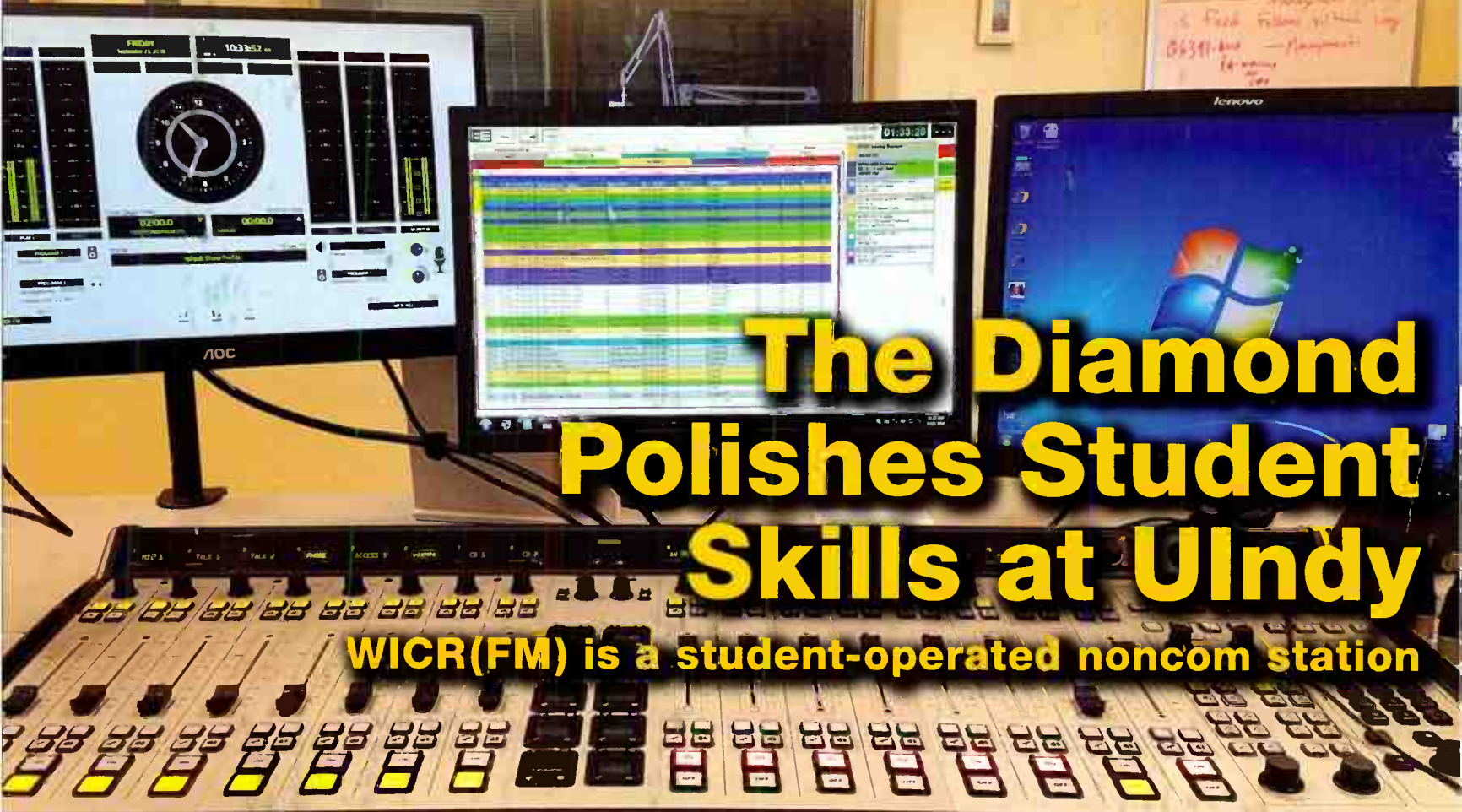




Radio

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TABLE OF CONTENTS



UIndy TV's main set emphasizes station branding and its university connection with colors and the school mascot, Ace the greyhound.

FEATURES

- 10 **Facility Showcase**
"The Diamond 88.7" Polishes Student Broadcasters' Skills in Indianapolis
- 16 **Trends in Technology**
Tips to Outfit Your Workbench and Fix Your Workflow



21

On the cover:
Axia fusion console installed at WICR.

COLUMNS

- 6 **Viewpoint**
Happy Holidays From Radio Magazine!
- 8 **Managing Technology**
Mitigating the DDoS Threat
- 14 **FCC Update**
New Administration, New FCC
- 28 **Tech Tips**
The Best After-Hours Fix Is the One That Takes the Least Time

DEPARTMENTS

- 21 **Applied Technology**
The Human-Machine Interface and PLCs
- 24 **Field Report**
Marantz PMD 561 Is a Useful Gadget
- 34 **Sign Off**
The Weaponized Internet

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Happy Holidays From Radio Magazine!



December is naturally a time to reflect upon what has happened during the past year and to look forward to the New Year that awaits.

And for all of us, it's also a good time to take stock of what we accomplished over the last 12 months, and to perhaps refresh our to-do list for the next. I always find it enjoyable to mark off the tasks that were accomplished because it practically guarantees some level of satisfaction. If you're like everyone else, not all the projects got done, and some have become obsolete. While working on next year's list, I usually drop the old

list into an archive folder — it can be interesting to go back and read three or four years hence.

Of course, as you get older, the years seem to peel away faster and faster. I'm not sure why it feels that way, except that if you look at it like a math problem, it makes logical sense: When you're 10 years old, one year comprises 10 percent of your entire life. By the time you're 50, it's only 2 percent.

DIGGING DEEP IN DECEMBER

Don't let it be said that there are no schools teaching the broadcast engineering art. Jason Ornelas brings us an article about the University of Indianapolis's WICR(FM), where students can learn about radio engineering hands-on. Jason is an alumnus of the program and is currently the director of engineering for CBS Radio in Sacramento; WICR is clearly doing something right.

Dennis Sloatman introduces to the concept of the human-machine interface. He describes what an HMI is and how to use it, before getting back to the details of a PLC-based controller that we've been learning about in his series of articles.

The various DDoS attacks carried out on the public internet have faded from the news recently, but the reality is that one could be pointed right at your station right now. Chris Cottingham is back this month, sharing some simple steps you can take to mitigate the threat.

This month's Trends in Technology column gives tips for maximizing your productivity during the winter and beyond. While you may not get a lot of project work done during this time of the year, it is a good time for housekeeping around your office and shop. This month's Tech Tips follows a similar theme — how to plan ahead to make your job a little easier. What spares devices and types of gear should you have on-hand? None are complex or expensive, but any of them could save you time and even money later.

What are the potential differences for the FCC under the incoming Donald Trump administration? Lee Petro speculates about potential policies and priorities.

Contributor Chris Wygal spent some time getting to know the Marantz 561 hand-help solid state recorder, and tells you all about it. Smaller is no longer considered better — the 561 is a good example of the reversal of that trend.

As you would expect, the Wandering Engineer, with the revered final page, is back — this time to address the topic of weaponized internet. "Radio has taken a back seat to social media — which has been weaponized in a way that radio never was," according to this month's Sign Off. Is the fake news phenomenon simply an unintended consequence, or something far more sinister? You'll need to decide that for yourself, of course.

Have a wonderful holiday season and a great New Year! **Q**

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Mitigating the DDoS Threat

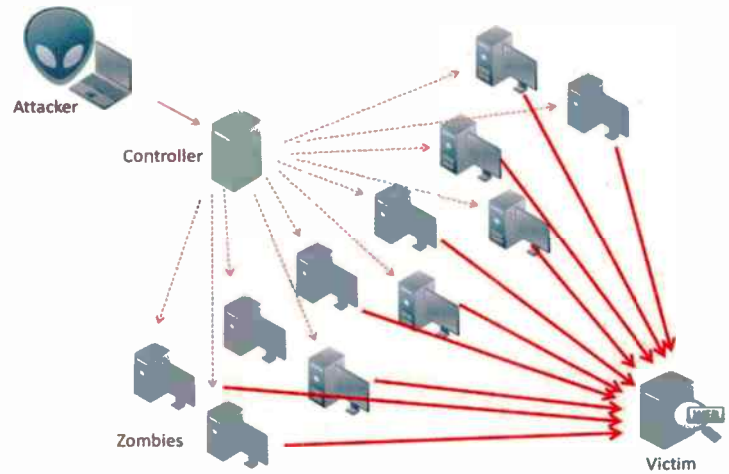
by Chris Cottingham

Distributed denial of service attacks that leave the internet inaccessible to many users are becoming more common. The disruption of internet-based services seems to be a favorite way to cripple businesses globally. These attacks are not limited to websites and major operators; this same breach could cripple a radio station's services and audio streams. They could wreak havoc on remote broadcasts, transmitter links and other related services.

This is an unintended consequence of the fact that engineers have become dependent on internet services, since they are inexpensive to implement and simplify our jobs.

DDoS attacks are simple in nature: A nefarious person sets up millions of computers to swamp a target computer with a flood of requests for service. The target computer gets overwhelmed with the requests and crashes. Seems simple in theory and it is terrifyingly simple in practice.

A computer or cluster of computers is usually set up to offer services



This illustrates the basic scheme of a DDoS attack.

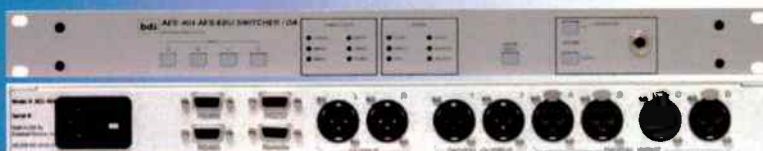
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such as websites and email by being configured to “answer a specific door” (i.e., port number). Normally, the computer can handle requests for these services, and it is built to do so. In a DDoS attack, the attacker has as many computers as they can muster ask repeatedly for these services with no intent of actually receiving them. Since the computer offering services has to respond to each request, valid or not, it quickly runs out of resources and crashes.

The attacking computers are usually part of a network or “botnet” of compromised machines; the owners of the attacking computers usually have no idea that they are participating in an attack. Most malware on the internet seeks to compromise the computer and make it wait to be activated for use in an attack.

Imagine being on a remote with a Comrex BRIC link or a Barix encoder, or imagine having one of these units feeding the main audio for your station to a transmitter. These devices depend upon network connectivity to operate properly. They run the audio stream for your broadcast across the internet and, eventually, to the radio station or transmitter.

Unfortunately, these devices are also susceptible to DDoS attacks just like major websites. Clearly, this disruption would cause the audio to skip or completely cut off, and the only way to restore service would be to move the device to another IP, which may not be possible in the field.

In the case of station websites, these attacks could disrupt contesting or social media campaigns. There would be no easy way to fix this, unless the provider has a plan to deal with such attacks.


Most internet-enabled devices have some type of security in place to mitigate this type of disruption. That’s why Comrex BRICs and Barix devices have the ability to use alternate port mappings, and unused services can be disabled.

Often codecs are not placed behind a firewall due to audio latency issues, and because of this, engineers must take care to disable unnecessary services and change the default ports.

The best action an engineer can take when utilizing these units on the internet is to change the default ports and disable remote web access. It would also be advisable to have an extra static IP to which the device can be moved, if needed. Engineers should also use these units without DNS mappings — doing so will reduce the chance that someone can find the units IP

addresses based upon the DNS name.

When examining the vulnerability of station websites, engineers need to work closely with their web hosting service providers to ensure that steps have been taken to safeguard these websites and other related online services.

Providers should be well versed and provide the station or engineer with documented DDoS mitigation plans. 

Cottingham is a former radio chief engineer, now working in streaming media.



Get in Sync

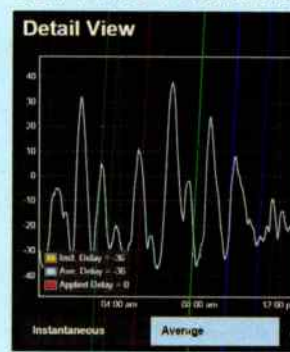
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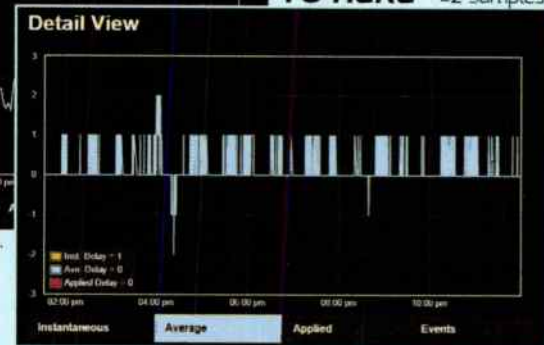
– Sam Caputa, Director of Engineering, Emmis Communications.

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WICR's newsroom features an Axia Fusion console.

“The Diamond 88.7” Polishes Student Broadcasters’ Skills in Indianapolis

by Jason Ornellas

WICR(FM) “The Diamond” 88.7 is a public radio station owned by the board of trustees of the University of Indianapolis. It is operated by university students, faculty and staff with programming from Classical Music Indy, American Public Media, and other outside, independent producers.

In 1962, WICR was broadcasting with only 10 Watts of power. Throughout the years, it has received grants to increase its effective radiated power, and today it’s a licensed non-commercial full-power Class B station at 5,000 Watts. The combination of 5,000 Watts of power and an antenna height of nearly 700 feet give WICR coverage area equivalent to that of a 30,000-Watt FM station.

The building housing the station was built several decades ago; WICR resides on the third floor of a 50,000 square foot expansion completed in 2005.

The WICR engineering staff designed the facility, working with the university’s physical plant. Current General Manager Scott Uecker (who is also the former chief engineer) and Russ Maloney, who was the director of engineering at the time, contributed to the design of the stations and studios.

WICR also received input from students, alumni working professionally in the field, and some professionals in the local engineering community, most notably the late Don Payne.

All were instrumental in the build-out.

TECH SPECS

The studio furniture in the radio facility is all custom-built by local contractor Mike Grzelak, local carpenter in Indianapolis. The university also recently updated the TV control room and installed new studio furniture from Forecast Consoles.

WICR radio and television facilities are both driven by Axia. The on-air studios are equipped with Axia Fusion consoles; Element consoles round out the rest of the studios, including the television control room.

WICR has a total of five studios that are used for on-air purposes: three air studios, a talk studio and a news studio. Each HD channel has its own air studio along with the FM. There are three production studios in the facility, and the HD-2 air studio, since it is usually unmanned, can double as a production studio; if an on-air studio fails, any production studio can be put on the air with the click of a few buttons through Axia.

With Axia, the routing is simple and mainly software based. All routing controls are done with a computer and a web browser. The analog and mic nodes take the different inputs and outputs to and from recording devices and sound cards via an Ethernet cable.

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WICR chose the StudioHub Adapters to hookup gear to the network. These adapters work with several types of connections, going from RJ45 to XLR, 1/4-inch, 1/8-inch, RCA, etc.

The engineering staff is in the process of documenting every single input and output in the facility.

As daunting as it sounds, the binder that they are using to put everything together has come in handy on several occasions.

Currently, they have maxed out capacity on two Cisco 24 port switches — just on the radio side. The television facility is connected to the radio side via a trunk cable to the TV Cisco switch.



This “candelabra-style” tower supports WICR(FM).

LEARNING

WICR is using Audio Vault for its automation systems, as well as other equipment like the Sage Digital ENDEC, both VoxPro and 360 Systems Short-cut. They use these in the FM/HD-1 and HD-3 studios to give every student the experience using various systems to prepare them for the real world.

WICR is also teaching students how to use the Telos Assistant Producer call screening software during its talk shows. They have access to the Associated Press for its 5 p.m. newscast that airs Monday through Friday.

The students stay busy with two Comrex Access Portable units that are used for remote broadcasts. The station airs radio broadcasts of all the university’s football and basketball home and away games. They have also aired softball and baseball games on its HD-3 channel, unless the teams are in collegiate tournament play, at which point those games air on HD-1.

Program audio from the main FM/HD-1



Uindy students take part in TV production project.

studio passes through Nielsen encoders and hits the Omnia-6hd from the processor in the engineering room. Continuing through the air chain, program audio then feeds both the Broadcast Electronics XPi 10esp exporter and a Moseley Starlink, which is the first half of a back-to-back radio shot out to the tower site. (WICR uses a second STL frequency from the intermediate relay point out to the transmitter site. The back-to-back path is roughly 18 miles long.)

The HD-2 and HD-3 channels pass through the encoders and then go into a Broadcast Electronics IDi 40 importer, before joining the exporter in the air chain. Once



WICR(FM) uses a BE FMI-703 as the main transmitter and an FMI-201 as its auxiliary.

the signal reaches the tower site it goes into a BE FXI 250 exciter, which drives the primary transmitter, a BE FMi 703. A BE FMi 201 is ready to go as a backup transmitter as well.

WICR also has two Barix boxes that serve as a backup audio feed for its main channel. Using its remote control system, if the exciter detects a drop in signal from the Moseley Starlink SL9003Q, it will automatically switch to the Barix. In addition, WICR has an ISDN from its studio to tower site which serves as an additional redundancy. WICR strives to stay on the air by any means.

AudioVault from Broadcast Electronics is WICR's on-air playout system; online streaming is supported by WideOrbit. There are various ways you can listen to WICR online and on mobile devices. The WICR app is available from the Google Play Store or iTunes; in addition, WICR also sends AAC and MP3 streams to TuneIn, iHeartRadio and iTunes Radio.


WICR provides students a wealth of opportunities to learn valuable skills needed in radio broadcasting and allied industries.

These opportunities range from

on-air work to behind-the-scenes roles in production, programming, news, sports, promotions, sales and engineering. WICR has a student management team that oversees the staff and runs the station.

The broadcast technician usually runs department meetings and during that time will train the students on proper termination of cables, connector types, soldering, proper usage of the Access remote gear, Axia systems, AudioVault administration and RF.

During the summer months, the director of engineering trains the student broadcast technician in the same areas, so that they are ready to go for the start of the school year. The phone number and email addresses of the broadcast technician are also entered into the emergency call list for off-air situations. This gives the student real world experience.

Still, the department works together as a team to fix whatever problems exist and always tries to involve everyone in the solution. 

Scott Uscker and Joe Boehlein, WICR director of engineering, contributed to this article.



WICR's rack room, featuring Axia nodes, Dell servers, Comrex Access units.

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by Lee Petro

New Administration, New FCC

With the largely unexpected election of Donald J. Trump as President of the United States, it is useful to consider how the Federal Communications Commission will change under his administration, and how these changes will affect the broadcast industry.

First, and most fundamentally, the leadership of the FCC will change. The president has the right to nominate commissioners for approval by the Senate. Traditionally, an incoming president will specify a new chairperson upon

taking office, and most times, the immediate past chairperson resigns from the FCC as of the inauguration date. But, as with the election itself, this is a nontraditional year, and the FCC may be in for some rough waters.

Chairman Wheeler's term on the FCC does not expire until 2018, whereas Commissioner Rosenworcel's term expired earlier in 2016. If her re-nomination is not approved by the Senate by the end of the year, her term will automatically expire. That would leave Chairman Wheeler and Commissioner Clyburn as the

two Democratic appointees, and Commissioner Pai and Commissioner O'Rielly as the two Republican appointees.

While President-Elect Trump will have the power to name a new acting FCC chairperson when he takes office (the smart money is on Commissioner Pai), there is a possibility that Wheeler will stay on as a commissioner until his term expires. Trump would then have to nominate a third person, a move which could be delayed until the middle of 2017.

HYPOTHETICAL SHIFTS

With the (hypothetical) acting Chairman Pai or O'Rielly taking over on Jan. 20, 2017, it is likely that we will see several proceedings that were thought to have been resolved by the end of 2016 either reopened or significantly modified.

This is a nontraditional year, and the FCC may be in for some rough waters.

For example, the FCC was ready to vote on several items at its Nov. 17, 2016, meeting, but Chairman Wheeler was warned by certain congressmen that the FCC should not take action on any contested rulemaking items prior to the new administration taking office. That warning led to the deletion of items that would have led to new rules for business data services, universal service fund reform, and video description requirements.

Also, because the FCC chairperson sets the agenda while holding office, it likely that we will see action on items that are important to the acting chairperson.

For example, Commissioner Pai has been a strong advocate for the revitalization of AM

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stations, and pledged in October that he would press for new FM translator filing windows for AM stations to be opened as soon as possible in 2017. He has also been a strong proponent of further reforms to the public file requirements, and supports the elimination of the requirement

he could to “rid the airways” of pirate radio operators, including working with Congress to increase the fines and penalties that the FCC can impose on violators.

Another possible area for further reform is the recently adopted media ownership rules,

Commissioner Pai has been a strong advocate for the revitalization of AM stations, and pledged in October that he would press for new FM translator filing windows for AM stations to be opened as soon as possible in 2017.


that stations maintain letters and emails received from the public in a paper inspection file.

Commissioner O’Rielly has spoken out against pirate radio operators and emphasized the need for their elimination. In a speech before the New Jersey Broadcasting Association, O’Rielly promised that he would do everything

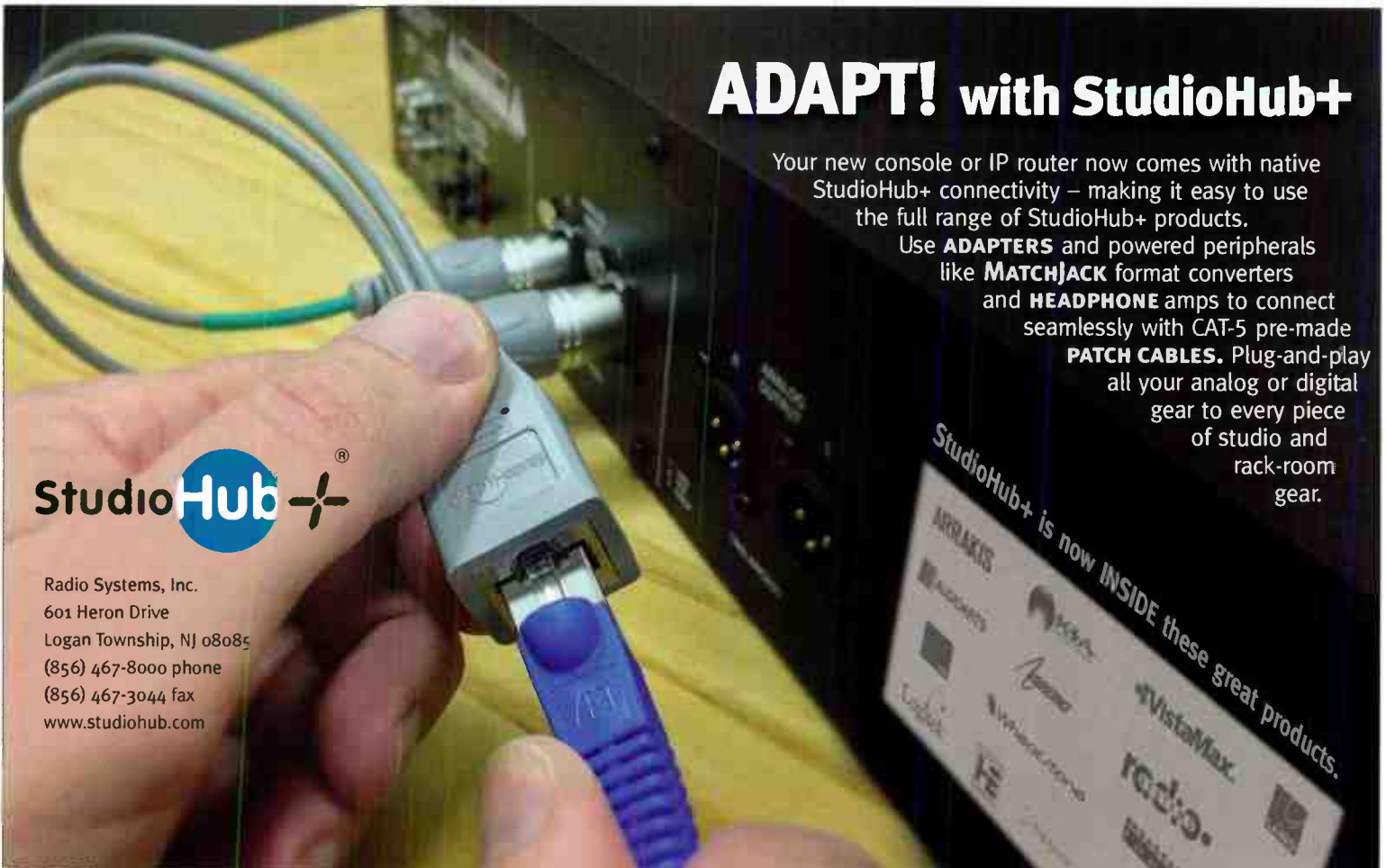
and the decision to maintain the newspaper-broadcast cross-ownership rule. While the FCC determined to keep the ownership ban in place, both Republican commissioners opposed the decision, and we may see additional work to eliminate that ban, either at the FCC or on Capitol Hill.

Both Republican commissioners also support the migration of television broadcasting to the ATSC 3.0 standard, so we might see FCC movement in that regard in the new year, as well.

Finally, there is also talk of a re-write of the Communications Act in the new Congress. The last major overhaul was in 1996, when, among other actions, the broadcast ownership rules were substantially relaxed. Leading House members and senators have called for the reauthorization of the FCC, as well as adopting reforms on how the FCC conducts its rulemaking procedures.

Thus, while it is clear that the election of Donald J. Trump will lead to many changes throughout the country, it is also likely our little corner of the universe will experience significant change. Stay tuned in 2017. 

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



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Tips to Outfit Your Workbench and Fix Your Workflow

by Doug Irwin, CPBE AMD DRB

The holiday period is a tough one for getting major projects done. There are the scheduled days off, of course. There are also the many unplanned days when colleagues take off to do something other than work. There are also weather considerations, of course. Still, some of us man the store for the duration of the season.

So what are some ways to be productive during this season — ones that will pay dividends as soon as January rolls around? Here are some productive housekeeping items that make your job easier.

TECHNICAL WORKSTATIONS

I recommend keeping your administrative space and your workbench



The solder fume extractor should naturally be placed adjacent to your soldering station.

separate, to the extent possible (and assuming the space exists). This is especially true if your administrative space is amongst other department heads at the radio station.

In fact, the ideal situation is this: have the department heads who know you as an administrator see you doing work in front of your computer (working on spreadsheets and the like). This would include the GM, the sales manager, and business manager. Likewise, the department heads who know you as the guy who responds to technical issues should see you hunched over a soldering iron; locate your workbench space somewhere near the studios.

A workbench that is designed for the analysis and repair of electronics is no luxury at the station. If your job is fixing electronics, the workbench is just as important as other tools, like your computer. The right tools are always needed for the job, and the correct workspace is one of those.

Here are some of the more important features you should consider when picking your workbench:

Resilient countertop. The last thing you want is to have a piece of rackmount gear, or a computer chassis score or otherwise mar the countertop on day one. A butcher-block style would be ideal in the event you don't care about divots; on the other hand, if you do, you could always cover the top with something like Masonite.

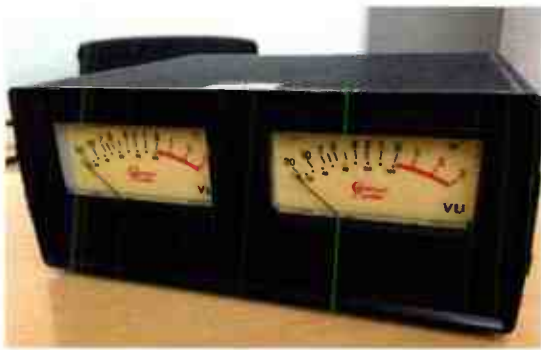
Adjustable height. Ergonomics are very important. I usually opt for a slightly higher work surface and slightly lower chair, because this keeps my back straighter, hopefully preventing soreness later on. If your workstation countertop is too low, your back will grow tired before long.

Shelf space. Some of your test equipment belongs at eye level, above the primary counter top. Get a shelf for items such as voltmeters,

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Stand-alone VU meter sets are rare nowadays. Every station needs one though — such as this one by Coleman Audio.

oscilloscopes, and audio meters. Save the primary countertop space for the item(s) you are currently working on.

Electrical outlets. Clearly the shelf is going to need access to electricity if you load test equipment on top of it. I prefer outlets to be on the back of the shelf. If they are in front, before you know it, power cords will be in the way.

Magnifying lamp. The reality of getting older is that you need more light to see what you are doing as time goes on, and magnification can be especially vital when working on electronics. If you do get a new workstation, see about a magnifying lamp at the same time.

As in so many cases, Amazon is a good website to see what electronics workstations are available and to easily compare pricing between models.

If you have seen factories or other locations

where a lot of soldering is done, you know that the smoke is very deliberately removed from the area. (Here's a good Youtube video on the negative effects of solder smoke, in case you need extra motivation: <https://www.youtube.com/watch?v=EGdlM48eDbA>).

There are quite a few fan/filter combination devices that can be used to keep solder smoke from circulating in the air around the shop. As just one example, you could consider the Aoyue 486 Bench-top Solder Smoke Absorber. It's quite inexpensive, coming in at less than \$50.

MOST VITAL TEST EQUIPMENT

"If I were stranded on a desert island, what would be the one piece of test equipment I would need..." If I were to answer, it would be "portable digital multimeter." There's more to a well-equipped shop than that, though.

DMM. Probably the most important feature of a digital multimeter is its ohmmeter. After all, how many problems boil down to a bad connection? Many. Secondly, a DMM's AC and DC voltmeter functionality comes in second. Measuring current flow is something you may do while troubleshooting — its use is fairly rare. Other features are marketing. Stick with well-known brands (Fluke comes to mind) and don't cheap out. This isn't something you want to buy at hardware or auto parts store.

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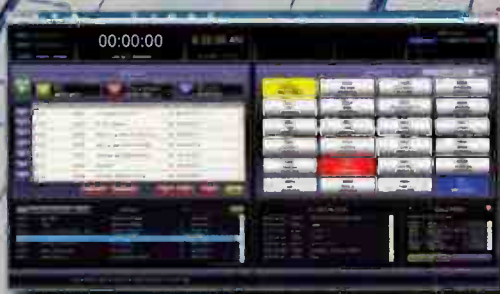


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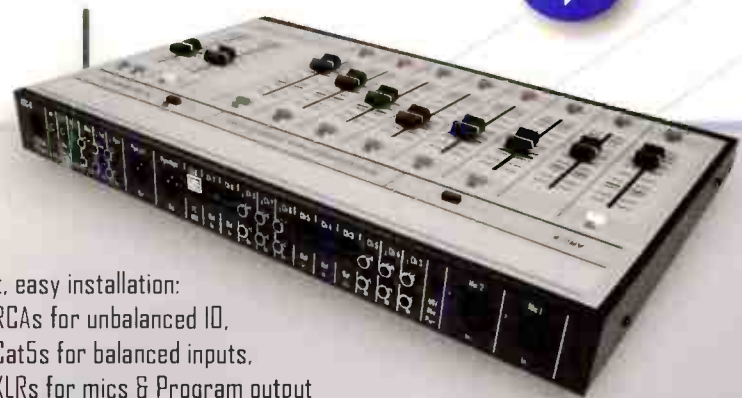
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Audio signal generator. You'll want both AES and analog outputs. Analog outputs should go as high as you can get them — +24 dBu would be ideal.

Audio metering. A set of actual VU meters is extremely important to have at the station. The Coleman Audio MBP2 is one of the few units out there — stereo meters, switchable between +4 and +10 dBu, with XLR inputs.

Variable power supply. Troubleshooting power supplies is a task in which you should be competent. It's the one part of every device most likely to fail. Having a variable bench power supply allows you to isolate a potentially bad power supply and substitute a known-good power supply as part of the process. Voltage and current capacity are the parameters you'll be paying for: Get a variable, dual-polarity output (at least 0-15 VDC) as well as a 0-24 VDC output with 5A of capacity. (You may need two separate devices.)

Layer-2 switch. You will often have a piece of gear on your bench that needs configuration, or some attention, best applied via Ethernet. Outfit yourself with a small layer-2 (Ethernet) switch for just those occasions.

PORTABILITY IS KEY

In our October 2015 issue, I mentioned other inexpensive pieces of test equipment that use a laptop as their base —including an oscilloscope and spectrum analyzer. You may want you to look back at that issue; you can read it online here: <http://tinyurl.com/zmhkhvu>.

I can't imagine not having some sort of computer in the shop, but a laptop and Wi-Fi is often



Putting it all together — the work bench with everything you need at hand, and light to see it by.

more useful than a desktop for any number of reasons. For example, you can:

- Look at user manuals online while standing in front of a piece of newly racked up equipment.
- Run the user interface of a piece of gear while standing in front of the equipment itself.
- Configuration of the new device via its user interface.
- Install an audio recording program, such as Audacity. This can be a great troubleshooting tool, if you pick up an inexpensive audio-to-USB converter as part of your test equipment.
- Serial-data connection testing, using PuTTY or CoolTerm. Pick up an inexpensive serial-to-USB converter to facilitate this sort of testing, unless your laptop still has a serial port built-in.

Sure, you can do much of that with a PC in the shop, but do you really want to run back and forth between there and the rack-room, if they aren't colocated? Not every problem is analyzed and/or fixed in your usual work area. You could be doing work in a studio, a hallway, or in the rack-room. For this reason, portability is key.

And every shop needs a place to keep and organize tools, of course.

Usually this is accomplished with a toolbox of some sort — often one you would see in a mechanic's garage. I recommend that you

use a roll-around toolbox, one that can easily be pushed out from your workstation to wherever you need it around the station. How annoying is it to continually get up and go back to the shop to grab more tools? (Very.) This type of case is designed to minimize all that back-and-forth.

It's easy to stock the toolbox with 95 percent of the items you use on a regular basis — cutters, screwdrivers, keys — as well as materials. My roll-around has the usual hand tools, along with the test cables I use for the vast majority of work.

I have also found having a butcher-block on top of the roll-around is very helpful, so that you have a space to set your work as necessary.

A variation on this idea is a workbench on wheels. You'll need a place to set the computer, too, unless you don't mind sitting it on the floor all of the time. You can also use the horizontal space to hold other test equipment, and items meant for a horizontal surface, such as a soldering iron and vise. I also suggest



Work happens all around the station. Have an easy way to take your tools with you.

you install some sort of AC power strip to this roll-around, so that all the various items can be accommodated for their power needs.

If you want to get more work done in the same amount of time (especially if you want to stick to a 40-hour work week), then workflow is an important consideration. These ideas are meant to make your work flow more smoothly, which should lead to an increase in productivity, and a decrease in frustration. **Q**

The Human-Machine Interface and PLCs

by Dennis L. Sloatman

This article is one in an ongoing series about programmable logic controllers and their applications in broadcasting. You can read past articles online at radiomagonline.com.

In the last article, we discussed design of and some considerations for a PLC-based automatic transmission line pressurization system. I also indicated that, in this issue, I would go into detail regarding the programming and ladder logic, as well as provide a detailed list of the necessary components.

I have since reconsidered that plan and will defer that portion of the discussion until a later article.

Introducing the human-machine interface, commonly referred to as the “HMI.”

In the previous article, I discussed several parameters such as Set Point (SP) “EV” — or Error Value — and “PV” — or process value. There are, in fact, other values that must be monitored and set by the technician, and far and away the best way to do this is with some sort of visual interface. (Consider if you had an air conditioning unit with no thermostat!)

Let’s consider options for monitoring and controlling the PLC-based controller through an HMI.

THE HUMAN-MACHINE INTERFACE

Among the ways to interface and program the PLC, you may use a PC running the programming software and “hard-code” the program parameters such as set points, timer delays, etc. and let it fly, use a PC running HMI software which provides a GUI; or, by use of a dedicated HMI touch screen.

The latter has several benefits, not the least of which is a self-contained interface to the PLC without adding layers of complexity, i.e., the PC operating system as well as the HMI application software and the attendant hardware drivers. The HMI is usually a panel-mounted unit which comes with a cutout template. (At this point, let me suggest a company which will, based

upon your design and ability to use their free software, fabricate a first-rate, manufacturer-grade front panel for your project: Front Panel Express.)

The HMI unit, depending upon which model you select, will communicate with the PLC using serial communications or by way of an Ethernet connection. HMIs are programmed using free software and via a serial port (USB, or standard DB9 port) available from the vendor.



Touch-screen HMI, front and rear panel view

PROGRAMMING THE HMI

The HMI is programmed, as stated earlier, by using free software provided by the vendor, similar to many Windows-based programs, making use of objects and their associated properties (like “VB” or Visual Basic).

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APPLIED TECHNOLOGY

Fig. 1 shows a sample screen of the Automation Direct C-more HMI software taken from the interface I used for a directional antenna controller. This HMI is capable of displaying up to 256 different screens, each of which is accessible by front panel function keys (which can be “context sensitive”) or by touch screen objects or by the HMI under program control. This particular HMI has a display resolution of 320x240 and a color depth of 32k.

If you'd like more color depth or higher resolution, more costly units are available, or you have the option of using HMI software which runs on a PC. Like many electronic devices, prices are dropping as manufacturing technology and fabrication techniques progress. For most of our applications, its display specifications are more than adequate.

HMI SOFTWARE OVERVIEW

Refer to Fig. 1, the C-More Micro programming software screen. As I said earlier, it's all about objects and their associated properties.

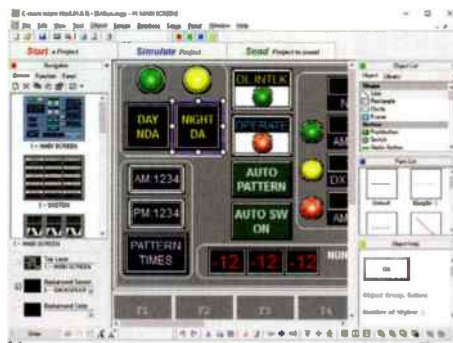


Fig. 1: Configuration of objects that will appear on the user interface is done with the CMore software.

Each of the graphic items you see on the screen is an object: The Auto Pattern button is an object as are the LED graphics. Each of these objects can interact with the ladder program of the connected PLC either by use of “Tags” (discussed in earlier articles in this series) which are variables with user-friendly names such as “Auto_Pattern_Toggle” and refer to a ModBus address of a ladder logic object in the PLC; or alternatively, by direct access to the PLC object by ModBus address.

If you use the tag method (preferred), you first export the tag database file from the PLC programming software and import this file to

the HMI software. This makes assigning a PLC ladder object (including “system tags”) to an HMI object a breeze.

I should note that, in addition to the tags you have created while programming the PLC, the PLC itself has a great deal of internal system tags the programmer (you) will find quite useful to display on the HMI. Examples of such tags include the internal real-time clock, PLC scan time, error codes, backup battery voltage, firmware versions and many other useful tags are there for you to use as you see fit.

HMI PROGRAMMING OBJECT AND PROPERTIES

As in many Windows programs, you access the HMI object properties by a right-click action on the object of interest (say a button or LED), which brings up the properties window for that object. Once in the properties window, you configure on/off button colors; font size/color; graphics options, such as frame style (3D or flat); the tag or ModBus address of the ladder object you wish to interact with; and finally more object-specific parameters—like whether a button is momentary or push-push.

In general, you select the type object you want on the right of the screen (object list), drag it to the display area (or “form”), set the properties for each object, and then save the project to a file.

The final step is to upload the project file to the HMI display.

SET UP SUMMARY

- Connect a serial port from the PC running the HMI programming software (using a USB-DB9 converter device, if required) to the HMI serial port used for programming.
- Connect the HMI port for PLC communication to the PLC port used for HMI communication (the HMI has two ports — one for each function).
- Run the HMI programming software
- Follow the software steps to select the serial port to be used and the type of PLC to be interfaced with.
- Export the tag database file from the PLC (if using a tag database)
- Import the tag database to the HMI software
- Create a new screen with some objects

(pushbuttons, switches, LEDs, analog meters, digital meters, etc.)

- Assign properties to the screen objects
- Save the project file and upload to the HMI display
- Test your program by touching a screen object and observing the expected action in the PLC.
- Vendors often have videos that will walk you through this process. Here is one example: <https://www.youtube.com/watch?v=fq5ScU0BI-k>.

HMI FINISHED PRODUCT

After we have programmed our HMI and interfaced it with the PLC, we can have a user-friendly and intuitive (if properly laid out) interactive means of setting parameters and monitoring virtually every internal function of the PLC — including user-programmed values such as current time, next action time, set points, current values, etc.



Fig. 2: Putting it all together — custom HMI designed for use with an AM directional antenna controller

Fig. 2 shows a touchscreen HMI for a directional antenna system controller mounted on a panel I designed, which was then fabricated by Front Panel Express.

Throughout this series, we have thrown

many concepts out there: PLCs, ladder logic, HMIs, tag database, ModBus, as well as some possible applications of these devices and some control theory. Once you get the hang of it, you'll find virtually no control system problem which cannot be solved through a PLC. The added benefits of an HMI really bring the system to a much higher level of functionality and serves to add that "manufacturer-level" quality to your project.

Next time we'll dig deeper into the ladder logic programming and continue to tie all of

these concepts together. 0

Slozman is the director of engineering for SummitMedia's Richmond, Va., radio stations.

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Marantz PMD 561 Is a Useful Gadget

by Chris Wygal

Visit any radio engineer's office and you'll find a smattering of everything imaginable. Classic microphones, owner's manuals from the 1980s, useful (and most likely never-to-be-used) connectors, and of course, snacks. You might find an equally eclectic smattering of items in the news guy's office. Engineers and news reporters are two different breed of broadcaster, but one thing unites them in a mighty way: gadgets.

Engineers like gadgets because they help get the job done, and news reporters like gadgets for the same reason. What defines a gadget? Well, short of turning to Webster for the definition, a gadget is something small, cool and with

inherent benefits.

I would contend that Marantz has been in the business of making highly useful gadgets since the inception of their PMD series cassette recorders. Remember the PMD201 or PMD430? Or better yet, how about when Marantz took the moving parts out and went digital with the PMD660 compact flash recorder? Not to be outdone by its older self, Marantz has released the PMD

561 solid state flash recorder, and it too boasts plenty of great new features.

HANDS-ON

Handheld recorders are small for a reason. To a fault, however, they can be too small. Miniature LCD displays, limited meter segments and tiny buttons are maddening. Small designs can sometimes limit inputs and outputs to 1/8-inch mini and RCA jacks. The small buttons generally lack tactile response. The PMD 561 alleviates nearly all of these concerns by sacrificing some compactness for real audio jacks, real rubberized buttons and rugged toughness.

For starters, the PMD 561 is just over 1.5-inch thick, 4-inch wide and almost 6.75-inch tall. It fits nicely in-hand with clearly labeled buttons and a 128 x 64 dot matrix OLED (organic LED) display. The display is a major highlight for the PMD 561 in that the onscreen text, options and metering are large and easy to see.

Nine large buttons live on the front panel, and they facilitate menu navigation and typical transport functions. The record button has a red ring that illuminates during recording. Essentially, the designers were conscious of users who find themselves in dim work environments.

THE INS AND OUTS

Additional controls and the inputs and



Marantz's PMD 561 features all manner of input and output connectors.

outputs are positioned on the sides of the PMD 561.

A slider-type control is used to power the unit on and off. Next to the power control is a "key lock" switch. When activated, all of the buttons on the unit are locked. This prevents an accidental recording stoppage or setting change.

Engineers like gadgets because they help get the job done, and news reporters like gadgets for the same reason.

On the same side as the key switch are the stereo RCA output jacks, 1/8-inch TRS input jack and a post-and-ring-style left and right record level control.

The top side of the PMD 561 is home to a 1/8-inch remote control jack, headphone and speaker volume control and a line/mic/48V selector switch for the XLR inputs. The best feature on the top side is the 1/4-inch TRS headphone jack. While some may consider this a nuisance when using earbuds, this is actually another highlight for the PMD 561, as far as professional users are concerned; with a

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FIELDREPORT

few exceptions, studio-grade headphones use 1/4-inch plugs. The 1/4-inch jack on the PMD 561 eliminates the trouble of finding (or having lost) a headphone adapter.

As we round out our tour, the left side of the PMD 561 has a 5V DC power jack, USB connector and the SD card slot. Additionally, this side houses an RCA S/PDIF input. The use of this jack may be rare, but there are times when the only available output from a mixing console is the S/PDIF jack. When in a pinch at a presser, the RCA S/PDIF jack could be a life saver and provide a little better quality to boot. The last input feature on the PMD 561 is a pair of Neutrik Combo A series XLR and 1/4-inch TRS jacks. Nearly every output interface can be used with the PMD 561.

ONBOARD MICS AND SPEAKERS

The PMD 561 has a set of stereo speakers on each side. These are small speakers with considerably less than full-range response used for

confidence monitoring and spot checking a recording. The stereo mic pair is situated on the front of the PMD 561 the mic elements are hidden behind two separate grills.

Many comparable portable recorders have an exposed X/Y microphone configuration on the front. As for the PMD 561 and its rugged plastic construction and tough rubberized buttons, exposing microphone elements for the sake of gaining an X/Y pattern would be counterintuitive. The condenser microphone configuration on the PMD 561 is well suited for capturing on-location sound and critical recordings where accurate stereo replication is necessary. More importantly, the PMD 561 can be tossed into an ENG or portable



Small but not too small. Its buttons and meters are all easy to read and use.

recording rig without fear of breakage.

TECHNICALLY SPEAKING

As would be expected, the PMD 561 comes ready to record stereo or mono mp3 (up to 320 kbps) and 16 or 24 bit PCM formats using 44.1, 48 or 96 kHz sampling rates.

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Up to three presets can be stored that include 23 settings which include input type, record format, high and low cut, mic attenuation and many others. One record timer and three play timers can be set for automated record and payout.

Unique to the PMD 561 is a feature called "Retake Recording," which allows on-the-fly editing. Retake Recording can be utilized in the field to save editing time later in the studio. Pitch control during playback is helpful in dictation scenarios.

The PMD 561 has highly-transparent automatic level control. When used as an archive recorder during a recent radio broadcast, the ALC on the PMD 561 was accidentally left on. The recording sounded excellent, and the ALC function was inaudible. The surface mounted ten-segment LED meter provides quick-refer-




Small, light-weight and rugged: this a great addition to the remote engineer's arsenal.

ence level monitoring. However, the OLED display can be toggled between four screens during recording. Information including recording time remaining, elapsed time, file name, input source and input levels are easily viewed. A high-resolution PPM meter shows accurate recording levels.

All in all, the PMD 561 is indeed a useful gadget. After a day of recording, all the files are easily transported to a computer via USB. It will record for up to seven hours on a set of four AA batteries. The input preamps on the XLR jacks are smooth a clean when using dynamic or condenser microphones. The overall design and construction of the PMD 561 allows the unit to travel well and be used nearly anywhere. The

large buttons and easy-to-read OLED display are stunning characteristics for a small, portable recorder.

The best feature is that I used the PMD 561 as an archive recorder and a recorder for a video shoot without cracking open the manual!

The PMD 561 is highly intuitive and easy to use. I look forward to keeping this gadget in my arsenal for many years to come. 

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

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Behind the Scenes With Chris

by James Cridland

After five years working for the legendary TM Studios in Dallas, Texas, Chris Stevens returned to the UK and recognized that he missed something. The country radio stations.

"I came to really love the country stations. I had no prior knowledge of country music, but I loved the stories, the musicianship and the production values of the tracks. Before I knew it, I was a convert," he told me in an interview via email.



Chris Stevens

Returning to the UK, however, he found no similar stations. Country stations are almost unheard of in that country. So, "as a bit of a joke," he launched his own station: with a stream of country hits and lots of imaging.

Five years on, "Chris Country" is carried on DAB Digital Radio transmitters across the country. According to the official RAJAR radio research figures in the UK, his station now has 35,000 weekly listeners in London alone. And it's still just one person running it: Chris himself.

The station is based in Salford's MediaCityUK in the north of England. I asked him how he puts it together.

"I use the Myriad playout system, which I'm a big fan of. It gives me great control over the output, and the two machine have been running 24/7 for four years without any issue. The streaming encoder is SamCast, which has some superb processing on it; the entire processing chain is SamCast."

"We're on two traditional DAB multiplexes, and for those we enter the Arqiva private network via the base site of our main investors, Nation Broadcasting. We send them a high quality private feed for that." Arqiva is the main transmission provider for the UK, and runs the vast majority of broadcast infrastructure in the country. "We're also on some smaller multiplexes, and we use Odroid and NUC machines to get the signal to each site, or regular broadband. Bitrates vary depending on cost and availability. Three of our areas are DAB+, and one area is mono. Much as it'd be great to have a high bitrate stereo signal in all markets, we get very few comments on quality or encoding."

I asked Chris why he's bothering with broadcasting on DAB, when online radio is supposed to be the future. He answered: "Online is the future... not the now. If you live in a major city, it's easy to forget how crappy a 3G — let alone 4G — signal can be in more rural areas, plus the simplicity of just switching a normal radio on can't be beaten. Plus, a lot of our potential audience don't realize that they might like country music. They're not going to go searching for a country app, but when we're amongst all their "normal" choices, they're far more likely to give us a go. Seeing as country music is about great melodies, strong lyrics and memorable hooks, we reckon they'll stick around for a few songs."

That's not to say that he isn't focusing on the online elements of the station. "The website is from the extremely talented guys at Aiiir.com — it's so user-friendly — and they also supply the apps. Our apps are fantastic. They tie in with our websites, meaning that all of our web content is available on the app. The most popular sections are the gig guide and track listings.



Country stars Maddie and Tae have appeared on the show.

We also have interviews available on demand, and we've had lots of positive compliments."

Chris also runs a jingle and production company; and, because of that, there's a lot of production on the station, which makes up for the lack of presenters in most dayparts. "The production supplies the personality, a bit like a Jack format, and we're pretty active on social media. We do also have a few shows — interestingly, the online peak of the week is Saturday mornings, when we broadcast Bob Kingsley's Country Top 40." The station also records acoustic sessions, and gains regular interviews with country stars who tour in the UK.

The station isn't, yet, profitable. The biggest cost is transmission, and investment in the station has come from a successful UK radio group, Nation Broadcasting. Chris believes that it will be, however. Country music is the biggest music genre that isn't available on terrestrial analogue radio. "We may not have the same amount of country heritage, but a great song is a great song, anywhere."

Regrets? "Had I realized that the station would keep growing, I certainly wouldn't have named it after myself," Chris claims. 🇺🇸

Cridland is a radio futurologist and managing director of media.info based in Australia. He also blogs for radiomagonline.com.



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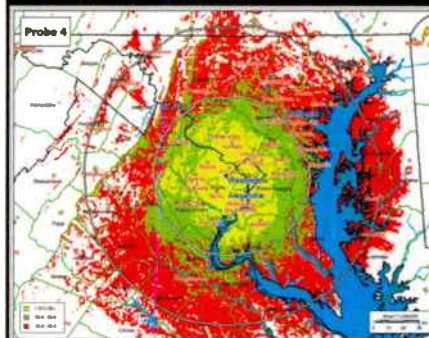
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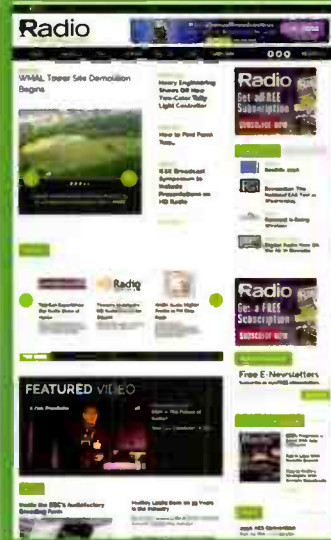
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The Weaponized Internet

by The Wandering Engineer

When the United States first entered World War II, radio was fairly new. A number of people had already used it for what we now see as unscrupulous causes: John R. Brinkley famously promoted questionable male augmentation procedures, first in the United States, and later from over the Mexican border, after pressure built to take him off the air and close his clinic. Across the ocean, Adolph Hitler promoted a populist agenda that made Germany great again, and to put it politely, was a threat to democracy, even here.

Approximately seven weeks after the United States' entry into World War II, "Voices from America" began transmitting with this pledge: "Today, and every day from now on, we will be with you from America to talk about the war... The news may be good or bad for us — We will always tell you the truth."

It was a difficult decision to tell the truth, because America was not doing well in the war effort. The truth is, a lot of bad news was kept from the American public and the world, as U-boats sunk ships in sight of our coastline. The VOA would have reported such things (if they were made public). The decision to keep the VOA reporting as close to reality as possible paid off well when the tide of war shifted. The VOA had earned a reputation for accuracy, and in the end, the VOA made a difference.

Media is a powerful tool for good and for evil — radio, especially so. Today, radio has taken a back seat to social media — which has been weaponized in a way that radio was not. No matter how far you're leaning to the right

or the left, radio overall, self-centers. It's hard to keep an unsubstantiated position day-after-day on radio without cracks appearing: Sometimes it's subtle cracks in the talent's voice, but more often it appears as cracks in the narrative. In any case, one can tune around and find some balance.

Social media is not self-correcting — in fact, it is inherently the opposite. Social media built ISIS and gave us the Arab Spring Revolution. Arguably, it also gave us one of the most divisive elections in our history.

Radio tends (not entirely) toward discussion. There are callers, guests, interviews and analysis in radio's native form. But there are also shows, mostly on the AM band, that are "meant to be entertainment," that are nothing but one sided diatribes with an occasional hyper-screened call-in.

That's the price we pay to scrape up enough audience to pay the power bill mostly on a medium that most listeners have long abandoned. Listen longer or change stations, and you'll get another view. You know to doubt Planet-X's existence because it appears occasionally on only one show that airs way after dark.

Do this experiment: Search a controversial topic on your computer and then do it on a friend's computer with a different political view. The search results will be entirely different.

Homophily is the characteristic of social media that feeds you what you like. All media lives and dies according to the time spent using it, and by giving you unchallenging results that reinforce your views, you begin to believe that everyone sees the world as you do. When you tell someone you disagree with to "Google it," and they don't change their mind, it's often



The simplicity of radio sets from the '30s and '40s belies their impact on the psyche of the country. The radios shown here are from the International Spy Museum in Washington, D.C.

because they get different information. Radio doesn't do that.

Our military — and almost every other military service in the world— now does a lot of information gathering and opinion shifting with large staffs and piles of servers as social media has been thoroughly weaponized. Radio hasn't.

We might get worried about cyberattacks on our stations, but it's all low yield stuff, relatively speaking. Even if I log into your default passworded transmitter and upload my MP3 file and take over, what does it do? I will reach, maybe, one share of the small share of people listening. Outside of making the trade publications and maybe local TV news, not much will come of it. If it's about reaching people, the yield is much higher with social media.

A few months ago, there was a huge DDoS attack. We've already forgotten it. We've come to accept that the internet is a place with a lot of bad people doing a lot of bad things. Fortunately, the same can't be said of radio. **0**



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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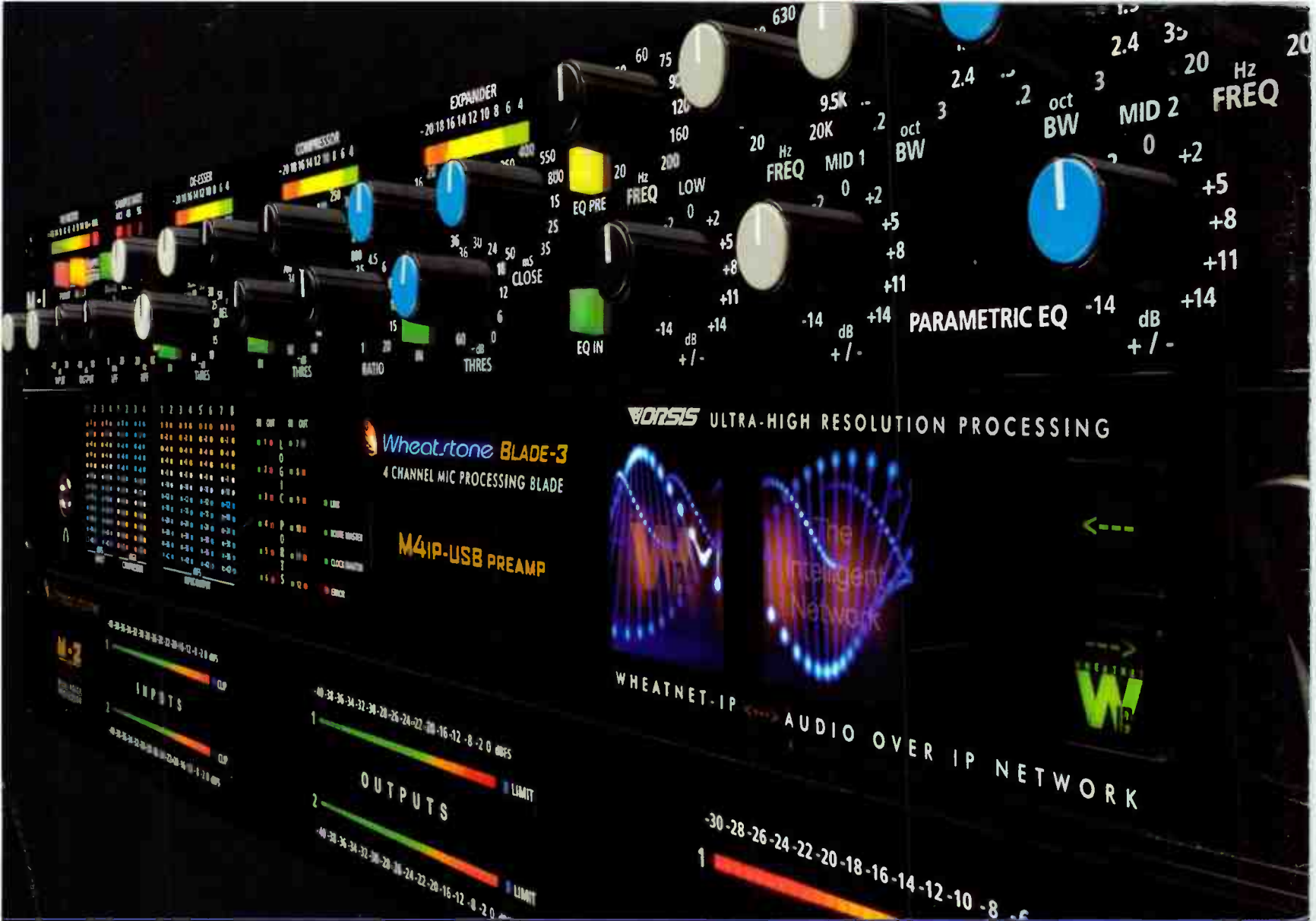
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