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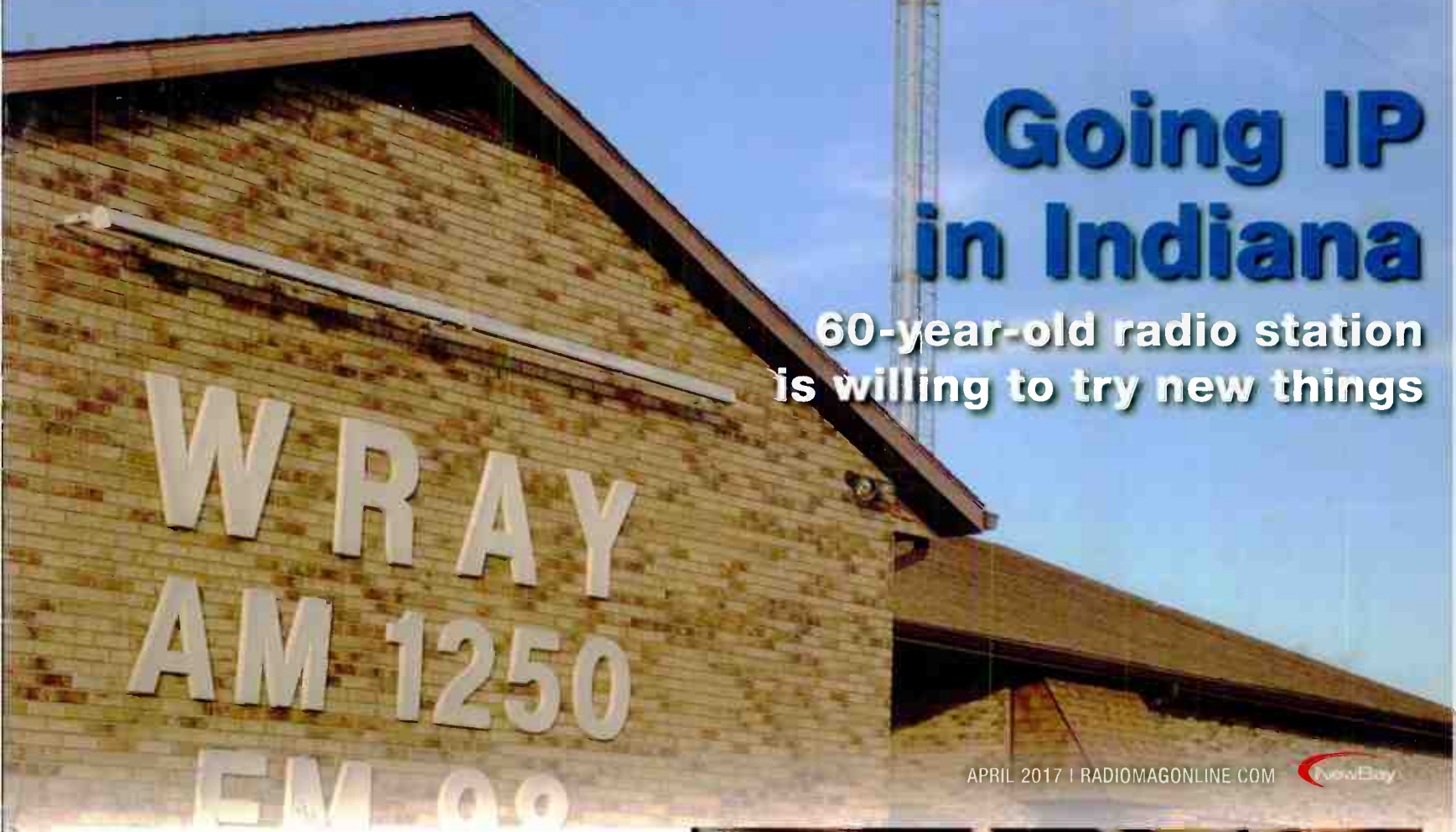

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WRAY(FM)'s on-air studio features a Wheatstone IP-12 and a Broadcast Electronics AudioVault

6 **Viewpoint**
On the Importance of Mentors

8 **Trends in Technology**
A Handy Road Map for Your NAB Show Transmitter Trek

24 **Facility Showcase**
WRAY Embraces Technology Changes With WheatNet-IP

30 **Tech Tips**
Broadcast All Your Audio on Live Social Media

32 **Managing Technology**
Consider Linux as Your Go-To Operating System

35 **FCC Update**
FCC Rules on Foreign Ownership Requirements

36 **NAB Show New Products**

42 **Sign Off**
Cliff's Crimper

On the cover: The WRAY(AM/FM) building and its 420-foot tower

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Tell us where you think the mic icon is placed on this issue's cover and you could win a **CBT-500 Audio Cable Tester**. Send your entry to radio@RadioMagOnline.com by **May 10**. Be sure to include your guess, name, job title, company name, mailing address and phone number. No purchase necessary. For complete rules, go to *RadioMagOnline.com*.

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VIEWPOINT

On the Importance of Mentors

One of the best things about going to the NAB Show is running into old friends and colleagues you haven't seen in a while, maybe since last year. If you are particularly lucky, you could run in to a mentor — someone who's both a friend and colleague.

We all have war stories — unless you just got into this business yesterday — and naturally, these tales are very timely. Other engineers understand their significance immediately. Mentor stories are more personal; you may not realize you even have one, or understand its significance until years after the fact.

When I started out in the business, I worked for a couple of consulting engineers who were doing everything they could to turn around a five-tower end-fire DA that never worked correctly. I was part of a valiant effort to forever fix this array, but after a certain amount of time and effort, all parties recognized we were tilting at a windmill that didn't have any future. The license has long since been turned in and the land covered with expensive houses.

Problems, I learned, don't always have easy solutions; in fact, sometimes none exist. Persistence is a great trait, but setbacks don't always resolve like they do in a 30-minute TV show. I was able to apply what I learned about directional antennas later in my career, at least.

Mentors sometimes provide opportunities that you would not otherwise find. One day, one of my original mentors called me and said I was needed to work on an old AM transmitter down south of San Jose, Calif., where I grew up. The local engineer was having trouble with it, and could I go take a look? I said sure; after all, I didn't work for the owner, and didn't have to worry about being fired should I not get the old girl fixed, right? I headed out.

By the next day, when the transmitter still had not returned to the air, my mentors called me up. They could have said, Did you give up? Were you not able to figure it out? Instead, they offered some encouraging words, and I headed back down with the items I felt I needed to fix the rig. They were still confident. Later that day, I had it going again. (This isn't a war story so I'll skip the details.) It was my first transmitter fix in the field, and it felt great. I was on top of the world — at least 'til the next problem.

Now that I've been in the business for over 30 years I find myself in the role of mentor (at least, I like to think so). You see, my mentees may not realize it yet, but one day they will. I hope at that point in time they think back to a thing or two that I was able to teach them — the values of persistence, of patience, and perhaps most importantly, the need to instill confidence in someone to whom you've delegated a task or project.

You likely have your own mentor stories. This month's edition is filled with articles that I know broadcast engineers are going to find interesting and hopefully enlightening. On our last page is the Wandering Engineer's tribute to his own mentor. I hope you read it and take a moment to reflect on where your career has gone and those that helped you along the way.

Thanks for picking up the April edition of Radio magazine. If you happened to discover us while attending the NAB Show, welcome! I think you'll like what you read, from cover to cover.

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Doug Irwin, CPBE AMD DRB | Technical Editor

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A Handy Road Map for Your NAB Show Transmitter Trek

by Doug Irwin, CPBE AMD DRB

The spring NAB Show in Las Vegas provides the best opportunity to get an up close look at all the high-dollar capital items you may need in the upcoming year.

In our March issue, we covered audio-over-Internet Protocol consoles and router systems; this month, we're looking at the latest in transmitter technology — the big players, of course, and some you may not have heard of before, all deserving of your attention.

There are multiple reasons to look at transmitters, including:

- Replacement of an old, tired main transmitter
- Addition of a backup transmitter
- Addition of an alternate transmitter site (perhaps with an N+1 methodology)
- Construction of an LPFM
- Construction of a translator site

As I cover various brands, I'll point out which transmitters could fit into each of those categories, just to give you some ideas to get your search started.

Let's head out to the floor!

ARMSTRONG TRANSMITTERS

Along with their line of AM transmitters, Armstrong (located in booth N8416) offers some FM transmitters.

The T series, which is a single tube, grounded-grid design, comes in power levels up to 35 kW. Armstrong's line of solid-state transmitters includes the FM-2500B, the FM series B (up to 12.5 kW) and the series C (up to 6.5 kW).

If you need a high-power exciter, or perhaps an LPFM transmitter, consider that Armstrong also offers a line of exciters, one of which is the FMX-300B. As its name suggests, it tops out at 300 W and features front panel frequency-agility, an LCD display of all parameters and full remote control and status indicators.

Armstrong FMX 300

Automatic power output control and VSWR protection are useful features, if you plan to feed an antenna directly; an optional FSK IDer and an optional stereo generator make it a candidate for a translator, as well.

BROADCAST ELECTRONICS

If you're searching for a new AM transmitter, consider Broadcast Electronics (booth N7512).

BE makes two lines of AM transmitters: The A series (500 W to 10 kW) and the E series, at 2.5 or 5 kW. Features common to the A and E lines are high efficiency, low acoustical noise generation and cool running temperatures. Power amplifier modules are accessible from the front panel. Either line is adaptable to HD or DRM.

BE offers FM transmitters in six power ranges: The single-tube transmitter line is the T-series with a range of 20 to 40 kW; the S-series offers a completely solid-state solution in the 4 to 20 kW range; the solid-state C-series range is from 500 W to 5 kW; the STX-LP series range from 1 to 5 kW; and the STXe from 5 W up to 500 W.

The STX-HP series includes the STX-10, BE's newest solid-state FM transmitter, requiring 22RU of vertical space in a standard rack (30 inches deep).

STX 10 makes use of hot-pluggable power amplifier modules and power supply modules, and achieves 70 percent AC-to-RF efficiency. The STX 10 can be accessed from any PC, tablet or smartphone, and is also SNMP V2 and V3 compatible.

Last year, Broadcast Electronics announced the release of a direct connection interface with the Davicom remote controls, making use of the built-in SNMP agent in the STX 10, and the SNMP manager in Davicom's DV-mini and the DV-208/216 remote controls.

STX 10 can also be used in an N+1 system, or in a single frequency network, due to a delay feature in the exciter. If you are planning to transmit HD Radio, you would then equip the STX 10 with a STXe 500 exciter.

BW Broadcast TR600V2

BW BROADCAST

BW Broadcast (booth N8631) offers up several "one-box" solutions for translators.

Their TR600 V2 combines the technology from the RBRX1 re-broadcast receiver and the V2 transmitter. The built-in receiver has audio and RF bandwidths configurable to meet "the most demanding applications." The

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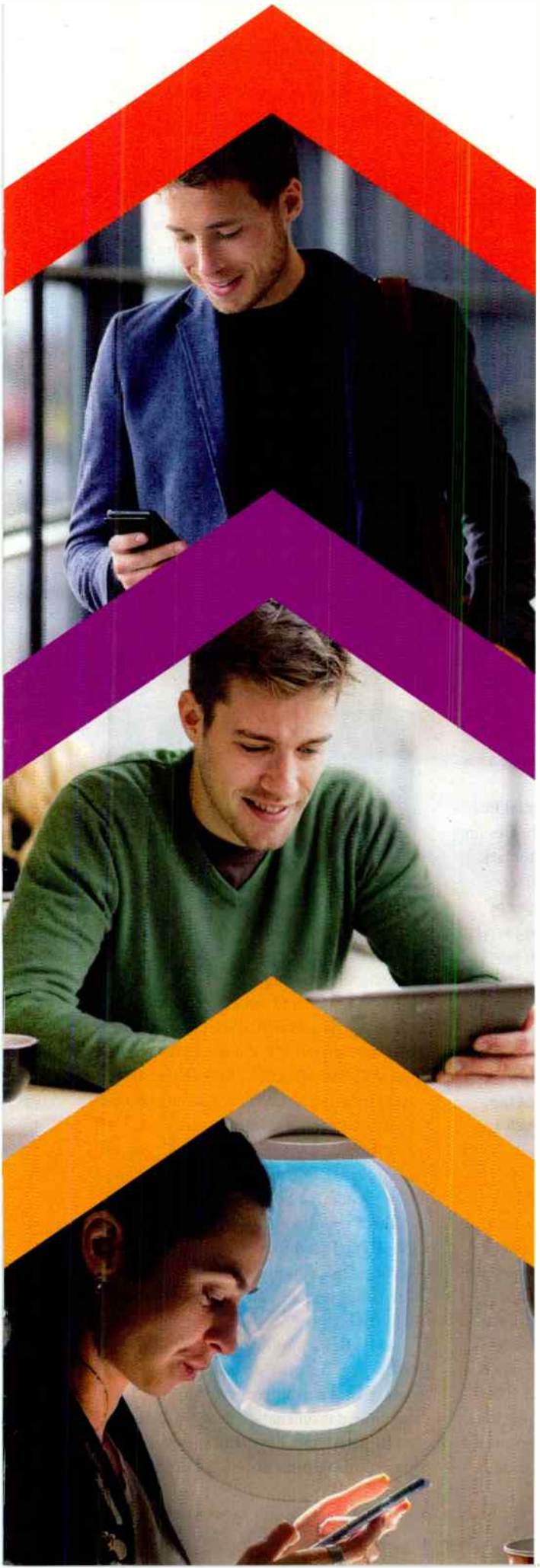

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receiver can handle strong signals at the local transmitter site while still picking up distant broadcast signal to be retransmitted. "Plan-B" silence detection automatically switches to either of the MPX, analog or AES/EBU inputs, to keep going just in case it does lose the distant station. Built-in audio processing eliminates the need for a separate audio processor.

Regarding the transmitter portion, the TR600 V2 features "slide-in" power supplies that can be replaced quickly, should one fail. It can supply between 60 to 610 Watts of RF output power, with VSWR and temp monitoring.

Continental 816R in red livery

It also features extensive remote control: You can access it via Ethernet (LAN or internet) and SNMP. It has configurable status and alarm ports that can control external equipment. Alarm messages are logged and can be sent out as email alerts.

As a translator, it has a built in Morse code FSK ID keyer as standard equipment, and RDS PI code checking to prevent the translator from being hijacked or jammed.

CONTINENTAL ELECTRONICS

Continental Electronics (booth N7520) continues to offer the 816R line of FM transmitters and the 816-HD and 816-HDR lines (HDR meaning "HD-ready").

The 816R line covers the power range of 11 to 40 kW, using the same three-bay design for the last 30 years, with the 4CX15000A, the 4CX20000E or the 4CX25000C (depending upon power level, of course) driven by the solid-state IPA.

The 816HD family of transmitters is based on three different analog FM+HD power levels: the 816HD-20 for power up to 20 kW; the 816HD-25 up to 25 kW of power, and finally, the liquid-cooled 816HD-28L for applications up to 30 kW of analog power.

Common features of the Continental line of FM transmitters are the single-tube design; solid-state IPA; SCR "Soft-Start;" automatic power output control; use of the quarter-wave cavity in the output amplifier; use of the grounded screen grid circuit using screen neutralization; automatic filament voltage regulation; automatic power interrupt recycle; two independent VSWR protection circuits; and, a positive-pressure cabinet, which helps to keep the inside of the transmitter clean.

Crown FME series

CROWN BROADCAST

The Crown Broadcast (booth N6927) E series deserves a look if you need a high-power solution for a relatively small space.

The E series (FME 3000, 4000, and 500) transmitters all make use of FME100 exciter, which uses direct-to-channel modulation and a built-in stereo generator with both analog and digital inputs and automatic fail-over. A dynamic RDS encoder is included as well.

FME 3000 consists of the exciter and two FME1500 amplifiers combined; the FME 4000 has two FME2000 amplifiers combined; the FME 5000 uses three FME 2000 amplifiers combined. Other common features are remote access via Ethernet; SNMP support; GPIOs for local connections to a remote control; and relatively small size (the FME 5000 needs at least 14 RUs, not including space above or below for air flow).

ECRESO

Ecreso (part of WorldCast Systems, booth N8924) has an extensive line of solid-state FM transmitters, from power levels as low as 100 W, to as high as 10 kW.

Ecreso 10 kW

The Ecreso 10 kW all solid-state transmitter features hot-swappable power amplifiers, power supplies, and fans; its exciter uses direct-to-channel digital modulation, and is ready for "digital MPX" (also known as MPX over AES/192 KHz SR). The exciter can supply audio from a micro SD card, via its silence detection and auto-switchover; it comes with an integrated FM limiter and AGC, clipper, MPX power control and a built-in dynamic RDS encoder.

The transmitter provides full TCP/IP and SNMP support for remote control, GPIOs for local control, as well as their Advanced Measurement Interface and Expert Maintenance Reporting.

AMI allows the end-user to see a real time dashboard that provides an at-a-glance overview of the transmitter performance. Built-in instrumentation enables detailed analysis of the RF Spectrum, baseband spectrum, audio spectrum and peak meters, all displayed

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EMR is a proactive service that sends regular reports on the status of key parameters — such as temperatures, currents and voltages, plus information on the performance and lifespan of components (such as the fan and power supply of the transmitter). The system works through a data cloud managed by WorldCast Systems.

GATESAIR

The GatesAir area at the show (booth N2613) is one for which you should dedicate part of a day, if you're in the market for a transmitter. Whether you're looking for an AM transmitter, an FM transmitter or a digital radio transmitter (HD, DAB or DRM), make sure you plan your trip accordingly.

GatesAir Flexiva DAX

For AM, GatesAir offers the 3DX series (25, 50 and 100 kW levels); the DX series (10 and 15 kW levels) and the Flexiva DAX series (1–6 kW).

GatesAir Flexiva HPX

Their FM line is more extensive and includes the Flexiva Compact and the Flexiva High Power, among others.

Let's take a look at those two lines.

The Flexiva Compact comes many different power levels — the lowest of which makes an exciter, and the highest of which a medium power transmitter. Its main features are:

- Power levels up to 3850 W (analog FM), 3100 W (FM+HD Radio)
- Broadband, frequency agile design 87.5–108 MHz, requiring no tuning or adjustments
- 2, 3 or 4RU design

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features include RF amps that are hot-pluggable from the front of the transmitter, having only four transistors that can be replaced using only a screwdriver; a very high degree of linearity achieved by the employment of six-phase, direct digital modulation encoded at 2.7 mega-samples per second; and, pre-correction for all primary forms of distortion which typically affect both analog and digital AM broadcasting, including envelope equalization, AM-AM correction, and AM-PM correction.

All NX Series transmitters include Nautel's Advanced User Interface with Ethernet access. Some of the features of the AUI include:

Nautel NX25

- Real-time impedance locus measurement
- Instrument grade spectrum analyzer
- IBOC modulation analyzer
- Module level monitoring and control
- Logging of all functions
- 100-percent remote access

Nautel's line of FM transmitters includes VS (300 W to 2.5 kW); the NV-LT (3.5 tp 40 kW); and the GV line (3.5 to 88 kW).

Let's examine that in detail.

The GV Series incorporates solid-state components in highly redundant, hot-swap architecture (power amp modules feature screwdriver-replaceable high-power FETS). Common modules across the GV family minimize spares requirements. GV comes with an integrated exciter.

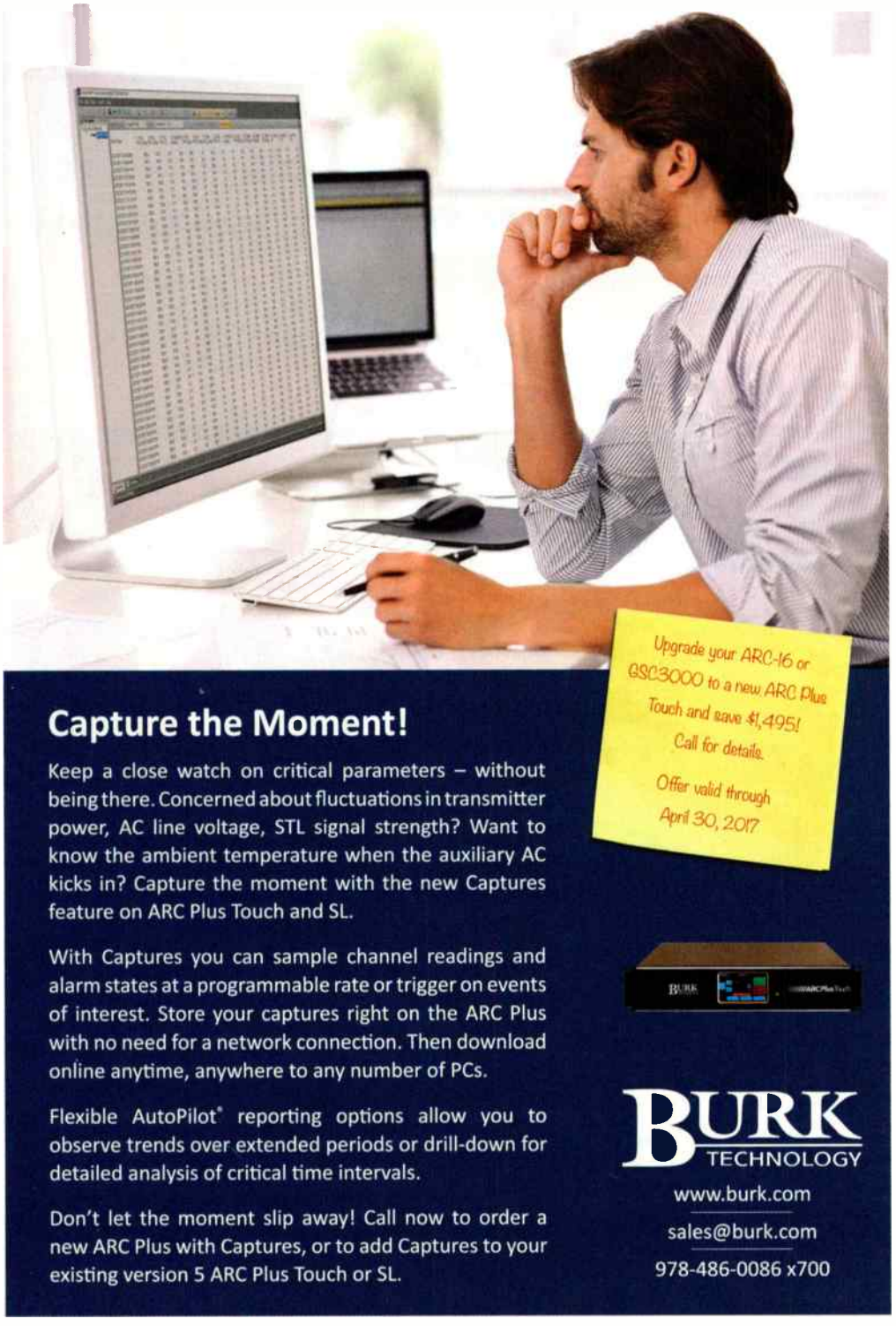
Local control is provided by means of the front-panel touch screen (and GPIOs for connections to a remote control) and Nautel's AUI, so that the same level of control is accessible via IP from anywhere. GV Series transmitters also provide an additional LCD display on the control module for extra control redundancy.

Nautel GV40

The GV will operate as a combined amplifier should the station wish to transmit HD radio. It supports adaptive pre-correction, MPX over AES and accepts I&Q directly to permit a plug-in HD Radio Exgine card.

Some of GVs other features include:

- HD spectrum/efficiency optimizer
- Separate controller "back up" user interface



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- Low mains operation down to 90 V (at 1/3 TPO)
- Dynamic RDS scrolling
- Asymmetrical sideband capability
- MPX over AES
- Nautel's instrumentation in the AUI includes:
- oscilloscope instrumentation
- MER instrumentation
- Spectrum analyzer (RF out or MPX baseband)
- Constellation view

NICOM

One transmitter manufacture you may not be familiar with is NicomUSA (booth N7227).

Let's have a look at their NT-2000.

As the name suggests, its output power is adjustable, from 5 W up to 2000 W with APC and the unit includes low pass/harmonic filter, so that it can be used as a stand-alone transmitter. The output connector is a 7/16 DIN Female. AC power requirement: 220-240 VAC, 50-60 Hz, single phase. Overall power consumption is approximately 3500 W.

Nicom NT-2000

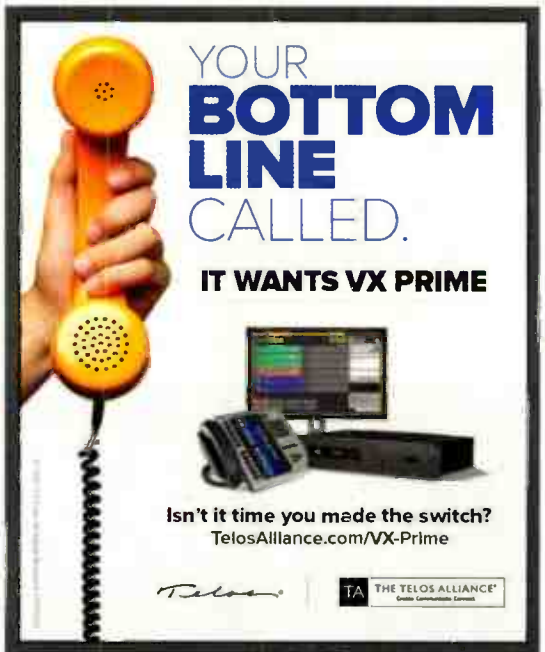
Its exciter portion features front-panel frequency agility in 10 kHz increments. (All front-panel functions are password protected.) It has four unbalanced inputs: one for MPX and three for SCAs. The design features direct-to-carrier frequency modulation.

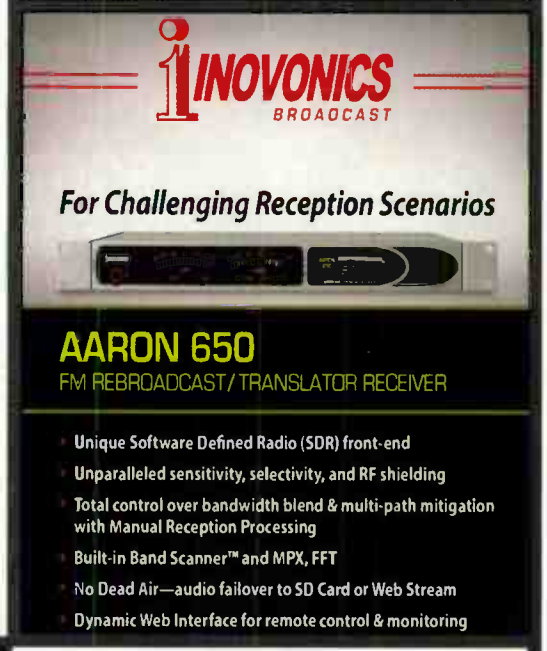
The NT-2000 includes remote control for power on/off, forward and reflected power metering and internal temperature. The company says that its frequency can be changed by remote control, which potentially makes it usable in a N+1 system at a backup transmitter site.

OMB

At the N7729 booth, you will find transmitter manufacturer OMB. They offer a line of solid-state FM transmitters from 500 Watts up to the 5000 Watt level.

If you are looking for a low power transmitter as backup, or perhaps as an LPFM transmitter, then you could consider the EM 500 HE. Using a MOSFET-based RF power amplifier, it tops out at 600 W, with a typical RF efficiency of 82 percent. The speed of its cooling fans is optimized, in consideration of the power amp temperature, to minimize acoustical noise. It features advanced protection against





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high-VSWR conditions and includes a low-pass filter (attenuating harmonics in excess of 80 dB).

One option is a built-in stereo generator with an AES input and automatic source switching.

GPIOs are provided for local control, which can also be accomplished via RS-232 and local computer.

The unit also features event logging.

PTEK

At booth N7216, PTEK shows the FM300ES, which is type-certified for LPFM use and can be used as a standalone transmitter or translator.

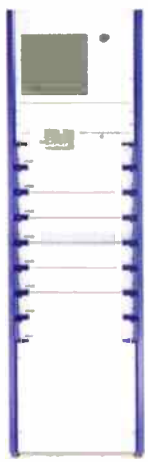
All ES models have a front panel programmable FSK ID. Some of its other features include a built-in stereo generator; a remote control interface; AC power input range from 88 to 264 VAC; frequency agility; proportional (VSWR) fold back; and, front panel metering. It uses a type-N female connector for the RF output.

The ES line includes the FM500ES and the FM1050ES in addition to the FM300ES. PTEK also offers the Gamma series, which goes from the Gamma2000HE up to the Gamma5000HE.

ROHDE & SCHWARZ

Rohde & Schwarz (booth SL1205) is a transmitter manufacturer with which many of you are probably not familiar — although it's one of the largest in the world.

Their THR9 high-power FM transmitter line is liquid-cooled and can deliver FM output of up to 40 kW in one rack, and 80 kW in two racks. One PHR901 power amp can supply up to 5 kW of FM, or alternatively, 3 kW of FM with -10 dBC of HD; two PHR901 amps can supply double that (as one would expect).



Rohde and Schwarz THR9 Liquid-cooled FM transmitter

The THR9 transmitter family for band II attains overall efficiency values of up to 75 percent in analog FM mode; they incorporate redundant transmitter cooling systems; and as mentioned above, they support the hybrid HD Radio standard (IBOC), as well as purely digital standards in Band II (87.5 to 108.0 MHz).

BEXT

Bext (a company that is a not exhibiting at the NAB Show) has an extensive transmitter line and the XL 10000 is one you may want to investigate, if you were considering an N+1

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solution for an alternate transmitter site project.

The XL 10000 is solid-state, frequency-agile, 10 kW transmitter with user-adjustable output levels, proportional fold-back in the event of excessive VSWR and automatic power control. It also has a built-in low pass/harmonic filter that meets or exceeds all FCC and CCIR requirements; the output connector is a 1 5/8 EIA flange. Its built-in exciter can be fed by an optional AES input module or by an optional stereo generator module. Its AC Power Requirement is 208-240 VAC, single or three-phase (which you specify when ordering).

Bext XL10000

The user can access all settings and readings from the front panel or via Ethernet (allowing LAN or internet access). Its remote control is accessible via Ethernet as well, as is its operating frequency.

The user manual and other technical documentation are available via a USB port in the front panel.

The XL 10000 is 21.5 inches wide and 33.5 inches tall and 31.5 inches deep, so it will even fit in to a relatively small space.

ELENOS

Elenos — a company that is not exhibiting its products on the show floor but will have a presence in Las Vegas — offers the E10000 Extreme, a 10 kW amplifier needing only 4 RU of height.

The unit contains 14 amplifiers each capable of developing 1 kW, and three power supplies, each capable of supplying up to 5 kW of DC power. It features dual speed VSWR protection: fold back in the case of slowly increasing reflected power, and instantaneous in the case of a fast increase.

It also features high temperature protection — the proportional reduction of RF power to keep the temperature at an acceptable value. (Temperature is measured on each MOSFET and on each power supply.)

The E10000 features advanced diagnostics, including measurements of the voltage and current of power supplies, RF efficiency, power consumption, the temperature of each MOSFET, the temperature of each power supply, the fan speeds, temperature of the input air flow, temperature of the output air flow, and last but certainly not least, forward and reflected power and the input drive power.

Elenos E10000 web interface

Elenos also offers a compact line of FM transmitters that they've named the Indium series, comprising the ETG 2500, the ETG 3500 and the ETG 5000. These transmitters include a built-in exciter with built-in stereo generator with analog and AES inputs (24-bit, 32 through 96 kbps sample rate, with automatic fail-over the analog).

Ultimately, the NAB Show isn't just about sitting down to enjoy dinner or a beer with business associates and friends — although that certainly adds to the fun.

Once per year, the Las Vegas Convention Center becomes the nexus of everything broadcasting, and the NAB Show provides a great opportunity to get your hands on the cool gear you've only been able to read about before.

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WRAY Embraces Technology Changes With WheatNet-IP

by Floyd Turner, CBRE, CBNT

Like any technology, the world of radio broadcasting is in a constant evolution, and when you are a legacy radio station like WRAY in Princeton, Ind., with more than 60 years of continuous broadcasting operation, you've seen a world of change.

Vice President and General Manager Steve Lankford is the third generation to manage this AM-FM combo, and like his father and grandfather before him, he is committed to serving his community and the surrounding area as only live, local radio can do.

WRAY is a 1,000 Watt daytime AM facility that went on the air in 1950, and WRAY(FM) is a 50,000 Watt class B station that began broadcasting in 1960 as technology changed. The AM-FM combo gives the Lankford family the opportunity to super-serve their community, and they were committed to doing that even when it required live board operators and on-site engineers to stay on the air.

The station has had 60 years of continuous broadcasting operation.

Now, changes in technology allow the AM station to broadcast news-talk programming around the clock, completely automated by satellite-fed Broadcast Electronics AudioVault.

The FM Country format is live in the studio from 6 a.m.–6 p.m. (Monday through Saturday) and automated overnight, also via AudioVault. Weekend programming includes a three-hour live studio jam session called "Roots of Country," as well as satellite-fed long-form programs.

The synergy of the operation is made possible because Steve has embraced the changes in technology that have come along over the years, which is where my part of the story begins.

I have a contract engineering business that serves clients primarily in three states, and the first technical work I did for WRAY was to upgrade the on-air phone system to a Gentner multi-studio setup back in 1995. With two main studios, one for on-air and one for large production, two additional smaller studios for news/production, WRAY is a busy place.

I then installed the AudioVault system around 1998, which was a huge change from carts and reel-to-reel production, and unleashed the AvAir Automation shortly thereafter. The next big change was to update consoles and completely re-do all four studios. We pulled miles of old wire out that had been there forever and replaced it with miles of new wiring. Wheatstone supplied the R-60 consoles that had served extremely well for almost 20 years, which brings us to the present.

As a major update to the facility was considered, we had four major goals in mind:

- System audio quality must be equal to or better than the present analog system and not just on paper — it had to sound good, too!
- System must be robust and able to operate in high-RF environment with co-located 1000 Watt AM and 50,000 Watt FM just outside the back door.
- System needed to be flexible, easily configurable and updateable, with a minimal operator learning curve.
- System needed to integrate well with existing AudioVault automation system.

Lankford's commitment to technical excellence took us back to Jay Tyler at Wheatstone

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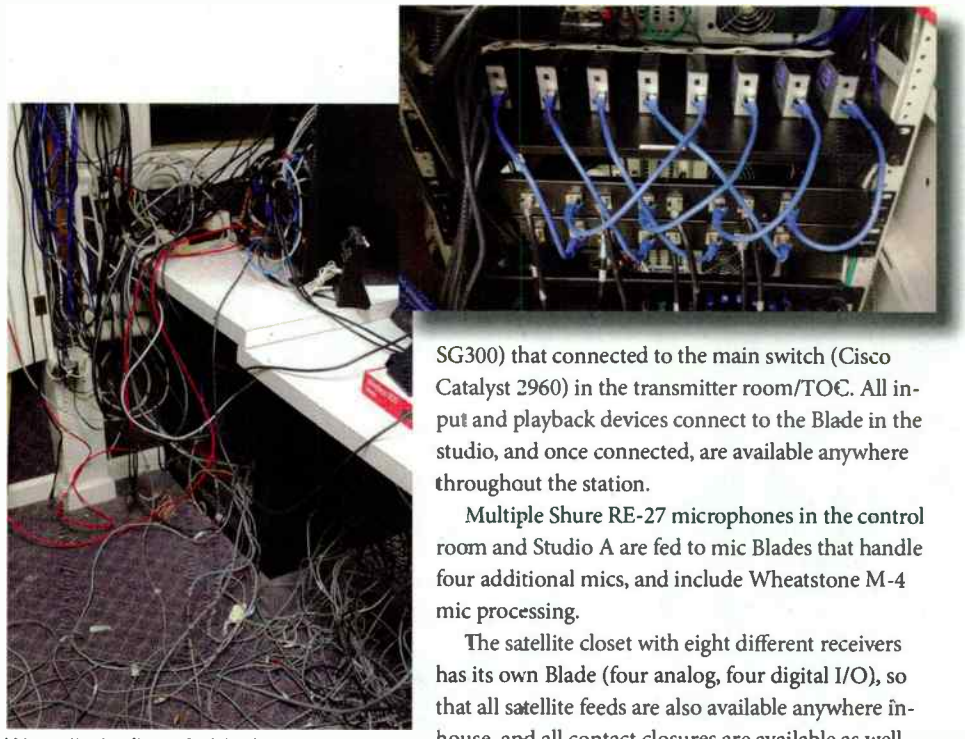
and the new WheatNet-IP system. We were intrigued by its capability to handle multiple studio operations and at the same time remain flexible to change, so finally the decision was made to move forward. Wheatstone's corporate commitment to excellence in both products and support along with our years of working with them made it a relatively easy decision, and the ability to integrate it with AudioVault was definitely a bonus. In early 2016, the equipment was ordered and began to arrive.

In order to both learn the WheatNet-IP system and to begin to integrate with the facility without disrupting operations, each studio's WheatNet Blades were first set up in a desktop rack in Lankford's office. After getting them to talk and play nicely together, it was time to get serious about change, once again. Equipment was moved into the transmitter/TOC space and installation began.

The WheatNet architecture is relatively simple, with each studio using a Blade as the analog/digital IO. It is connected to a control surface, which for us was the IP12, and to an edge gigabit switch (Cisco SG300) that connected to the main switch (Cisco Catalyst 2960) in the transmitter room/TOC. All input and playback devices connect to the Blade in the studio, and once connected, are available anywhere throughout the station.



We pulled miles of old wire out that had been there forever and replaced it with miles of new wiring.

Multiple Shure RE-27 microphones in the control room and Studio A are fed to mic Blades that handle four additional mics, and include Wheatstone M-4 mic processing.

The satellite closet with eight different receivers has its own Blade (four analog, four digital I/O), so that all satellite feeds are also available anywhere in-house, and all contact closures are available as well.

All data is routed throughout the station on an isolated WheatNet-IP network built with Cat6 shielded cable that terminates in L-Com RMSP-CAT6T-4IP surge protectors at each end. With a 420-foot tower at the back of the building, lightning is a way of life, and close attention to shielding is required with the 1000 Watt AM exciting every wire in the building.

To remove the computer fan noise from the studios, WRAY installed two rackmount PCs for each studio in the TOC, one running production software (Audacity) and one running AudioVault. An ATEN rackmount CS1308KIT KVM with monitor was installed in the rack with the PCs, and then also sent to the individual studios with an ATEN CE100 Cat5 USB KVM Mini Console Extender which has a 320-foot range. We found that Belden Cat5e cable gave the best performance on these boxes, and that cheap cable did not work reliably.

L-Com RMSP-CAT6T-4IP surge protection is also used on each end of the KVM runs, and so far we have had one catastrophic lightning event that destroyed the extenders while protecting the equipment. They were easily replaced, and spares are on hand for future issues.

Because Wheatstone provides virtual drivers, WRAY no longer needed Digigram soundcards for the AudioVault, and the four AudioVault computer workstations now appear on the WheatNet as another device, like a Blade. Two four-channel drivers and two single-channel drivers to handle all audio I/O, and remote control functions like satellite closures are routed to AudioVault from the satellite room by a BE RiotBox which distributes closure activity over Ethernet to the entire building.

After building the new eight-PC system from off-the shelf hardware in a rack in the TOC, we brought up the

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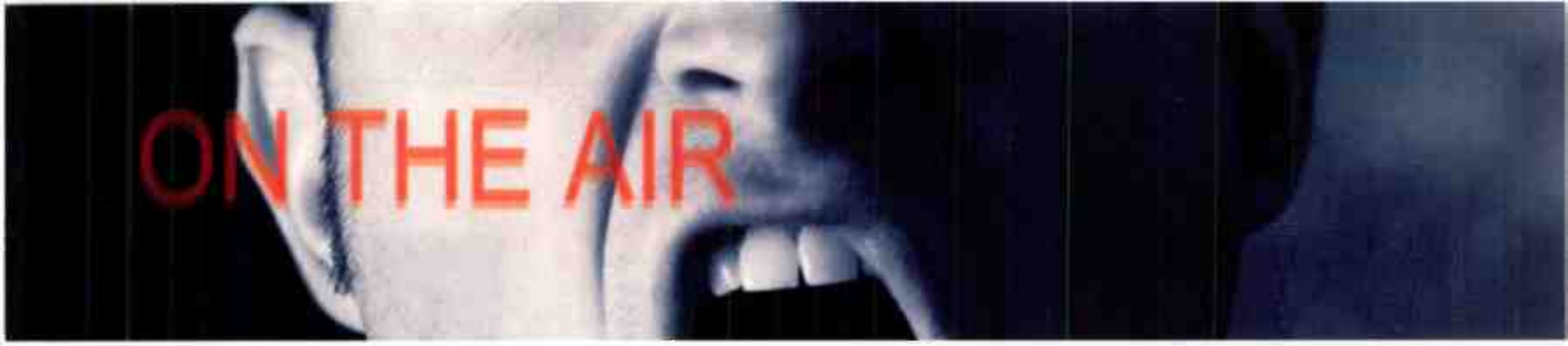

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new AudioVault system in parallel with the current analog Vault. This enabled us to resolve driver issues, build contact closure salvos and debug the entire integration.

Wheatstone also offers a crosspoint router/programming interface utility called WheatNet-IP Navigator that was installed on a separate utility PC with a big monitor to enable observation, monitoring, troubleshooting and programming of the entire system, as needed.

Installation was then rolled out studio by studio with minimal interruption of normal operation and only a few late-night sessions.

TODAY

With WheatNet-IP, change is almost unending. By that, I mean we are constantly finding better ways to do things.

The miles of wire have been reduced to hundreds of feet of Cat5 and Cat6 wiring. While we had to learn Cisco-speak to program the switches, and found that not all Cat5e cable is equal, we were able to get the gigabit Ethernet network working well in short order.

We actually have three separate networks: one for WheatNet-IP; one for Audiovault; and one for production/email/online work. The isolation protects the mission-critical parts, and the exposure to the outside world is protected by both hardware and software firewalls. So far, so good!

The WheatNet-IP-Metering app was added,

WRAY(FM)'s studio also features the WheatNet-IP-metering app, seen on a large monitor in-studio, monitoring the output of the final blade in the air-chain. Dave Kunkle assesses the situation.

Floyd Turner and Vice President/General Manager Steve Lankford admiring the WheatNet/AudioVault system.

which lets the audio-channel outputs be projected on a large confidence monitor in the on-air studio, and with WheatNet-IP, it can monitor any point in the air chain. It is set on the final Blade output, just before the audio processors for both AM and FM, and it can also view off-air signals, if desired.

Other applications have been discovered through necessity.

With a 420-foot tower at the back of the building, lightning is a way of life, and close attention to shielding is required.

The FM audio was dropping out intermittently (audio sync unlocking?), and since the entire air chain is digital up to the transmitter, we were looking at a multitude of potential places for failure. An engineer friend suggested running Ping Plotter, an IP activity recording device that pings every device on a network every few seconds and plots the results (both latency and packet

World Radio History

Ivan MacDonald, engineer-in-training

loss). It's an IT stress test, and after running it for 24 hours, we found no issues with any of the WheatNet or AudioVault devices; so we looked to the Orban 8600 processor.

Changing to our backup processor eliminated the problem, so we shipped the processor off to Orban, but they found no problem.

The only other link in the chain was the Sage EAS AES/EBU pass-through, and sure enough, that was the source of the issue.

WheatNet-IP to the rescue! A few mouse-clicks and some simple salvo programming allowed the EAS output to be routed through the transmitter Blade, and WheatNet-IP switched the audio when alerted by the EAS receiver.

When we started out, we kept the studio configuration as close as possible to the previous setup for ease of learning, but, quickly, the on-air staff wanted to take advantage of the WheatNet ability to call up different configurations at will, mixing mic signals down to faders and using signals from other studios with ease. So salvos were built, buttons programmed, and the morning guys can reset the board with a button push from where it was left the previous night. (We could have set it to reset automatically, but I thought they needed to have something to do…)

TOMORROW

While we still have a few bells and whistles to add to the system, we are confident that the built-in flexibility and configurability will keep it functioning well into the future.

Most importantly, it sounds fantastic on the air, functions well in an RF environment, and has made me feel like the proverbial Maytag repair man…. And I love it!

Thanks to my assistant Ivan MacDonald, to the staff at WRAY, to the tech support staff at Wheatstone and Broadcast Electronics, and to Steve Lankford at WRAY — everyone who made this exciting job possible!

Floyd Turner, CBRE, CBNT, is the owner of FET Engineering and president and chief engineer of Thy Word Network Christian Radio, which has six FM and one AM stations in Indiana, Kentucky and Illinois.

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Broadcast All Your Audio on Live Social Media

by Chris Wygal

iRig 2, front and rear views

If you've spent time on Facebook recently, you've seen "live" videos of users doing just about everything.

In my radio sphere, I have several sportscasters who are propping up their phones in front of themselves and broadcasting pregame shows and coaches interviews, to name just a few of the listener experiences to which they want to add content.

Some of the more savvy sportscasters have asked me, "How do I get my remote mix into my [Android/iPhone] smartphone? I want the listeners to hear the broadcast quality-audio on the Facebook live session."

In another scenario, the morning show wanted to feed a mobile device from a headphone output source and record the tracks for FTP upload. In these situations, it's just as easy to find a handy headphone output.

An engineer's first reaction is often to acquire a 3.5 mm TRRS (tip-ring-ring-sleeve) plug and connect it to a 1/4-inch TRS or XLR to accommodate feeding a console output or headphone feed into the mobile device.

Sometimes this can work, but generally, the effort is wrought with impedance mismatches and wrong pinout configurations.

THE MISMATCH

Most mobile devices use the CTIA (formerly known as the Cellular Telephone Industries Association) standard on the TRRS (headphone/microphone) jack.

The CTIA standard is different from the Open Mobile Terminal Platform standard used by some older devices and tablets.

In-line volume controls on ear bud cables employ different pinout configurations for play/pause and volume signaling. And in my experience, an impedance mismatch can confuse the device and create all kinds of signaling problems.

So after taking that into consideration, what is the best way to feed audio into a mobile device?

I stumbled across the iRig 2 from IK Multimedia. It uses the CTIA standard on a TRRS pigtail, which means it is compatible with virtually every mobile device.

The form factor of the iRig 2 favors musicians — its 1/4-inch input is even marked with a guitar symbol.

The iRig 2 has an input level control on the side and it takes care of impedance mismatches. Plus, it's dirt cheap — it costs about $40.

The only caveat is this: The input jack on the iRig 2 is a TS, or "tip sleeve" jack.

Maybe I'm picky, but if our staff decides to use a headphone output to feed the input of the iRig 2, and they use a typical mono or stereo 1/4-inch cable, they're missing half the stereo signal.

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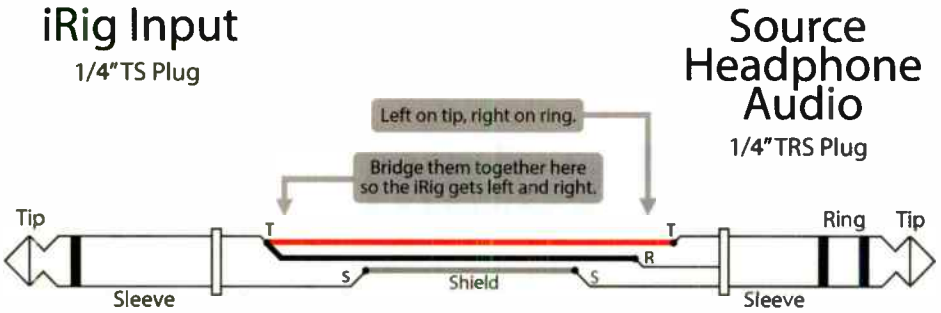

Simple wiring diagram for the iRig 2 specific cable. Left and Right are simply multed together on the Tip/sleeve connector.

I prefer to have left and right both fed into the mobile device, otherwise, TS-to-TS and TRS-to-TRS only picks up the left half of the program material.

So I built an iRig 2-specific cable.

THE (SIMPLE) SOLUTION

The end that plugs into the headphone output uses a TRS 1/4-inch cable. The tip carries left audio, the ring carries right audio and the sleeve is common. The other end uses a TS 1/4-inch plug, wherein the shield of the cable connects the common (sleeve) on both ends and the TS wires are paralled together into the tip of the mono end.

(Please refer to the diagram on above because what you just read makes no sense to me, either!)

It's important to label the cable accordingly. The TRS end must be plugged into the source. Otherwise, the purpose is defeated, and you'll only be feeding left side material into the iRig 2.

The cable assembly is fairly elementary. It's no more than a stereo-mono sum. But it's really important!

We've all attempted to do impedance matching using project boxes and every assortment of jack configurations.

But the iRig 2 will work in most situations when trying to feed line level audio into a phone, and an extra five minutes of soldering will ensure that you get all of the program material.

Chris Wygal is the operations manager for The Journey Radio Network in Virginia.

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Consider Linux as Your Go-To Operating System

by Chris Cottingham

Linux. You have probably heard about this operating system over the years, but what is it really? What can you do with it? How do you get a copy?

Well, the answers are easier than you can possibly imagine.

Linux is a computer operating system that has been embraced by vendors, including Telos, Wheatstone and Orban. This operating system can be used to run almost any computerized hardware. It is used on phones, tablets, microphone processors, AoIP controllers and even your microwave oven.

This OS runs well on older computer hardware as well as new products. This allows engineers to breathe new life into older hardware and save money.

Best of all: Linux is free to use!

OPEN SOURCE CODE

Linux is the base of a movement of free computer operating systems and software, and it has revolutionized computing in the new century by offering a stable and freely distributable alternative to Windows. An individual can load Linux on a computer or laptop and start working right away — there are office suites, scientific suites, Web browsers and other related items either packaged with the distribution or available for free download.

Windows and Apple users will likely be comfortable with a desktop supported by the Ubuntu distribution of Linux, as shown here.

Its strength is that you can do just about anything with Linux. Since the source code is freely distributed with the operating system, people can make changes and configure it to their specific needs. Linux also keeps the cost of computerized hardware down because there is no licensing agreement.

Linux comes in various distributions. Perform an internet search and you will find hundreds of varieties of Linux available for download. I currently use Ubuntu due to the stability and ease of use.

The best advice I can give is this: Try a few different distributions and find what you are comfortable with.

Most major distributions will allow the downloading of a bootable live version. This version can be run entirely from either DVD or USB drives, without touching the computer you are running it on. This is a great way to test out Linux and also make sure that it will run properly on the hardware you have chosen. I highly recommend doing this *before* you install it on your computer.

There are some very specific uses of Linux, such as dedicated firewalls and NAS devices. If you can think of a use for Linux, someone probably has created a custom version to do just what you are looking for. Since

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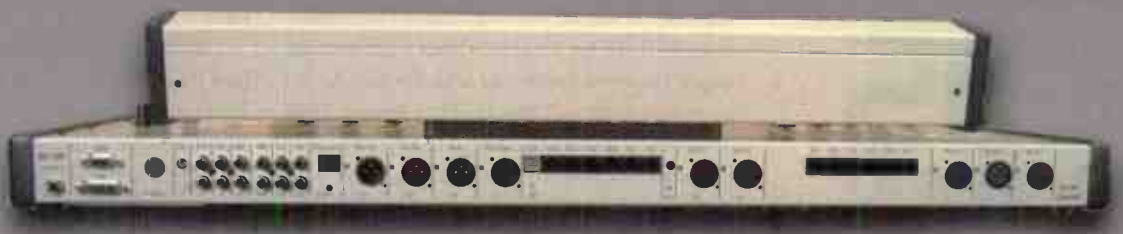

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Linux is open source, you can modify it as needed, even creating your own distribution if you wish!

There are numerous forums and support groups that will help you with almost any issue that may arise. Because Linux is open source, bug fixes and problem resolutions are often implemented a lot faster than in Windows.

You can run Ubuntu Linux on a computer more than ten years old — use the X86 version. For computers not that long in the tooth, use the X64 version.

INSTALLATION

The first stepLinux is to get a copy of it. All major distributions of Linux come in many formats but the most common is the ISO format. This is the standard CD/DVD format for PC and Apple iOS computers.

Whether you are installing on physical hardware, virtual machines or just running a live copy, you will need an ISO image of your favorite distribution. As I wrote earlier, my favorite is Ubuntu. We'll use it as an example.

Hop on over to *www.ubuntu.com*, go to the downloads tab and grab a copy of the desktop version. Unless you are planning to run Linux on a computer that is more than ten years old, grab the X64 version. The X86 version is for older hardware.

PCs from Windows 7 onward have a way to burn ISO images to CD or DVD formats built into the operating system. Insert a blank CD or DVD disc into your local drive, right click on the downloaded Ubuntu image and then select burn to disc from the drop down menu. That is all it takes to make an Ubuntu Linux install CD or DVD. Once you have burned the disc, you are ready to install.

A USB media device can be used to install Linux, but it is a bit more complicated. The USB media device you select has to be a minimum of 3 GB for Ubuntu. Other distributions might require a larger size USB device. A great way to gauge the size of the needed USB device is to look at the size of the ISO image that was downloaded. For example, if the ISO image is over 3 GB, then you will need at least a 4 GB USB device. To proceed using USB media, a USB media creation tool will be needed. The Rufus USB media creation tool is the one that I use, and it can be downloaded freely at *https://rufus.akeo.ie*.

You are ready to start creating your Ubuntu USB install once you have the Rufus tool and the downloaded Ubuntu ISO image.

Open the Rufus tool and select your USB device. Once you have selected your USB device, make sure that the partition scheme is set for "MBR partition scheme for BIOS or UEFI" and the file system is set for "FAT 32." The next step is to check the box for "Create bootable disk using," then select "FreeDOS" from the drop down menu and then finally select the ISO image you downloaded by clicking on the CD image box. When you select the ISO image, Rufus might ask to download and install an updated version of sysimage. Please do so if it asks.

After sysimage is updated, you will be presented with another information box asking if you want to create the image in ISO mode or DD mode. Please choose ISO mode.

Once all of these options have been set, click the start button at the bottom of the Rufus window. You will be warned that the USB stick is to be completely erased. If this is acceptable click "OK," and you are done. You now have a bootable Ubuntu USB installer!

Linux is a great operating system for engineers. Engineers embrace Linux because of the low cost and because it is so freely configurable.

Linux does require more technical know-how than Windows, but that is the cost of free. Linux is also, in my opinion, more secure than Windows due to the same day fixes that are available and the lack of viruses being written for Linux.

Cottingham is a Cisco, Microsoft and CompTIA instructor with 25 years experience in IT and radio engineering. He now works for a well-known streaming media service.

World Radio History

FCC Rules on Foreign Ownership Requirements

by Lee Petro

On two occasions in the last six months, this column has addressed the regulatory migration toward the Federal Communication Commission's authorization of non-U.S. citizens to hold majority interests in broadcast stations. Recent actions by the FCC to approve three transactions involving foreign ownership in broadcast stations above the statutory benchmark of 25 percent provide a useful perspective on how future transactions will be processed by the FCC.

By way of background: In July 2016, the FCC sought public comment on three proposals in which non-U.S. citizens would acquire equity and voting interests above the 25 percent benchmark set forth in Section 310(b)(4) of the Communications Act. One transaction proposed that an Australian couple be permitted to expand its interest from 20 percent to 100 percent in a broadcast company with radio stations in Alaska, Texas and Arkansas. Two other transactions proposed the acquisition of up to 49 percent of the equity and voting interests in the broadcasters by foreign investors.

Subsequently, in September 2016, the FCC adopted rules that paved the way for such transactions to be approved. The order established a procedure by which parties seeking approval of foreign investments above the 25 percent benchmark are required to submit a petition for declaratory ruling. The petition must inform the FCC whether the transaction contemplates the assignment or transfer of "controlling" interest in the broadcast station, and if the company is publicly traded, the steps it will take to confirm that foreign

CONTINUED ON PAGE 36

World Radio History

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ORBAN FM PROCESSING LINE

Less is more with Orban's new series of FM processing products, offering fewer models but boosting the feature sets of popular ones.

The new FM processing line includes the 5500i with a full-featured RDS/RBDS generator with PS scrolling; the 5700i features the same RDS/RBDS generator, but also has FM and HD outputs; the 8600Si now comes standard with FM and HD outputs; the 8600 FM/HD also now features FM and HD outputs; and the 8700i, which will be introduced at the 2017 NAB Show and has a processed low-latency headphone output, Dante AoIP (AES67) and Orban's Xponential Loudness algorithm.

All models are now available except for the 8700i, which will begin shipping following the NAB Show.

CONTINUED FROM PAGE 35

investment does not exceed the FCC-authorized stake. The FCC also permitted the post-foreign investment broadcaster to acquire additional stations so long as its ownership structure remained the same.

With these guidelines established, the FCC approved the three transactions referenced above.

Specifically, the FCC approved the foreign ownership of up to 49 percent of the equity and voting interests in Univision Holdings, including up to 40 percent to be held by Televisa, a publically-traded corporation based in Mexico. The FCC imposed a requirement that Univision establish a monitoring program to ensure that it remains below the approved ownership limits and that it modify its organizational documents to require its board of directors to remain in compliance with the terms of the FCC order.

The commission also made clear that any change in ownership or organizational structure that would lead to a foreign ownership stake above that which was approved will require prior FCC approval.

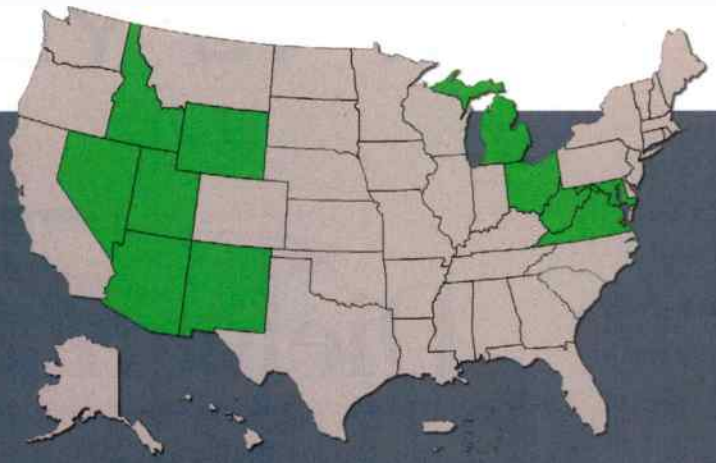
The second transaction involved a TV broadcaster and programmer in Puerto Rico, Hemisphere Media Group. The broadcaster sought approval for a Mexican corporation to increase its ownership interest in Hemisphere from 7 percent of the equity and 13 percent of voting interest up to 49 percent of the equity and voting interest. This approval was requested not only for the current corporate entity, but also for each individual and corporate entity in the ownership chain.

Noting that no party, including the executive branch, had objections to the request, the FCC granted it. As with the Univision transaction, the FCC required Hemisphere to maintain a monitoring program to remain in compliance with the ownership interest limits, and to ensure that any structural change to the corporation does not result in a violation of those limits.

Finally, the FCC granted the request for the married Australian citizens to jointly acquire 100 percent of the equity and voting interest in Frontier Media. In doing so, the FCC noted that the September 2016 order permitted foreign investment up to 100 percent, and that no party, including the executive branch, opposed the transaction. The FCC also noted that the transaction would serve the public interest by both (i) encouraging new sources of investment in the broadcast industry, and (ii) maintaining service to small communities that may have lost service absent approval of the transaction.

With the approval of these transactions and anticipated effectiveness of the September 2016 order, it would appear that the FCC has instituted clear guidelines for future foreign entities to follow should they be interested in investing in the U.S. broadcast industry. Coupled with the likely relaxation of the local media ownership rules under the Pai administration, it is possible that we will see a new wave of media transactions in the near future.

Petro is of counsel at Drinker Biddle & Reath LLP. Email: lee.petro@dbr.com.



DATELINE

June 1, 2017 — Annual EEO public file reports for stations located in Arizona, Idaho, Maryland, Michigan, Nevada, New Mexico, Ohio, Utah, Virginia, West Virginia, Wyoming and Washington, DC, with five or more full-time employees.

June 1, 2017 — Broadcast mid-term report (FCC Form 297) for stations located in Arizona, Idaho, Nevada, New Mexico, Utah and Wyoming with 11 or more full-time employees.

World Radio History

STREAMGUYS PODCASTING SAAS SERVICE

StreamGuys is launching a service to turn video into a podcast.

The cloud-based SGrecast uses transcoding technology to convert audio to formats/bit rates appropriate for live syndication; it also can record audio streams in their native format.

The technology can also be applied to video for live syndication and is capable of recording live RTMP, RTSP and HLS streams for conversion to mp4 files.

It offers scheduling tools that enable unattended operation, while integrated publishing to RSS feeds, automated delivery and compatibility with syndication services are also available. Additional features include rebroadcasting tools and social media integration.

OMNIRAX CONTOUR

The Omnirax Furniture Co. offers the Contour series of ergonomically superior workstations. The series is available in adjustable-or fixed-height; three sizes; multiple rack configurations; built with American-made steel; and with a choice of finishes. The adjustable height models have Bosch German motors and four-position programmable controllers with numeric readout. The base configuration is two-rack bays by three-rack spaces. Rack bays are positioned within easy reach and angled for neck-neutral sightlines either sitting or standing. They are open in the rear for easy access to gear and wiring, with cut-outs in the modesty panels to feed wires beneath the desk. All desktops are constructed of high-pressure laminate over particleboard cores trimmed with durable tee-molded edges.

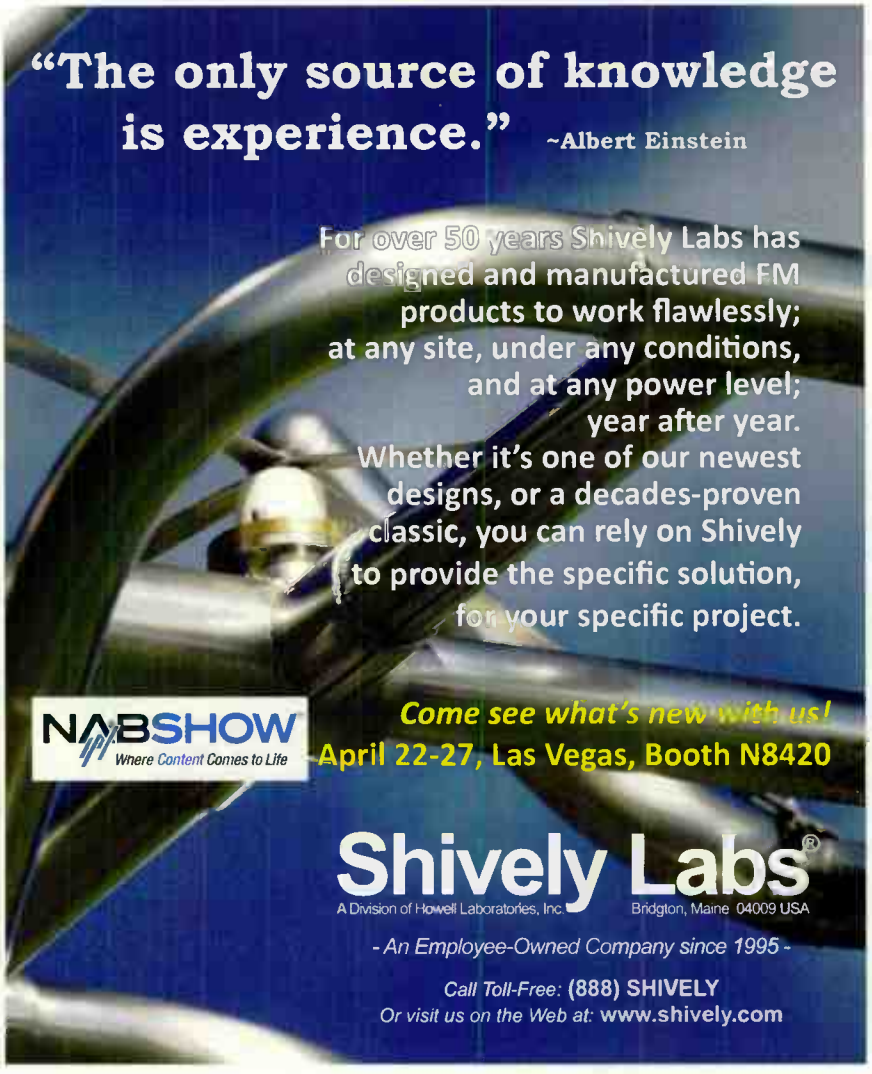
TELOS ALLIANCE AXIA PATHFINDER CORE PRO

Telos Alliance is now shipping the Axia Pathfinder Core PRO routing control and facility management system.

The goal of the Axia Pathfinder Core PRO is to provide system-wide routing control independent of a PC.

This new model of Axia's Pathfinder line of routing control software features an intuitive web interface; the ability to create, adjust and monitor events with real-time state reporting; and control protocol for third-party integration. Updates have also been made to the legacy Pathfinder software, including customizable user panels, automatic table generation, virtual source routing and Memory Slots.

Additional features include 500 crosspoint and 500 logic rules, dual Gigabit Ethernet ports, dual-redundant internal power supplies and auto-sensing power supplies (90VAC to 240VAC, 50 Hz to 60 Hz).



World Radio History

NEW PRODUCTS

BURK CAPTURES CAPABILITY AND DIGITAL TEMPERATURE UNIT

Burk Technology will debut its "Captures" capability and the BTU-4D Digital Temperature Unit.

A new feature for the ARC Plus Touch and SL remote control systems, Captures allows station engineers to track changes in critical site parameters over time. Sample rate and the number of channels captured can be adjusted to meet analysis needs. Captures can also be triggered by events, creating a record of site conditions. Captured values are directly stored on the ARC Plus and data can be accessed or downloaded through AutoPilot. Captures is standard on ARC Plus Touch and SL units and is optional for v.5 models in the field.

The BTU-4D Digital Temperature Unit connects up to four digital temperature sensors to the ARC Plus or ARC Solo remote control system. The unit supports sensor cables up to 1,000 feet long. Line voltage telemetry is also built in. The digital temperature sensors available for use with the BTU-4D include general purpose, wall mount, stack mount and exterior installation. The sensors can also be used with Plus-X EM and Climate Guard Environmental Monitors.

RTW TM3 19-INCH RACKMOUNT

RTW has unveiled its slate of products to be shown at NAB Show, which includes the new 19-inch rackmount for its TM3 and TM3-Primus series, and upgraded firmware for the TM7/TM9 TouchMonitors.

The TM3 RackMount is available in two versions that integrate with the TM3 TouchMonitor or TM3-Primus. The first is the TM3-2U, which works with the TM3, TM3S, TM3-3G and TM3-3GS. The TM3-Pri-2U, meanwhile, is the exclusive rackmount for the TM3-Primus.

RTW also has its latest firmware for the TM7/TM9 TouchMonitors, which offers up to four parallel instances of the stereo vectorscope, allowing for simultaneous monitoring of transmission streams. A 12th octave filter bank has also been added to the Real Time Analyzer feature set for graduated frequency distribution analysis. There is also support for four-channel operation of a TouchMonitor, even without a multichannel license. Changes to loudness standard were also made.

OCTOPUS 8 NEWSROOM

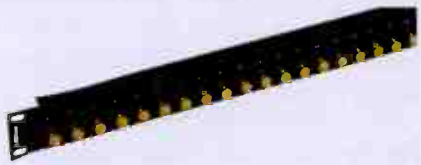
Computer newsroom system developer Octopus Newsroom will have its Octopus 8 Newsroom solution on display for NAB Show attendees.

The Octopus 8 system is able to ingest all incoming source material and can source from, and output to, social media platforms, as well as other social media features like following hashtags, or uploading customized content to specific sites. The Octopus 8 Social Media Hub tracks the feedback from social media followers. Content can also be uploaded from the rundown to a website via an integration with certain CMS.

Additional features include the ability to connect to customer-selected technology; an assignment desk; editable and flexible news rundowns; processing of multiple news agency sources; simultaneous broadcast transmission and web publication; built-in instant messaging; email and SMS notifications; automated tasks and workflows; floating licensing model; HTML5 plugins; and support for VLC player. The Octopus 8 works with Windows, OS X and Linux operating systems.

BITTREE DATA PATCH PANELS

Bittree has a new series of flush-mount, high-density, modular keystone data patch panels, available in fiber, copper and mixed configurations. The 1RU data panels offer



1x24 density in a single, non-staggered row with room for a bar-and-cap front designation strip; it can also accommodate inserts with up to 17 mm pitch. The front panel features rear lacing bars while the nickel-plated rear panel serves as a ground plane for shielded and bonded applications when used with corresponding jacks in copper configurations. The keystone panels support ST, LC and SC fiber, plus RJ45 Cat6 and Cat6A punchdown or feed-through, shielded or unshielded adapters. Fiber-equipped configurations support multi-mode and single-mode fiber applications and are compliant with ANSI/TIA-568-C and UL1863 communications standards. There are also four copper connectivity options that incorporate nickel-plated phosphor bronze contacts with gold over-plate and exceed ANSI/TIA-568-C.2 requirements. RJ45-to-RJ45 feed-through and RJ45-to-110 IDC Punchdown interface modules are available in shielded or non-shielded variants.

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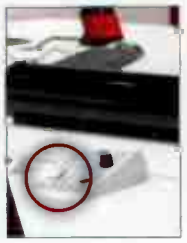

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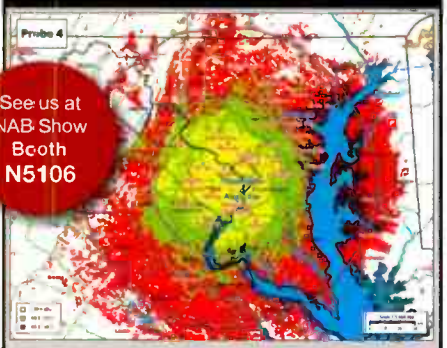

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World Radio History

Cliff's Crimper

by the Wandering Engineer

Yesterday, I was "helping" a fellow broadcast engineer install a brand-new, rather sizable FM transmitter. It's a good excuse to be both slightly useful and to get a ride up the mountain.

All transmitter sites are magical. In days gone by, they might have had religious significance — closer to God in many ways. From the door of this windowless site, one can see the mega-city below and know that on average, 1 percent of the car radios being used in this morning's rush hour are listening to any one of the 99 radio signals available. Actually, this girl is more popular than most, so maybe one-in-20 of those little cars are connected to the other end of this link budget. We won't touch anything serious until drive-time is over.

It's a time, place and occasion to meditate and just put on connectors. All the thinking has been done by my friend. I don't have to solve anything but tactical physical construction. There is a zen in that.

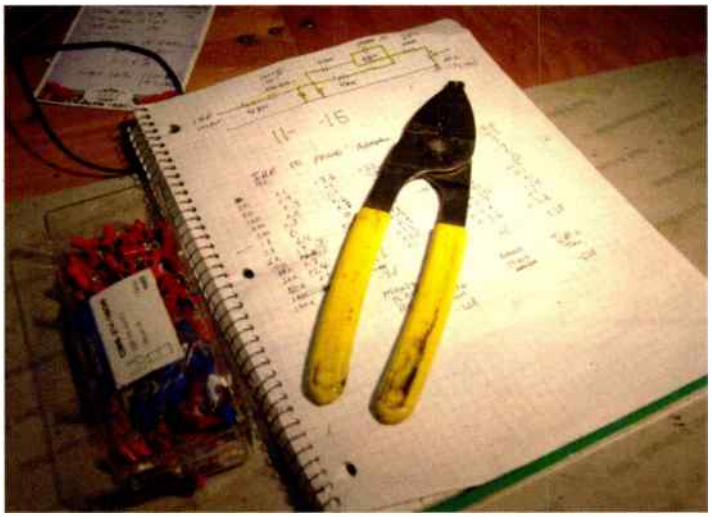
I think back to my first general manager. Lou believed that a transmitter had just so much power, and each radio tuned in to the station took a bit of that power. Lou watched the power output meter, trusting that the fluctuations represented people tuning in and out. He was not entirely wrong. I still can't look at a TPO meter without thinking about this basic connection that makes radio work, and how much power is broadcast and how little in the end reaches and how much less than that is consumed by each radio. The first law of thermodynamics has its limits. That is, not everything is measurable.

Part of this project is to clean up an inherited control rat's nest on the now auxiliary transmitter. Barrier strips, tapping screws, applying labels, crimping spade lugs — you know the drill.

I had suspicions before, but the exact minute that I learned that I wanted to do this for the rest of my life came as I took a summer job assisting Cliff, who took care of a dozen or so transmitters.

Cliff knew a lot I didn't, despite my four-year degree and years of playing low-cost disk jockey and all-around radio handyman. In my spare time, I had taken over as chief of a small daytime directional station that had been one of Cliff's clients.

What was an opportunity for me was a loss of business for Cliff, as the small station owner found he could cut his engineering expense by hiring a near incompetent — me. I didn't make that connection back then. All I knew is that the station needed a rebuild, and I had the summer off from teaching budding electricians about three-phase and power factors while venerating the NEC code book.



The crimpers, worn as they are, are worth more than any toy or tool I have owned.

In the hand-off, Cliff should have been less than friendly, but broadcast engineers don't do that. Instead, he asked me if I wouldn't want to work with him some. In the next two weeks, I learned more than I had ever before in the overnight serenity of his transmitter sites — the value of caffeine and the safety of the chicken stick, to name a few important lessons.

One of his favorite tricks was using small 600/600, very cheap transformers to kill off ground loops and match single ended gear to balanced audio. He sent me off to a small supplier to get some of these. The small supplier (now rather grown up) had connections to a union radio station that needed a staff engineer. If I hadn't felt bad before, I got the gig and had to tell Cliff I was going to take the opportunity to get into broadcast engineering in a bigger way.

When I first showed up at Cliff's shop, I had a collection of K-Mart tools. Cliff handed me a really good crimper so the wires would stop falling out. When I resigned, I told Cliff the truth: I owed him, and not to worry at all about paying me for my brief time. I wasted his time, slowing him down as he explained things. I handed over the crimper, but Cliff said no — keep it; I'd need it.

I got a lot for a few tanks of gas running around the south end of the state after dark.

A few weeks later a check arrived in the mail. Broadcast engineers are like that.

It's 40-some odd years later, a thousand miles away, and Cliff's crimpers have been around the world and to more of these holy sites than Cliff will ever see himself. I set the crimpers down on my open spectrum analyzer, and it hits me that the crimpers, worn as they are, are worth more than any toy or tool I have owned. And no matter how I try, I will never be able to pay for them.

The Wandering Engineer is an industry stalwart who has been in broadcasting since the days of Marconi and Tesla. He gives his thoughts on the current state of broadcast engineering and the broadcast engineer.

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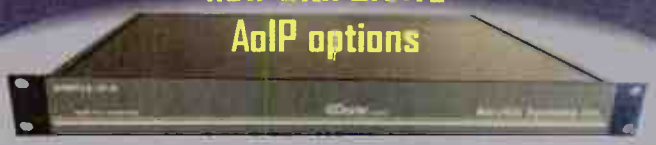

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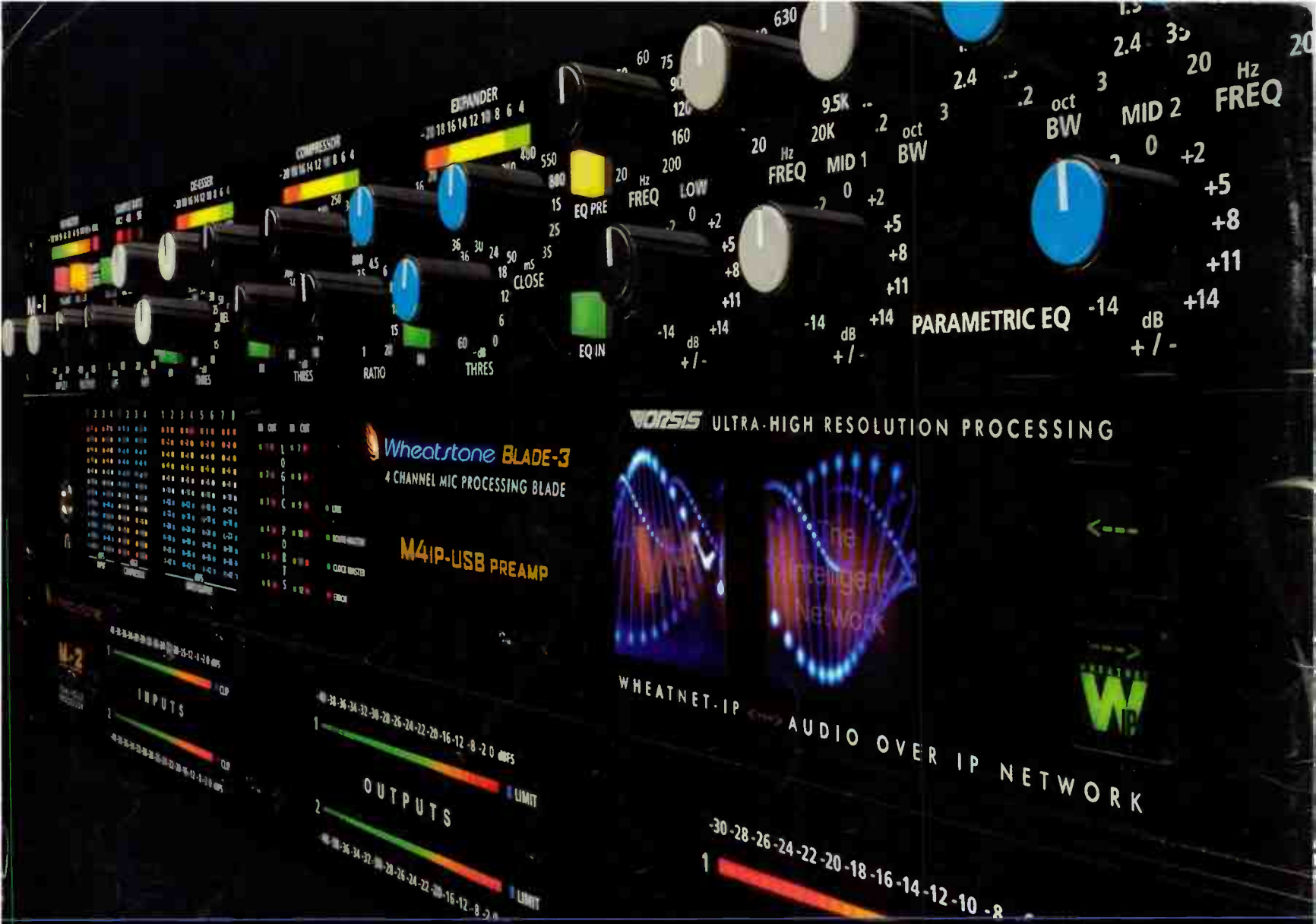

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