidebands: the tertiary, secondary, and primary sidebands, located in the regions from 0 to 5 kHz, 5 to 10 kHz, and 10 to 15 kHz from the carrier frequency, respectively.

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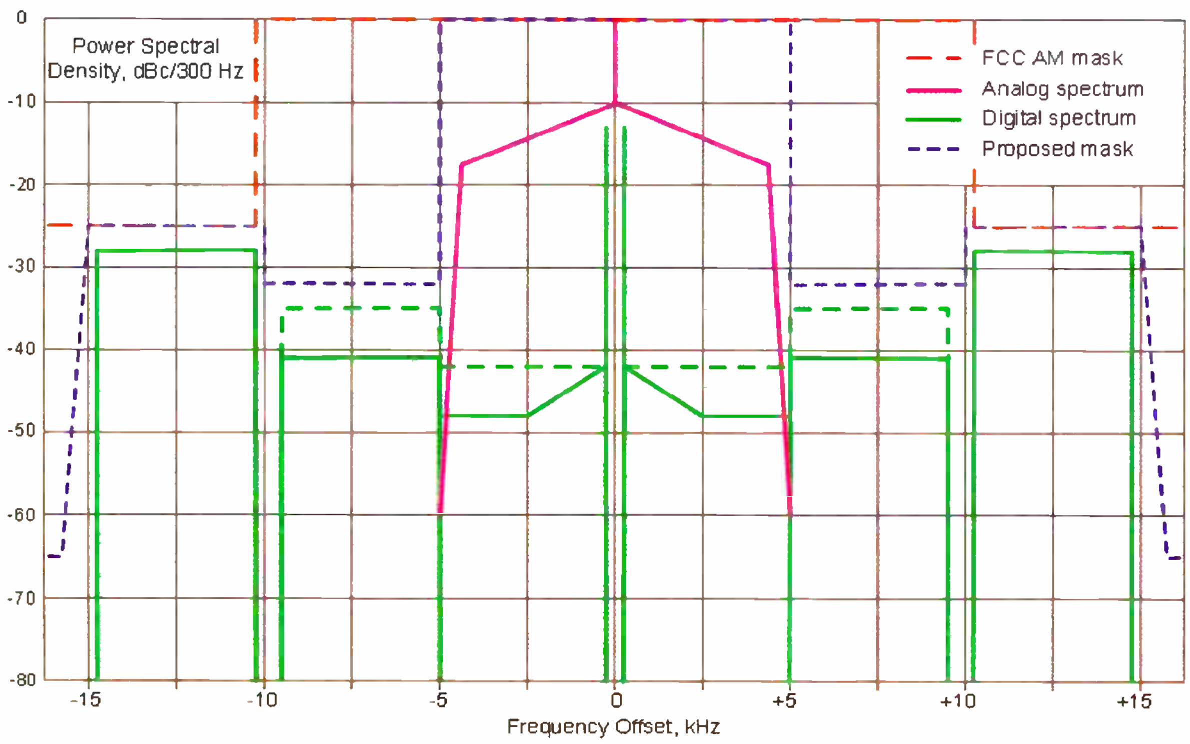
A Look at the Digital Horizon

Continued From Page 8

The bandwidth of the analog signal is reduced so that it occupies only the ±5 kHz region. The tertiary sidebands that lie under the analog signal are modulated as quadrature pairs, producing a constant envelope signal which in principle should produce no audible output from a standard AM detector.

Because of varying power levels in the different sidebands, it is best to consider separately the three frequency zones in which those sidebands fall. In order to relate this to the real world, we will assume the analog carrier power is 50 kW; for lower transmitter powers, just scale the numbers appropriately. Here is how it breaks down:



Power Spectral Density for AM IBOC

Another difference from the FM system is the existence of two tiers of quality: core mode, which provides monophonic audio encoded at 20 kb/s, and enhanced mode, which raises the overall audio bit rate to 36 kb/s stereo and adds a 0.4 kb/s ancillary data stream. Core mode depends on the primary sidebands that, as we shall see, have much higher power levels than the other digital sidebands.

The upper and lower primary sidebands carry the same information, but are offset in time by about 4.5 seconds. This provides a time diversity function, so that impairments such as noise bursts do not interrupt the core data stream, provided they are short in duration.

For the enhanced mode to kick in, the data carried by the secondary and tertiary sidebands must be decoded with a sufficiently low error rate. Since they are at lower power levels and lack the time diversity feature, this mode is considerably less robust than the core mode, and its coverage contours tend to be significantly smaller.

Just how much smaller is difficult to discover, since iBiquity is careful not to disclose which digital mode is operative when they publish coverage maps for the hybrid AM system (except for some of the older tests – for an eye opener, go look up the one they did with KABL).

ANALYZING THE SPECTRUM

In any case, our focus here is interference to analog service. And to study that, we need to know what power is contained in the digital signal, and how its spectrum is distributed.

Most people probably assume the total digital power is 20 dB down from the analog as it is in the hybrid FM system – and IBOC proponents do not go out of their way to disabuse us of that notion. In fact, you never see the figure quoted anywhere. The only way to determine it is to get the system specification and do some calculations. We will do that, but here is a hint: the answer is nowhere near -20 dBc.

CALCULATING SPECTRAL POWER

0-5 kHz: In addition to the tertiary sidebands, there is a pair of reference subcarriers and a pair of data service subcarriers. The total power in the reference subcarriers is fixed (250 watts), but there are two choices of power levels for the rest. The total power in the 50 subcarriers making up the tertiary sidebands is 100 watts or 37.5 watts. The total power in the data service subcarriers is either 20 watts or 5 watts. So, the grand total for this zone is 370 watts or 293 watts.

5-10 kHz: This zone contains the secondary sidebands (50 subcarriers) plus a pair of data service subcarriers. Here again, there are two selectable power levels. The total power in the secondary sidebands is either 500 watts or 125 watts, and the power in the data subcarriers is 20 watts or 5 watts, so the total for this zone is 520 watts or 130 watts.

10-15 kHz: This is the simplest zone, yet the one that causes all of the trouble! It contains just the 50 subcarriers that make up the primary sidebands. The total power here is 2500 watts, or -13 dBc. This may come as a great surprise to some people! If you ask someone who is running AM IBOC, they will probably tell you that they set the power in this region to around -28 dBc.

The discrepancy occurs because most people measure AM IBOC using a spectrum analyzer with 300 Hz resolution bandwidth, which is the usual procedure for checking compliance with the NRSC mask. But that is the power spectral density, not the total power. To get the latter, you have to include the full span of the primary sidebands (about 8.7 kHz total) by adding 10log(8.7/0.3) or 15 dB.

So, let us sum it up: the total digital power from a 50 kW IBOC station will be either 293 + 130 + 2500 = 2923 watts, if the lower power setting is selected, or 370 + 520 + 2500 = 3390 watts on the higher power setting. This is only 12.3 dB or 11.7 dB below the analog power, respectively. The NRSC evaluation report on AM IBOC says that a total digital power of -12.4 dBc was used during testing, indicating use of the lower power setting, but the difference is really inconsequential. In round numbers, the total digital power is -12 dBc, or 8 dB more than in the FM system, and the majority of this power falls into the first adjacent channels.

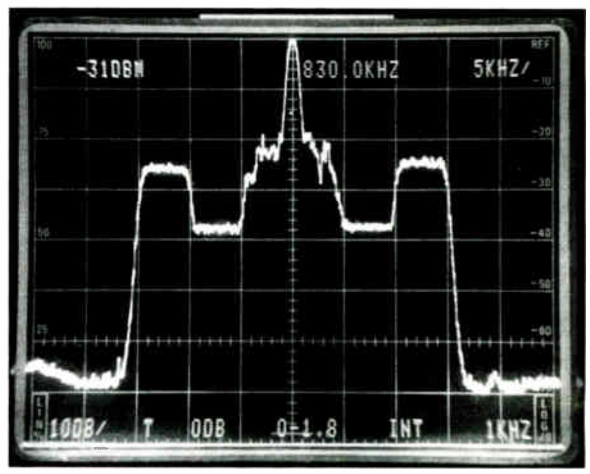
So, what does this do to the occupied bandwidth?

HOW WIDE IS IT?

Unfortunately, there is no convenient mathematical model for the analog signal, as in the FM case. Judging from spectrum plots I have seen, and what is required to stay under the NRSC mask, I will hazard a guess that the occupied bandwidth of a typical AM signal is no more than 14 kHz (i.e., 99% of the total power is within ±7 kHz of the carrier frequency).

Now, when the digital signal is added, it gets easier to estimate the occupied bandwidth. About 5% of the total power (analog plus digital) is in the primary sidebands, and they have a spectrum that is essentially flat, so we have to include about 4/5 of them on each side in order to get to 99% of the total power. This takes us out to nearly ±14 kHz, so the occupied bandwidth is about 28 kHz. So, by an estimate that is probably conservative, *adding IBOC to an AM signal increases its occupied bandwidth by roughly 100%.*

The total power output of the 50 kW station becomes 52,923 watts, a 5.8% increase. That is a lot more than in the FM system, but here again, the real problem lies in where that power goes within the spectrum. With that 2.5 kW in the primary sidebands, the station is in effect being allowed to establish two new 1250 W stations on the first adjacent channels. These "stations" are transmitting, essentially, wideband noise modulation at 100% duty cycle.



A Typical AM IBOC Spectrum

It is an amazing deal: each station gets two new ones, on channels for which they hold no license, with no technical studies or coordination required! However, anyone familiar with the AM band allocation standards should recognize this as a recipe for disaster.

LOST PROTECTION

Consider the protection for first adjacent stations. This was tightened up to +6 dB D/U by the FCC in 1991, but for the vast majority of stations, the old standard of 0 dB on protected contours still applies. It also applies to the international agreement between the US and Canada.

What this means is that if you have a first adjacent at 0 dB D/U, when they fire up IBOC, you also now have co-channel interference at +16 dB D/U. This is fully 10 dB higher than would be permitted if the usual +26 dB D/U co-channel protection rule were applied.

The Canada-US agreement also has second adjacent protection, set at -29.5 dB D/U. If a second adjacent station at this D/U level turns on IBOC, they will create a new first adjacent interference source at -13.5 dB D/U, which is 13.5 dB higher than would be permitted by the first adjacent protection rule.

Rising noise levels are always a concern in AM broadcasting, but in many ways IBOC is an unprecedented threat. If it achieves widespread use and operation is permitted at nighttime, the hybrid IBOC system will effectively cause a quantum leap in the AM band noise floor all over North America, and the coverage of AM stations will suffer correspondingly, especially in rural areas.

Broadcasters should be viewing this development with considerable alarm, and proceeding with caution instead of rushing headlong into disaster.

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Spectrographs Courtesy of Burt Weiner

Digital Guide

Listening to a DRM Signal

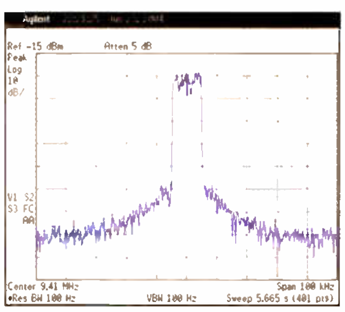
by Paul Christensen, CPBE

[JACKSONVILLE, Florida - July 2004] As we watch the rollout of IBOC in the US, it is interesting to note many other countries are also doing a rollout – of DRM. To get an idea of what this technology sounds like, I have been listening to DRM broadcasts on the SW broadcast bands where DRM transmissions are growing in popularity. Despite the present technological shortcomings as discussed in this article, the DRM broadcasts do sound exceptionally good.

DRM OVERVIEW

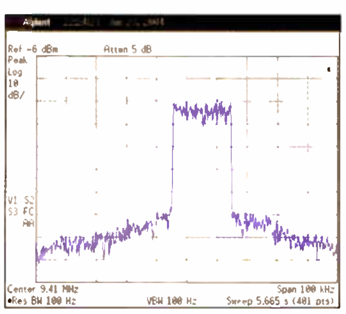
The DRM system supports a data multiplex that is transmitted using Coded Orthogonal Frequency Division Multiplexing (COFDM) multi-carrier modulation. The multiplex can support up to three data and audio streams. The carrier density is high within the transmitted spectrum mask, typically in the order of 200 carriers within 10 kHz of bandwidth.

In order to allow the system to be best adapted to the transmission channel and propagation path, (i.e., the LW, MW or SW bands, and ground-wave or sky-wave propagation), three different DRM coding modes are supported: A-Ground-wave; B-Sky-wave; and C-Robust. Additionally, in order to allow for progression from preexisting AM DSB conditions, it is possible to select various bandwidth and simulcast options (e.g 4.5, 5.0, 9, 10, 18, 20 kHz) to meet regional regulatory requirements.



DRM 10 kHz Bandwidth
23.6-36 kbps Data Rate

For data rates of about 16 kbs and above, the MPEG-4 Advanced Audio Coding (AAC) algorithm is normally selected for audio coding. For lower bit rates, an MPEG-4 CELP speech algorithm can be selected. In either case, where it makes optimum use of the available data rate, an optional Spectral Band Replication (SBR) bandwidth extender tool can be enabled and controlled under the direction of the broadcasting facility.



DRM 20 kHz Bandwidth
55-72 kbps Data Rate

In all modes, data is transmitted using either under (1) equal error protection (EEP) where the protection of the data is equal for all bits of data; or (2) unequal error protection (UEP) where the more sensitive parts of the data may be prioritized and afforded a higher degree of protection. Moreover, a hierarchical coding mode may be selected in which the multiplex is split into two simultaneously transmitted streams, but each with different modulation (e.g. 64-QAM and 16-QAM). Under this coding structure, the failure point signal-to-noise ratio is different for the two data streams.

RECEPTION CONDITIONS

The equipment used during the listening tests consisted of a Ten-Tec RX-340 commercial DSP receiver, Hewlett-Packard Z3801A 10 MHz GPS-locked ultra-high-stability frequency reference, Force-12 Sigma 40 antenna, DRM software version 2.0.34, and a Dell 4600C PC with full-duplex sound card.

Since I already had a Ten-Tec RX-340 commercial-grade DSP receiver, the addition of DRM software on my PC turned out to be an easy way to decode DRM broadcasts. The receiver's low-level (-10 dBv) audio output is connected directly to the PC sound card audio input. The RX-340's I.F. and audio frequency response is measured flat to +/- 0.5 dB from D.C. to the upper DSP filter skirt of 16.2 kHz.

In order to adequately decode DRM transmissions, it is necessary to center the DRM spectral envelope within the receiver's I.F. passband. Ten-Tec recommends a +2 kHz passband tuning (PBT) shift in upper-sideband (USB) in order to achieve maximum response flatness out to 16.2 kHz, but I have found using Fast-Fourier-Transformation (FFT) software and an external tracking signal (WWV) is the best way to ensure the DRM modulation envelope is optimally centered within the receiver's passband.

For control software, I am using Carl Morechi's RX-340 graphical-user-interface, which also allows for more incremental changes to the PBT. Hopefully, a new firmware release from Ten-Tec will make these adjustments more user-friendly for DRM users. Ideally, the selection of the DRM modulation mode on the receiver's control panel will automatically invoke the necessary mode, bandwidth, and I.F. passband settings.

SIGNAL QUALITY

My initial observation is that DRM transmissions are very immune to atmospheric static crashes. For example, in the middle of listening to DRM broadcasts one evening, we had a thunderstorm roll through the north Florida area. Nevertheless, not once did I experience a loss of receiver lock due to static interference. Provided that deep fading is not present during reception conditions, DRM holds up tolerably well.

Later that evening, I switched to Radio Kuwait on the 25-meter band and noticed the signal-to-noise ratio had degraded to 12 dB but there was little signal fading and I was able to decode the transmissions perfectly for approximately thirty minutes. The overall audio performance of DRM is analogous to listening to a moderately low-bit-rate (20 kbps) AAC Internet stream.

As long as the DRM software remains locked to the transmitted data stream, there is essentially no difference in audio quality during periods of light to moderate ionospheric changes. But once the received DRM signal becomes unlocked, you have already missed several seconds of content before lock is re-established.

At least under analog conditions, the human ear does a reasonably good job of resolving the effects of deep sky-wave fading. As receivers with internal DRM firmware evolve, the time required to achieve a locked data stream may improve.

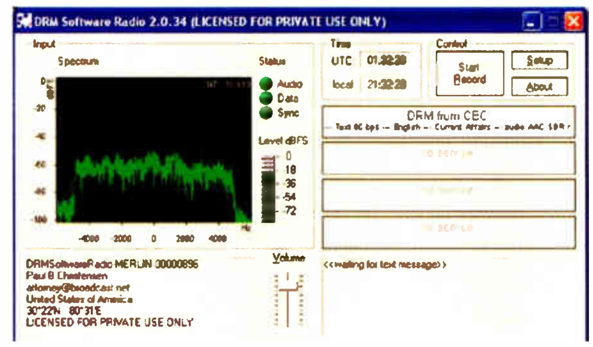
During the Radio Kuwait broadcast at 2200 UTC, the bit-rate was substantially reduced (as confirmed by the DRM software status panel), which contributed to a more robust decoding under much more adverse conditions, albeit fading was much less severe than that experienced with broadcasts from the Radio Netherlands Caribbean relay point at Bonaire and the Canadian Broadcasting Corporation. As expected, these broadcasts are extremely strong in signal strength – but were subject to extreme fading, owing to the multiple arrival angles into North Florida.

DEEP FADES AND DISTORTION

I noticed that DRM transmissions are susceptible to deep ionospheric fades and atmospheric phase distortion. For example, during my reception of Radio Netherlands, fading was as deep as 30 dB with respect to maximum received signal strength. As previously discussed, during periods of deep fading, the DRM software would completely unlock and it would take several seconds to re-synchronize, when all would be well until the next fade a few seconds later.

The DRM technical consortium recommends slow receiver AGC attack and release times but little difference was noticed when trying several settings, including a complete AGC bypass where I manually rode I.F. gain. Receivers with integrated DRM firmware decoding may do a better job during the recovery period when compared against the software/PC decoder system that I am presently using.

The spectral response of a typical DRM transmission in which a reasonable signal-to-noise ratio (> 18 dB) is attained appears in the following DRM software screen-shot image:

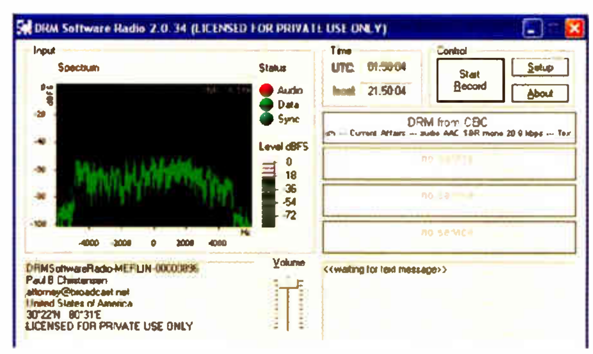


The image above was taken during a DRM transmission from the Canadian Broadcasting Corporation's (CBC) Sackville, Canada broadcasting facility. The CBC transmission was beamed to the southwestern United States on the 49-meter shortwave broadcast band.

As evidenced by the swept spectral plot above, the DRM modulation envelope is tightly contained within 10 kHz of spectrum. Since we are observing the spectral bandwidth at great distances from the source, the quality of the observed occupied spectrum is greatly influenced by ionospheric propagation, atmospheric noise, and other interfering sources.

Also note the scrolling text window that displays station identification, audio coding and other related information. A powerful attribute to DRM is that it can be scaled and fractionalized, providing multiple audio programs and corresponding text messages to match the content of the broadcasts.

The manifestation of atmospheric phase distortion appears in the DRM software screen capture below. Note the extreme non-linearity in what is ideally a smooth and flat digital modulation envelope within the transmitted passband. In this condition, the DRM software fails to synchronize with the transmission during an ionospheric fade and complete loss of audio occurs. The following screen capture was taken several seconds after the preceding image.



CONCLUSION

DRM was designed for use under a variety of broadcast transmission modes and frequencies, but my listening experience leaves me skeptical as to its long-term popularity among the shortwave broadcast community.

The DRM algorithm does seem to be evolving and improving over time. But since extreme ionospheric fading and phase distortion is pervasive between 5 and 30 MHz, shortwave DRM listeners will likely require a diversity-antenna reception approach, as listeners are not going to tolerate severely broken transmissions despite the dramatic improvement in audio quality.

I have not yet had an opportunity to observe the transmitted RF mask of DRM versus IBOC, but the AM broadcast band would seem to be a much better medium than shortwave for DRM transmissions. Rapid, deep fading due to nighttime ionospheric shifting is not as common on the MW frequencies.

On the other hand, co-channel interference will likely be an issue for those listening equidistantly between stations, much the same as the issue currently exists for nighttime IBOC AM transmissions.

Paul Christensen, has been a broadcast and broadband engineer in the Jacksonville, FL area for over 20 years, and now has a legal practice specializing in broadband CATV law. You can contact Paul at attorney@broadcast.net

Saving AM (again)

by Robert Meuser

IBOC is often hailed as "salvation" for the AM band. Yet, many young people today have never heard of AM: there is literally nothing they want to listen to on AM. Is AM headed for the junkyard of history? Robert Meuser offers his suggestions for revitalizing a medium that again has fallen on bad times.

[NEW YORK CITY, New York - July 2004] AM broadcasting has been on the verge of dying for 50 years. At various times different people have come along with plans to save the medium. The first time was in the early 1950s, although it was not so much a threat to the technology of AM as it was a threat the emerging Television medium brought to the radio programming of the day.

RECOVERING FROM TV, THEN FM

It was not technology that recovered an audience for AM, but the likes of Allen Freed, Murray the K and many other DJs of the day who brought a new music format with a new music style. As soap operas and dramas quickly faded away and found a new home on TV, AM radio entered a new Golden Age and grew stronger with a new generation. FM radio with its improved fidelity and resistance to static languished in the shadow of AM for decades, including nearly a decade after broadcasts were possible in stereo.

During AM's second Golden Age, many stations were added to the crowded spectrum and the resulting interference was one reason that AM receivers began sounding ever poorer and FM was becoming ever more a threat.

After the FCC forced separate content on FM, many owners let young, often underpaid DJs play music considered not commercially successful just to meet the Rules. This was the beginning of FMs rise to popularity. (As previously with AM, it was new content that pushed the transition.)

Many felt the solution to saving AM again was higher fidelity receivers and stereo. Much effort and technical expertise was put into the project, only to meet with little public acceptance (or even understanding). It seems the general public cared far less about the quality of what they listened to than the content. Talk radio evolved and pushed many AM stations to very high earnings. But again, it was content that saved the day.

NEW THREATS

AM (and now FM) Radio faces new threats in the 21st century. They come from numerous new technologies – from satellite to Internet programming – all of which offer many more personal choices than does the older radio technology. So once again AM needs to be "saved" – and to a lesser degree, so does FM.

For many, the answer this time is "digital." Anybody who has worked with IBOC or DRM on AM frequencies will tell you how much better the audio quality is with the technology. And in many cases this is very true.

The problem is that history teaches us better sound alone does not save the day. The digital technologies available to broadcasters either offer or have the potential to offer much more than is being exploited. Multiple program streams and the technical capability to solve propagation issues are but two examples.

HANDLING THE CHALLENGE

We have a lot of issues to deal with and problems to solve in a transition to digital, which is what makes engineering a challenge – and sometimes fun. We are learning that most transmitters will have to be replaced in order to go digital. Another technical challenge is a better means of delivering content as the current satellite delivery systems can produce serious artifacts when being re-compressed for digital radio. And to meet consumer demand, a means of delivering both text and pictures to the receiver will be a necessity.

Rather than looking at how radio was ten years ago when digital systems first were being developed, it would serve us better to look forward and realize we never really know how things will end up. AM radio itself was never planned; it was the result of unintended consequences by experimenters of the day. Ironically it began as a "talk" medium, music came later, only to return to talk formats being the driving force.

In many ways, the broadcast model evolved from a haphazard emulation of newspaper practices of the day. FM and FM stereo were more planned systems, but did not attract enough listeners, at least at first. The eventual popularity of FM came in part from FCC initiatives, as well as the unintended consequence of many owners doing what was least expensive and most expedient to comply with the Rules.

LOOKING FORWARD

Digital radio opens the door to delivering more than just audio. Hopefully it will also permit the delivery of multiple program streams and blend to analog only as an option. One frequently cited example is that of satellite radio delivery of traffic. Creative digital radio would be flexible enough to deliver a low quality stream of similar data.

Creative engineers and programmers can make digital an exciting new chapter in broadcasting. Those pioneers who succeed with this new broadcast technology will do so not just because it sounds better. We just might need more of what sounds worse – but is much more interesting to the audience.

Robert Meuser has been watching technology changes for more than three decades. He can be reached at robertm@broadcast.net

Leading POTS Codecs Compared.

	Comrex Matrix	Tieline Commander	Zephyr Xport
Audio Bandwidth @ 24 kbps @ 19 kbps	14 kHz 11.2 kHz	15 kHz 9 kHz	**15 kHz** **15 kHz**
Direct Internet Software Updates	No	No	**Yes, via Ethernet port**
Digital PC Audio Input	No	No	**Yes, via Ethernet port and supplied driver**
Audio Metering (XMIT/RCV)	Transmit only	One-at-a-time	**Simultaneous**
Audio Processing	None	Simple AGC	**Digital multi-band AGC with look-ahead limiter by Omnia**
Remote Control	No	RS-232 and dedicated computer	**Ethernet via Web browser**
Auto Dial Storage	19 Numbers	50 Numbers	**100 Numbers**
Frequently-Used Settings Storage	none	none	**30**
Standards-based POTS Codec	No - Proprietary	No - Proprietary	**Yes - aacPlus (MPEG HEAAC)**
Transmit-Receive Quality Display	No	Yes	**Yes**
Contact Closures	2	2	**3**
Display Resolution	120x32 LCD	120x32 LCD	**128x64 LCD**
Analog Cell Phone Interface	Optional	Standard	**Standard**
Mixer Inputs	1 mic, 1 mic / line	2 mic / line	**1 mic, 1 line**
Phantom Power	No	No	**Yes - 12 volt**
Automatic Voice-Grade Backup	No	No	**Yes**
Power Supply	External	External	**Internal auto-switching**
Local Mix Audio Outputs Headphone Line Level	 Yes Yes	 Yes No	 **Yes** **Yes**
Direct Receive Audio Output	No	Yes	**Yes**
Uses ISDN at the Studio Side for More Reliable Connections	No	No	**Yes - your Zephyr Xstream becomes universal POTS and ISDN codec.**
Available ISDN Option	$850.00 (adds MPEG L3 & G.722)	$850.00 (adds G.722)	**$495.00 (adds G.722 & state-of-the-art AAC-LD for high fidelity and low delay)**
List Price:*	$3,700.00	$3,650.00	**$2,495.00**

The world's most advanced POTS codec
is also the world's lowest priced POTS codec.

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If you need a routing switcher but aren't made of money, consider Axia, the Ethernet-based audio network. Yes, Ethernet. Axia is a *true network*. Place our audio adapter nodes next to your sources and destinations, then connect using standard Ethernet switches and Cat-6. Imagine the simplicity and power of Ethernet connecting any studio device to any other, any room to any other, any building to any other... you get the idea.

Routers are OK... but a network is so much more modern. With Axia, your ins and outs are next to the audio, where they belong. No frame, no cards, no sweat.

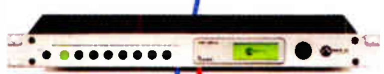
Scalable, flexible, reliable... pick any three.
An expensive proprietary router isn't practical for smaller facilities. In fact, it doesn't scale all that well for larger ones. Here's where an expandable network really shines. Connect eight Axia 8x8 Audio Nodes using Cat-6 cable and an Ethernet switch, and you've got a 64x64 routing switcher. And you can easily add more I/O whenever and wherever you need it. Build a 128x128 system... or 1024x1024... use a Gigabit fiber backbone and the sky's the limit.

Are you still using PC sound cards?
Even the best sound cards are compromised by PC noise, inconvenient output connectors, poor headroom, and other gremlins. Instead, load the Axia IP-Audio Driver for Windows® on your workstations and connect *directly* to the Axia audio network using their Ethernet ports. Not only will your PC productions sound fantastic, you'll eliminate sound cards and the hardware they usually feed (like router or console input modules). Just think of all the cash you'll save.

Livewire

There's a better way to get audio out of your PC. No more consumer grade ⅛" connectors – with Axia your digital audio stays clean and pristine.

Put an Axia Microphone Node next to your mics and send preamplified audio anywhere you need it, over Ethernet — with no line loss or signal degradation.



Put your preamps where your mics are.
Most mainframe routers have no mic inputs, so you need to buy preamps. With Axia you get ultra-low-noise preamps with Phantom power. Put a node in each studio, right next to the mics, to keep mic cables nice and tight, then send multiple mic channels to the network on a single Cat-6 cable. And did we mention that each Mic Node has eight stereo line outputs for headphones? Nice bonus.

Put your snake on a diet.
Nobody loves cable snakes. Besides soldering a jillion connectors, just try finding the pair you want when there's a change to make. Axia Audio Nodes come in AES/EBU and balanced stereo analog flavors. Put a batch of Nodes on each end of a Cat-6 run, and BAM! a bi-directional multi-channel snake. Use media converters and a fiber link for extra-long runs between studios — or between buildings.

An Axia digital audio snake can carry hundreds of channels of digital audio on one skinny CAT-6 cable. We know you're not going to miss soldering all that multi-pair...

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*Axia is already working with some great companies. Like Enco Systems, Scott Studios, Radio Systems, Balsys Technology Group, and of course Telos and Omnia. Check **AxiaAudio.com/partners/** to find out who's next.*

With a little help from our friends.
A networked audio system doesn't just replace a traditional router — it *improves* upon it. Already, companies in our industry are realizing the advantages of tightly integrated systems, and are making new products that reap those benefits. Working with our partners, Axia Audio is bringing new thinking and ideas to audio distribution, machine control, Program Associated Data (PAD), and even wiring convenience.

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"This sounds expensive." Just the opposite, really. Axia saves money by eliminating distribution amps, line selectors, sound cards, patch bays, multi-pair cables, and tons of discrete wiring — not to mention the installation and maintenance time you'll recover. And those are just side benefits: our hardware is about half the cost of those big mainframe routers. That's right... *half.* Once you experience the benefits of networked audio, you will never want to go back. AxiaAudio.com for details.

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Audio Processing From the Ground Up

Part 17 – Listening for the Right Sound

by Cornelius Gould

[CLEVELAND, Ohio - July 2004] When tweaking your station's audio processing for success, there are four key components that must be in place: a modern, competitive processor, solid knowledge of how that processor works, a concept for the "signature sound" desired, and clear ears.

While having "clear ears" may sound trivial, if you do not have them failure is assured. That brand new digital processor will not help, nor will your knowledge of all the tricks and tips about the box, nor even knowing exactly what signature sound you want. The ultimate in processing power and knowledge cannot overcome a lack of clear ears.

FATIGUE POINTS

In the last few installments, we have mentioned some ideas, tips, and tricks to get the sound you want from your audio processing. At the same time, we touched on how over-processing can create a signal that fatigues the listener. Perhaps more importantly, we mentioned the danger of ear fatigue in the person adjusting the audio processing chain, and how to minimize the effect.

This time around we will tackle in greater detail some listening techniques for setting up audio processing. To aid our discussion, I have made up a list of "Corny's Rules for Audio Processing." These Rules will help describe my particular audio processing technique.

At the same time, we will review a few important things in the area of ear fatigue, and some ways to minimize it. These tips may help you just as much (if not *more*) than some of the deep technical details of broadcast audio processing. Together, I am sure the following will help you with your audio processing adjustments. So, let us get to it!

RULE #1: KNOW WHERE YOU WANT TO GO

This Rule is very important on many fronts. Obviously, if you do not have a good idea of what you want to do with your audio, you are going to have a hard time getting a good sound. Typically, I start by listening critically to my station for a while and try to imagine what kind of sound would enhance the programming I hear.

With that in mind, I try as best I can to come up with descriptions of how I want the bass to sound, the highs, vocals, etc. That leads to a quick (or involved – it depends) conversation with the PD to see if he/she shares this "audio vision."

This Rule is very important when it comes to shopping for an audio processor! I have been emailed several times already by readers wondering, "So, what's the *best* audio processor to buy?" Yet, that is a question I cannot ask without more input. Why?

WHAT IS "THE BEST?"

What often gets overlooked is that there is no "one size fits all" audio processor. The correct audio processor for your application depends on what you are looking to do, and the size of your budget.

Audio processors range from very simple – to keep you legal, and not necessarily for loudness – to those built for loudness. Some are optimized for a "sound" the designers feel is best for you, with very simple adjustments to trim that pre-determined sound slightly. Others come with an arsenal of tools to allow you to do whatever you want – including getting yourself into big trouble! Still other audio processing choices fall somewhere in-between these two boundaries.

Having a really clear vision of the sound you want, and comparing the various features of each audio processor will take you far!

What works best for you depends upon your needs, and in many ways is not unlike shopping for a new car.

You can see how this works: everyone likes their favorite cars for different reasons. It is a pain in the rear to do the foot work, sometimes tiring and time consuming, but knowing exactly what you want from your new car (or an audio processor) will help you to ask the correct questions in your research to find the best choice.

After you have the processor of your dreams (or after you sit down in front of the one you have inherited) it is time to give attention to the next few Rules.

RULE #2: KNOW WHAT GOES IN ... AS WELL AS WHAT COMES OUT

A most important factor for me is to keep a solid grasp on the source audio. Frequently "A/B-ing" the off-air audio with program audio directly from the studio console is a very important step. It provides a wealth of aural information about what is actually going on with the audio processing.

Trying to tweak the processing without this reference inevitably finds me "running in circles" with the processing. After realizing the situation, I began to understand the meaning of one of Steve Church's favorite phrases: "It's like trying to nail Jell-O to a wall."

To pull this technique off at a transmitter site where there was no "program line feed," I once actually assembled a CD collection of all the currents in rotation on the stations. I would take these CDs to the transmitter site to A/B the CD audio: those CDs were my "program source" reference. Using them this way *really* worked to "stiffen the Jell-O" to the point where I *could* "nail the sound down" easily.

My point in comparing source to air is that by using this technique, you will be aware of whether or not you reach a point where you may be tweaking in too much emphasis on some parameter, getting you into trouble on-air.

Using the off-air signal is fine for a general reference when listening between yourself and your competitors during adjustments. Just do not forget to regularly check the program feed against the off-air signal to hear what you are *really* doing! It is much harder to tell when you are "beginning to step on the gas too hard" by listening off-air alone.

When you lose track of what *exactly* you are doing to your audio, you can quickly get into trouble with what seems to be some "unfixable distortion problem." Try not to lose your perspective. People often get hopelessly stuck with their processing and fail to back off on some parameter because they (easily) missed the subtle clues they would get using the A/B technique, letting them know they were in trouble.

This kind of monitoring has kept me sane many times when I thought I had discovered something I hated about "the processing" when certain songs play. Most of the time, a quick A/B check reveals it is just the way the song was recorded, and it has nothing at all to do with the on-air processing. Whew!

RULE #3: CONSIDER THE LISTENING ENVIRONMENT!

In addition to using the program source to keep your bearings, the listening environment will also affect the way you go about choosing the appropriate type of processing adjustments.

If your audience is mainly listening in cars, then you need to make sure the source-to-source levels are consistent. This does not mean you have to "squash" the audio into some sort of pulpy aural substance flowing forth from the speakers like Velveeta cheese. What it *does* mean is you have to carefully consider how to keep audio levels consistent without causing additional listener fatigue – a real balancing act, to be sure.

Processing for people listening on boom boxes will be different than processing for listening in cars, which will be different than processing for big stereos or clock radios or – you get the idea. The point is to listen on as many different radio sets as possible to get a true picture of how your audio processing adjustments are taking shape.

For "newbies:" keep in mind another enemy of accurate reception – Multipath Distortion! Multipath distortion takes on many forms, and can easily come across as distortion caused from too much clipping. The funny thing about this type of distortion is how it is often reduced as you decrease the amount of clipping used for loudness. This is a good reason to have different radios and use different locations to verify what you are hearing.

Those of you adjusting the processing for a "rimshot" FM signal or low power Class A station really have to be sensitive to how your processing adjustments may be aggravating multipath in ways that will cause your listening audience (or worse yet – the Boss) to believe that the signal is no longer as strong as it was before.

If your signal is not the best, and your audience is office listeners, keep in mind that there are a *lot* of computers in today's offices. This creates a lot of digital hash living at 100 MHz, with a detrimental effect on FM radio reception. Those rows and rows of computers sitting in or near to the cheap radios people take to their cubicles to listen to your station could fool you into thinking you have FM multipath even when you do not!

As a general rule in such situations, be very careful how you use clipping. It is usually better to be a little softer on the dial and preserve your coverage than throwing huge flames at the radio dial that just blow back at you and burn your own rear-end (so to speak)!

RULE #4: DON'T DO TOO MUCH AT ONE TIME!

In today's broadcast engineering world, there is not a lot of time to sit and diddle with the audio processing all day. I see this as a good thing, as it forces you to spread out the fine-tuning over a longer period of time.

In fact, some of the stations I get the most compliments on are the ones where the signature sound emerged slowly over the course of a few months.

Initially, try to get your sound close to some happy medium, where the DJs are fine with the way they sound in their headphones, and the way the processing feels while mixing on-air. Then, as you have a few minutes here or there during the course of several weeks, go in and tweak the processing parameters to emphasize a little more of this, smooth out that, fine-tune something else.

Eventually your desired sound becomes established. A nice thing about this approach is that the on-air staff rarely notices anything at all, since they were subtly nudged along with the changes until you and the PD were happy with the final on-air product.

Taking a longer period of time also helps to get around with the problem of listener fatigue-induced mistakes in judgment, the ones that can get you called on the carpet later.

As we continue this discussion, next time we will follow up on some of the practical tips & hints from this and the last article to help you get the sound you want!

Cornelius Gould's mission is to rid the world of bad audio. Meanwhile, he moonlights as Senior Staff Engineer for Infinity Broadcasting in Cleveland, Ohio. Corny can be contacted at: cg@radiocleveland.com

Radio.edu

A Newsroom on the Cheap

by John Devecka

[BALTIMORE, Maryland - July 2004] Well, this was a busy NAB. I saw a lot of things, but there was a lot more I did not get to see. Between chatting with old friends, talking, walking, making new friends, walking, eating, some more walking and meetings, I still managed to miss a lot of people and products.

Still, what I did see made the trip well worthwhile. For those of you that have not experienced an NAB, you really must get there. Nowhere else in the world can you see so much amazing gear in one place – nor so much hype and farce. But that comes with any trade show. This year I did have a goal in mind. I wanted to find a way to do a simple news desk for school stations. And I think I did!

A COMMON NEED

Many school stations need a way to do remote news and interview gathering, but have little space, engineering resources or budget to achieve this goal. At WLOY I have set up some simple desks, which are not really ideal, but are functional nonetheless. I really wanted to find a better way to do this – for us and you.

A basic news desk ought to be able to accomplish some simple tasks easily and quickly. It needs to have a telephone hybrid so a reporter can whip up a quick interview for a news report. A computer-based audio editing system that delivers quick composition and recording can ensure consistent work. Headphones, microphones and functionality need to be interfaced simply and easily, especially since many of the students doing news are not regular DJs.

Above all, a good news desk needs to have multiple busses so that hybrids work, editing works and no one has to listen to feedback, echoes or worse. Finally, to do it without breaking the bank or requiring a complex wiring plan, I needed a widget for all the ins and outs required of a news desk.

PUTTING IT TOGETHER

We will start with a new product from the folks at Henry Engineering, best known for their innovative solutions for common problems. Thousands of stations use Henry products like their remote relays to trigger on-air lights, or their level converter interfaces.

For NAB 2004, those crafty folks have come up with one of those wonderful things you did not really know you needed – or in my case, you knew, but no one made it. They call it the StudioDrive, and it fits into the standard drive bay of a PC (I suppose it might also fit a Mac, but finding one with a standard drive bay is a bit more of a trick). Thank you, Hank!

Henry Engineering StudioDrive

This nifty little box has everything you need for a simple news studio – or any other simple studio. It has a microphone input for the news person, a telephone hybrid interface for your remote interview, a spare input for all manner of options (second person in the studio, live music mix, etc.). And, most importantly, individual lines for the PC audio card, monitors and headphones. It is like they thought of everything.

Internal busing makes sure that you can route audio the way you want and monitor either the input (recording) or output (playback) of your PC audio. A simple interface box has all the 1/4" connection points for ins and outs neatly arranged and labeled. With the mix of balanced and unbalanced, mono and stereo inputs, you should be able to make almost anything work. And it all connects to the internal drive wiring harness in your PC for power.

So there you have a simple, in-PC mixer for $595. Of course, now we need the rest of the studio, so you can compile newscasts with ease.

ADDING MORE PIECES

While the StudioDrive has a built in tele-coupler, I would rather use a full hybrid for my studio setup. (You are free to disagree; after all it is your money.) However, since most schools now operate on a digital PBX system, I would suggest something simple like JK Audio's innkeeper PBX ($495) as the next step. It offers a compact solution for easy interfacing to a digital PBX system, with all those basic things you need – mix minus, level adjustments and easy connections.

I am already a fan of JK Audio gear, and using innkeeper rack mount units in my own news gathering desks right now. It all connects easily to the StudioDrive, but since the JK unit has XLR and the Studio Drive has 1/4" jacks, we do need a set of cables. Assuming that your engineering assistance is limited, perhaps you ought to order any adapter cables when you order the equipment.

JK Audio innkeeper PBX

Turning to the microphone itself, how about a new Studio Projects C1 condenser microphone and an LPB Silent Boom (of course, my bias shows a bit here). For relatively little money ($300) you get a clean, solid, large diaphragm condenser microphone and a heavy-duty arm ($160).

The StudioDrive has a microphone preamp, but my preference is usually to go with outboard preamps and processing if I can afford them. (Let your budget dictate this area.) I also prefer a tube in the audio path if possible, but I am not suggesting sending Doug Fearn $2,400 for a VT-1 preamp to put in my "newsroom on the cheap," much as I would like one. Instead you might try something simple like a Tube Pac desktop Microphone Tube Preamp/Compressor from ART ($245).

Since you do need to be able to hear what is going on, a simple inexpensive pair of AKG Headphones will get you there and leave change in your pocket. There are a zillion choices for decent headphones out there, but you need to determine how well each survives in your environment. Most stations will not buy big dollar headphones for DJs that play Samsonite Gorilla with them. AKG and Koss, among others, make very reasonably priced, good headphones.

AUDIO HORSEPOWER

Many schools have easy access to a generic PC through their IT departments. A screaming fast machine is not required; a 1 GHz Pentium III can be reasonably effective running audio software (Adobe recommends 2 GHz or better, and Windows 2000 or XP). Bump up the RAM to about 256 (Adobe would like 512).

I like the MIA Audio Cards from Echo. They sound good, are inexpensive, and have easy on screen controls. We have not had a failure or problem with any of the 15 in WLOY machines. However, there do appear to be some issues with the drivers and the newest version of Audition, so my only caveat – as with most computer hardware – is to suggest you download the latest drivers as soon as you set up the system.

To manipulate the audio, I would suggest Adobe Audition (the software formerly known as Cool Edit). Most folks know the old name, but the new owners were smart enough not to mess with success and the new version works just as well as the old. The latest version of Audition (V1.5) sells for $299. Note that Adobe offers both bulk licensing and discounts for educational institutions; check with your IT folks for their price for Audition – you will be pleased with the savings

Use a good-sized hard drive to provide storage for your projects – especially long interviews. A CD-R or DVD-R is a must for moving your files out to air or archives.

Of course, there are always lower or higher cost options. If you really must pinch pennies, drop down to a simpler microphone with a desk stand, lose the preamp, use the StudioDrive's built in coupler and cut costs quite a bit. Of course, the package may not be as tasty, but it will still work well.

Counting the Cost

Now you have a generic PC you can get from the IT department and a shopping list for a simple Newsroom. Better than that, it is *easy* to put it together. If you follow my basic recipe (as with all good recipes - modify it to suit your tastes), here is what you need:

1 Generic PC with CD-R - ask IT guys
1 Adobe Audition Software - $299.00
1 Echo MIA PC Audio Card - $249.00
1 Henry Engineering Studio Drive Mixer - $595.00
1 JK Audio Innkeeper PBX Hybrid - $495.00
1 Studio Projects C1 Microphone - $300.00
1 LPB Silent Boom Mic Arm w/riser - $185.00
1 ART Tube Pac Mic Preamp/Compressor - $245.00
1 AKG K110M Headphone - $45.00

Put it all together and a complete news desk is under $2,500, plus a PC. I took the liberty of calling one of my dealer friends – Dave Kerstin at Broadcasters General Store – to get a "street price" for a package like this. He says, "Buy Adobe directly, online; the rest of it is yours for $1,542 plus shipping." So there you have it: a new Newsroom for about $1,800 and a PC.

Come to think of it, since the StudioDrive has a couple of extra inputs, we could add an inexpensive dual CD player. This gives us a full production studio, and our cost would still be way under $2,500. How is that for making the most of a modest budget?

John Devecka is the Operations Manager at WLOY at Loyola College in Maryland. He tries to find ways to do the right thing with a bit less money. If you have improvements on this package, suggestions or general grumbles about it, please feel free to let him know! jdevecka@loyola.edu.

EAS Guide

Interfacing EAS Into a Digital Broadcast Audio Chain

by Dennis Baldridge, CSRE, CBNT

[RICHLAND CENTER, Wisconsin - July 2004] The advent of the 21st century has ushered digital electronics into the forefront of the broadcast industry. A few stations across the country have completed the necessary upgrades. Others are either in the process of making the transition, or making plans to do so in the future. I recently participated in upgrading an FM broadcast station.

DIGITAL GEAR

The improvements included a new Audioarts D-70 digital audio console, Moseley Starlink SL9003Q digital STL, Omnia 6FM digital signal processor and stereo generator, all of them feeding into a new BE digital ready transmitter.

The previous audio and RF path was all analog so among the new changes included using digital AES/EBU inputs and outputs. The cables were all connected and installed according to the manufacturer's specifications; the connections were straightforward and easy to accomplish.

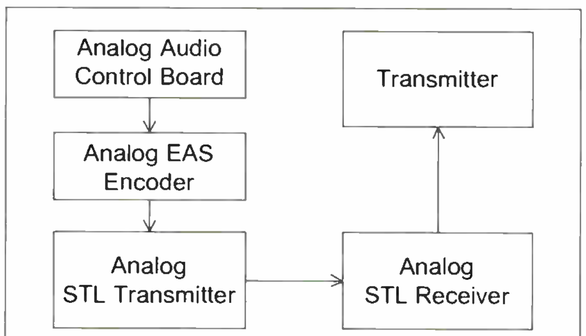
When the switchover from an analog path to digital was made, the system worked faultlessly the first time – truly an engineer's dream! Overall, the upgrade resulted in improved audio quality with a bit of signal delay due to the digital processing involved.

THE MISSING LINK

Upon final inspection of the new system, one item was discovered missing, something that engineers always include in the analog paths without a second thought. The new path – AES/EBU output of the control board to the digital STL to the processor at the transmitter building – was missing that key piece of equipment required to meet the FCC requirements: the all important Emergency Alert System.

The FCC's FM Broadcast Checklist states the following: *"EAS ENCODER/GENERATOR: All FM stations, with the exception of Class D non-commercial stations, are to have installed and operational equipment capable of transmitting the digitally encoded EAS protocol (73.11.34-35)."*

A quick look at the existing EAS encoder/decoder verified that there was no way to inject an EAS signal into the digital broadcast signal. The unit only had an analog output and lacked the AES/EBU output required for our new digital system. Our system needed a digital EAS unit!



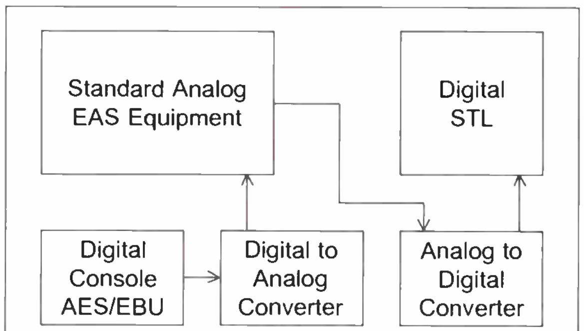
Typical Analog Audio/RF Path

Consequently, there was an immediate need to develop a plan enabling the broadcast of the required signals. Several possible solutions materialized as a result of contacting the manufacturers of EAS equipment and consultation with other engineers.

YOU DID SAY DIGITAL?

It quickly became evident that while many stations were talking about changing to an all-digital signal path, few had given serious consideration of how to insert the required EAS signal. Eventually, three solutions emerged from the research, some of which produce better results than others:

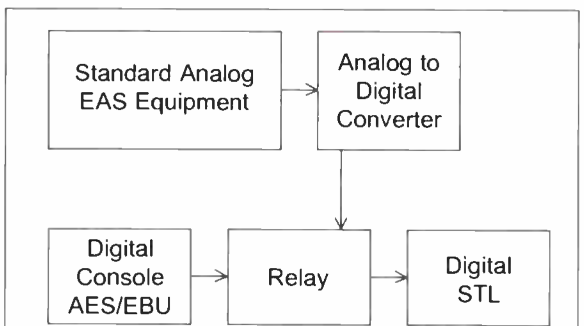
1. Break the AES/EBU audio chain between the digital console and STL, insert both a D/A (digital to analog converter) and an A/D (analog to digital converter) and use the EAS unit in a typical analog form.



Option 1

Since one of the goals in moving to digital audio is to keep the audio path as pure as possible, this option is less than desirable. Every time there is a conversion from the analog to digital domain, or vice versa, additional distortion and errors are introduced. Although one might be pressed to actually hear the distortion, this option seemed a step in the wrong direction since all digital was the future goal.

2. Install an A/D converter on the output of the EAS unit and use a relay to "switch in" the signal at the proper time.

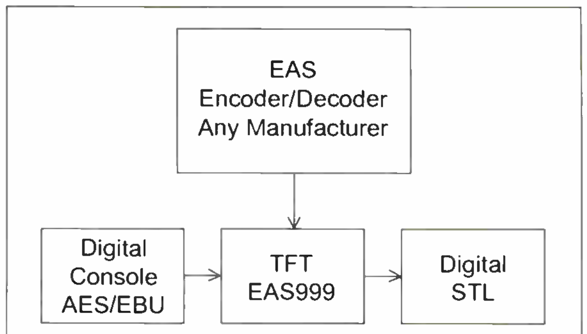


Option 2

This option presents some problems in that the digital signal of the converted EAS unit might not always be in sync with the main broadcast path. A relay switching only approach would not sense the incoming data stream, which could potentially cause a glitch, pop, click or even a delay in synchronization of the signal. This would not be a major disaster but is not ideal since an interruption of the AES/EBU signal would most likely result in lost data.

Such an A/D converter is made by M-Audio (www.m-audio.com) and is called the "Flying Cow." It would be important to verify that the data stream, including bit rate matched that of the main broadcast signal for this method to be effective.

3. Use a digital unit designed for interruption of the data stream.



Option 3

A digital insertion unit, such as the TFT model EAS999 (http://www.tftinc.com/products/datasheets/eas999.pdf) solves the problem of getting EAS audio inserted into the audio path. The EAS999 is designed to not only function with TFT EAS equipment, but is easily adapted to work with other manufacturers' products.

The TFT EAS999

USING THE EAS999

Use of the EAS999 is simple and straightforward. The AES/EBU signal output from the board goes directly into the unit. The output of the EAS999 will then connect to the digital STL. The unit provides seamless operation of broadcast signals and includes the following features:

- Signal detection and support of all popular sampling rates including 33, 44.1 & 48 kbps. Although it senses the incoming rate, it is transparent to the data stream.
- Switching from the broadcast signal to the EAS signal between data blocks to eliminate pops and clicks associated with abruptly inserting or changing a data stream (as in Option 2 listed above).
- Hardware bypass provides signal path in the event of a power failure within the unit.
- Standard XLR connectors.
- Easily connected to TFT EAS equipment or that manufactured by other companies.
- Front panel status indicators.
- Accepts Analog EAS audio inputs from any EAS Equipment, and does the necessary D/A conversion.

We found this third option – using the EAS999 to accomplish the digital insertion of the audio signal – to be clearly the most professional approach to solving this EAS dilemma. It provides seamless interruption of the data stream and at the same time provides the means to inject the EAS signal as required by the FCC.

In the future, as digital broadcasting becomes the industry standard, more manufacturers will produce equipment with both analog and digital switching included. This will certainly provide the options required for the next generation of broadcast facilities.

Dennis Baldridge is a contract engineer in SW Wisconsin (WDMP-AM/FM, WJTY) and the CE at WRCO-AM/FM Richland Center, WI. He can be contacted at info@7db.net

Camelot on the Moon

The Real Story of How We Managed to Fulfill Kennedy's Promise and Put a Man on the Moon

Continued From Page 6

WE MADE IT!

Standing there in my bathrobe, I suddenly realized there had been a second major problem related to the Intelsat failure across the Atlantic. Not only did it break the broadband data path to the US, but the broadcasters in Europe had lost their video channels back from the US as well. That was certainly important, for Kennedy's promise included showing pictures to the whole free world of the Americans being "first on the moon!"

How had they done it? I was probably the only person in the room who knew what it took to get video to the US so the mission could proceed. Then I recognized the familiar face and sonorous tones of Walter Cronkite coming from the TV set at some time around 3 AM in Madrid. He was talking about the astronauts preparing to open the hatch and climb down the ladder. Then he said some words that cut into me a bit.

Cronkite spoke about the heroic effort of satellite engineers to get video for broadcast in Europe. It seems they had uplinked US broadcast video received in Australia onto the Indian Ocean satellite. From there, the video was downlinked into an 85-foot dish swung around at Raisting, Germany to receive from the Indian Ocean satellite. He went on at length about how Raisting was feeding the whole of Europe's terrestrial television networks, instead of the usual routes via the failed Atlantic satellite. Someone else had been busy getting European video channels rerouted, too.

It seemed nobody – not even Cronkite – knew what a fragile, last-minute thread was carrying the NASA color video and sound we were all observing from the moon back down through Robledo, splitting it into a dozen submarine cable channels across the Atlantic to Greenbelt, Houston and ultimately back to him at CBS before it got out to the world! No one even asked: if there was no satellite to send video across the Atlantic to Europe, how did it get to them in the first place?

But then, does not The Phone Company or NASA just "take care of things," as always?

EPILOG

Some months after the event, the Director of NASA Communications sent me a lovely citation. It bears a color photo of an astronaut looking at his own footprints on the lunar surface. Part of the text reads, "in recognition of contributions toward NASCOM support of Apollo XI, the first manned lunar landing, July 20 A.D. 1969." Looking at that certificate today, it is rather difficult to believe that it all worked 35 years ago, without current day wideband digital techniques, microprocessors to compress color video to a portion of 48 kilobits, or millimicron wafer devices to do it with.

IT&T's own corporate brochures carried the achievement of the first wideband data circuit across the Atlantic as an IT&T "first" for a number of years. Robledo is still there, mentioned occasionally as being involved in current NASA missions, but it is doubtful anyone knows that was the place the famous lunar pictures came down to earth, or what a tenuous thread connected it back to the outside world.


Don Kimberlin

Telecommunications technology has evolved to the point that it may be a rather hum-drum part of the larger task. On the whole, America – and perhaps even NASA – did not even comprehend the drama in which we were engaged. They certainly had no notion of the geographic scope and depth of the infrastructure army being marshaled across the ocean in support of the Promise of Camelot.

Donald E. Kimberlin is President of Telecommunications Network Architects, based in Landis, North Carolina, where he continues to design and implement technologies the world has come to casually call "WANs." You can reach Don at: donkimberlin@earthlink.net

\\Networking\How To

Computer Security: Identifying the Real Threats

by Tren P. Barnett

[TUCSON, Arizona - July 2004] Remember the end of 1999? As the year began to wind down, so did the emotional state of many. The entire world was going to end at midnight January 1, 2000. Everyone depending upon modern technology was going to learn to rue "Y2K."

Doomsayers predicted great calamity as banks would no longer function, water companies would be shut down, electric companies – especially those running nuclear power – would overload and shut down. Some even claimed home computers and automobiles would stop running at all. A whole industry grew to sell Y2K solutions. Well, it is 2004 now.

LESSONS FROM Y2K

Why recall Y2K? That is because we should be able to learn a great lesson from what happened; a lot of the worry and panic currently happening in the computer security world is very similar to the run up to Y2K.

Y2K was much less a problem than predicted. In fact, many of the Y2K problems came from so-called solutions; more than a few users were taken advantage of by gurus who were supposed to be protecting them – numbers and problems often were drastically over-exaggerated in order to make a buck.

Now I am not implying there were no Y2K problems at all. Rather, I want to tactfully point out that some of those selling us security products may be the same individuals who took advantage of us less than five years ago.

BUYER BEWARE!

Unfortunately the world is a less than honest place to do business. Much of the business world has turned from providing what is best for the consumer to providing what brings in the most income. (I will not bother to substantiate my claims, the proof is so evident that it shouts out everyday.) The world of technology is no different; nerds are also greedy.

Of course, every business out there is not be attempting to take advantage of us, neither is every nerd. But the hype is great, and many were burned over Y2K from such hype. What really constitutes a security threat? Whom should we trust, and what should we watch out for? Where are the answers?

KEEPING PACE OR LOSING FACE

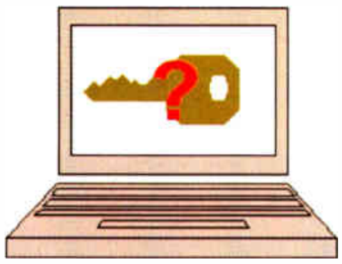
One of the biggest challenges for many today is just keeping pace with technological change. Unfortunately, this can set us up for a good scam. While none of us want to lose our privacy (or our pride), most users cannot keep pace with all of the latest products, hardware, and software, and often are easily convinced of a security flaw or breakdown in their computing tools. Can we keep pace, and if not, will we lose face?

Most have heard that Wi-Fi is insecure. And it is true: using wireless devices can expose a person to privacy invasion. But which wireless device is the most insecure with information? Is it the Wi-Fi card and router, the cellular phone, or perhaps a cordless phone? All can be culprits in privacy invasion, but to what extent and who is most guilty?

THE REAL LOSS OF PRIVACY

Consider what can be learned from a bank card. Yes I am aware a bank card is not a usually considered a wireless device. However, that nice little card they give you for shopping convenience speaks loudly about you. It steps on your privacy in ways about which most people never think.

Because of that little card, our buying habits, the days we are most likely to shop, and how to price and advertise accordingly, is bought and sold daily. The information gleaned from that little card is worth more than how to stock shelves – it is worth how to price what they stock and when, and therefore for what you will and will not *overpay*. In comparison, what can be gleaned from a wireless device in comparison?



The real truth is that data is being gathered on us daily. Honestly, in many ways Wi-Fi is far less of a risk than some would want us to believe. Yet a risk can be associated with Wi-Fi. To protect our privacy we need to identify the real security holes.

(Continued on Page 26)


DSPX Digital Audio Processor
18 x 24-bit DSP's providing 1 GIGA-MIPS of power
Comprehensive BLUE audio metering and screen
Digital and analog IO
Wide and multi-band AGC's with intelligent gating
Multi-band programme dependent limiting
Look ahead limiter and distortion cancelled clipping
DSP stereo encoder with composite clipping control
Back-panel and rackroom (front panel) serial control
LAN / Net webserver for remote control
Full range of user presets with live A/B switching
Software upgradeable
Dual processing paths for FM and DIGITAL RADIO USE HD/IBOC and NET)
BGS
Now available from Broadcasters General Store www.broadcastdealer.com
Version 1.0 now available
Available from top US broadcast dealers or factory direct from
www.broadcastwarehouse.com
call us free on
1-888-8661672
(6AM- 3PM EST)

Computer Security: Identifying the Real Threats

Continued From Page 24

OPEN LINES

The largest security breach may surprise you: some of the most damaging personal information can be gained merely by standing in a line and listening to a cell phone call. For example, while standing in line at the grocery store the other day, someone ordered pizza so it would be waiting when they got home.

This person used a credit card over a cell phone, and read the numbers and the expiration date out loud. (Have you ever noticed how *loud* many people speak on their cell phones?) This same individual quite possibly then went home and played on the Internet. Yet, when the credit card information turns out stolen, what will get blamed, the computer, the cellular phone, or their own foolishness?

I use this example because stealing information over a Wi-Fi connection is not an easy task. In fact it would be safe to say any information that could be stolen over a Wi-Fi connection is probably the same information that can be stolen over a wired network connection.

Actually, the biggest thing stolen via Wi-Fi is free Internet access at the expense of your connection, and the fix for this requires nothing more than following the setup instructions of your wireless access point or router. So worries about Wi-Fi become minimal compared to what we do with our personal data.

PROTECTING KEY DATA

Identity theft definitely exists and is a problem. We must be careful and protect ourselves. As you may have guessed by what I have written so far, most breaches are self-inflicted. Keeping track of you, what you are doing and stealing data without your help is not as easy as some would have you believe. Getting you to voluntarily give information away is far easier, and more cost effective. So then, security starts with us ourselves.

Computer systems do have holes that can permit security breaches, whether an Apple OS, Linux or Windows is running. If there is no need to keep bank account information on a computer, then do not do so. If you think there is a need, *re-evaluate thatneed carefully*.

Most people would not write down their credit card numbers and expiration dates and place them on the seat of their car. After all, everyone who looked into the car could have access to that information. Now would window tinting be the solution? Or is it better to not place the information on the seat of their car in the first place? All too often when we use our computers, our own laziness causes us metaphorically to leave information on the seat of our cars. Then we try to protect ourselves by "tinting the windows."

REAL ISSUES

The first thing any shrewd businessperson asks himself is: "Do I really need this product or service I am being sold?" The next thing they do is read the contract before they sign. Here is another area where security often fails.

On the other hand, how many users do you know who routinely ignore the end-user license agreements, just clicking on the "Accept" button? Many programs – even some that are supposedly protecting us – can hurt us. After all, when we install them, we agree to the terms of the license. Suppose that license says they can track, glean and store information about us (some end-user license agreements actually tell you they will)? Do we really need such programs?

In previous articles I have approached security from the standpoint of what tools really help. I again strongly suggest virus protection and hardware or software firewall solutions. Nevertheless, they will not protect us if we download and use applications randomly, and/or hand out information freely. It is critical to know what your computer is doing, by knowing what information it (and you) are giving out and why.

Select your help carefully. Many would-be experts exist, gladly charging you for nothing. I have seen good money spent protecting wireless connections when the real security issue was not the wireless, but who was looking over their shoulders. (No software exists for that problem yet.)

STAY CURRENT WITH PATCHES

The News and magazines are full of reports identifying newly found security holes. It seems new patches are offered for download on almost a daily basis. Many of the patches claim to fix possible ways some malicious application could exploit our computers.

Generally the patches *are* beneficial. Take advantage of all legitimate updates, since you never know when one of those "holes" could be used against you. Keep your virus signatures up to date, and use reliable firewalls. Some fear what a patch may break, yet more often than not, problems arise by failing to update than from the updates themselves.

A final thought: before spending your hard earned money for security, take some *time* to protect yourself first. Do not download every utility that comes along. Do Internet business only with trusted and reliable sources. Be careful whom you trust for solutions; while the threats are real, they can be over-exaggerated (remember Y2K). As you take these steps, you will uncover any real problems with your data system security.

Tren Barnett is a System Administrator and Programmer in Tucson, Arizona. He welcomes your questions on solving network problems in your facility. Contact Tren at tpb@aires.org

The Radio Guide Tech Initiative

As announced at the NAB 2004 Radio Show, **Radio Guide** magazine has embarked on a **Tech Initiative** to encourage the sharing of technical knowledge and experience among the engineering community.

As part of this outreach to encourage information sharing, a number of manufacturers have already contributed over $15,000 of gear, to be awarded to the best submissions. Some of the items include:

Audion Labs VoxPro Digital Audio Editor
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Henry Engineering Studio Drive Mixer
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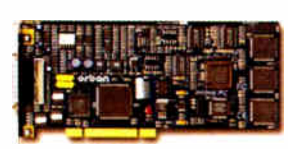
Orban Optimod 1100 Processor Card

What we are asking is for you to share your Tech Tips, User Reports and War Stories as well as longer articles on topics that interest you, from studio construction or renovation, to transmitter site maintenance, or the way in which you research new equipment purchases.

Do not worry about being a perfect writer; we will help you get it done. And besides the personal satisfaction of "giving something back," you will earn re-certification credits from the SBE, a check from **Radio Guide**, and the chance to receive one of the special awards.



More details will appear here. In the meantime, please address any questions or submissions to Editor@radio-guide.com.

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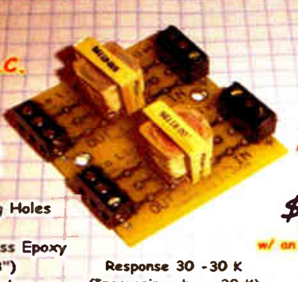

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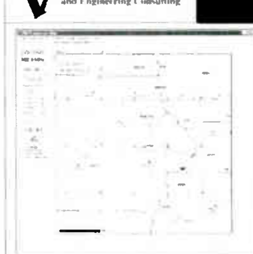

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Status and metering of a remote location is also via the same WEB-REM. Control functions appear as push-buttons on a web page. Status and metering functions appear as lights or meters on the same web page.

Four configurations of the WEB-REM are currently available. Two are designed for TTL inputs and outputs. One is designed with four control relays and four TTL status inputs, and one is a mixture of relay and digital outputs as well as digital and analog inputs. The WEB-REM IP address is also user changeable to match any IP address available.

The WEB-REM models also offer user changeable status and control labels on its web page which is internally generated by its own web-server. Connection to the network is via an RJ-45 10/100 Ethernet cable. Connections to the remote device (depending on model) is via a DB style connector or plug-in terminal block. (WEB-REM is a trademark of Titus Technological Laboratories)

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Burk Technology Offers $500 TC-8 Trade-In

Broadcasters using the Burk Technology TC-8 transmitter remote control system can now upgrade to the ARC-16 and take advantage of Burk Technology's $500 trade-in offer. From now until August 31, 2004, when customers purchase a new ARC-16 and trade in their TC-8, Burk Technology will offer $500 cash back.

In addition to providing twice the control and monitoring capacity of the TC-8, the ARC-16 offers multi-site capability with site-to-site control, and extensive hardware and software features not available in the TC-8 unit.

For details on the trade-in offer, visit www.burk.com/trade-in.

AMBER Alert Web Portal is Launched

By Clay Freinwald
Chair - SBE EAS Committee

[SEATTLE, Washington - July 2004] AMBER Alerts present a number of challenges. For Radio Broadcasters, the problem is that the EAS message only runs once. Broadcasters need to re-run the Amber message several times, especially early on in the emergency. The problem is where to obtain hard copy for the text of the message to be repeated.

What we needed was another communications system that would provide broadcasters with the required detailed information. After some discussion, we felt a website containing the necessary information would do the job.

Mark Allen, President of the Washington State Association of Broadcasters, who is a member of the Washington State SECC, was tasked with coming up with an effective solution. Working with other agencies, State Associations and the National Center for Missing and Exploited Children, the Amber Web Portal was created.

GETTING THE INFO OUT

This system allows broadcasters, and the public, to access information about AMBER Alerts, including detailed information that cannot be transmitted in the AMBER Alert EAS message.

The AMBER Alert Web Portal will not replace the EAS AMBER Alert activations, but will enhance it, by allowing local law enforcement in cities and states to post up-to-date information about an abducted child to a single location. This action will "push" that information out to any person who has subscribed to receive it. Law enforcement personnel, broadcasters and citizens will have the option to choose to be notified of alerts and status updates via e-mail, fax or text-enabled cell phone, or other Web service notification methods.

ADDING MORE STATES

The nationwide AMBER Alert Web Portal was developed by Washington and Arizona. Recently Arizona announced that they were activating the system for their state. An Arizona press conference was set to announce the financial participation of two Indian tribes.

There are seven more states that will be joining the AMBER Web Portal Consortium in the weeks following the launch of the Portal.

We will be providing instructions directly to stations on how to subscribe, import the Portal content into stations web sites, and other uses of the Portal. A major national press conference is scheduled in July to roll out the AMBER Alert Web Portal.

This project has been in development for more than 16 months – directed by the Washington State Association of Broadcasters, the Washington Department of Information Services, Washington State Division of Emergency Management, the Washington State Patrol and our counterparts in Arizona.

LOOKING AHEAD

My guess is that, given the enthusiastic interest communicated to me by my colleagues (many of whom chair their respective states' AMBER Committees) by the end of the year at least half of the states will be members of the Consortium and by this time next year nearly every state will participate. Stay tuned for updates on this program.

For more information about this system, contact Mark Allen and the Washington State Association of Broadcasters at: wa-broadcasters@earthlink.net


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