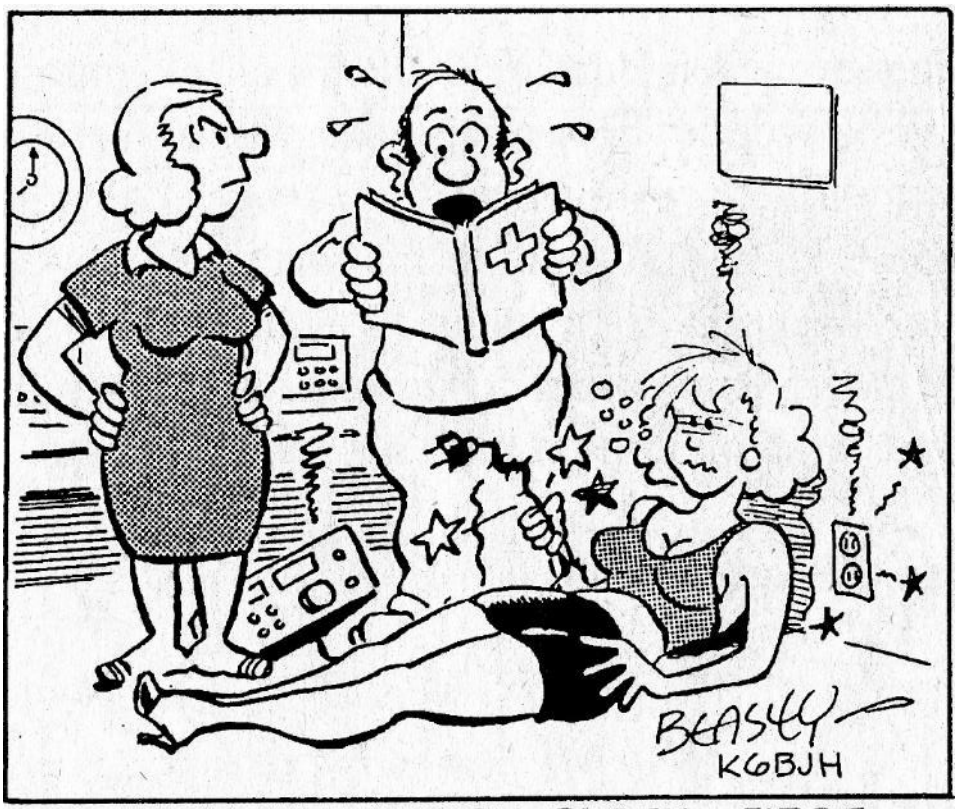
ATCO NEWSLETTER

VOLUME 36 NUMBER 3 **July 2019**

The ATCO newsletter is the official publication of a group of amateur television operators known as "AMATEUR TELEVISION IN CENTRAL OHIO Group Inc" published quarterly (January, April, July, and October)

ATCO SPOTLIGHT TOPIC

Thanks to Beasley, K6BJH (SK) for allowing us to share his cartoons.



ACTIVITIES ... from my Workbench

Welcome to the summer season, guys (and gals). Right now, I'm just sitting here thinking about all of the things I'm NOT going to do today. Lucky for me I just got a reprieve because although the grass needs cutting, I just heard thunder outside. How about that! Now I have a valid excuse. On to the Ham stuff…

I'm busy working on my MiniTiouner-Express receiver assemblies and DATV-Express transmitter boards for sale. That work is going to start winding down a little soon so I can pay some attention to other Ham things. However, we are now talking about possibly creating another DATV related product so the lull in the action may be short lived. Therefore, I need to finish a few MiniTiouner assemblies and get them in the mail to the UK for distribution first.

Next, I noticed the repeater 439MHz input is not as sensitive as it once was. It has been many years since I last checked on the components so I decided to remove the filters, signal splitter and analog receiver for a checkup at home. Re-tuning interdigital filters at the repeater site is a huge pain so the work is better done off site. There are two 7 pole interdigital filters in this line and it is tricky aligning them. I was anticipating eliminating one of them to see if we could get by with just one filter. **Bad idea!** The co-channel RF noise there is the worst anyone will encounter so I found the extra 1.2dB loss using 2 filters is a very small price to pay. The extra filter steepened the skirts a lot which kept the 439MHz bandpass away from our 449.975MHz link frequency and our 427.25MHz main transmit frequency. Also, there's FM repeaters in the vicinity starting at 443MHz so there is a lot to contend with. I added a high IP3 DEM preamp now to cope with the high levels of interference near 439, establish a good noise figure and make up for the 3.5dB signal splitter and 2.4dB filter loss. So far, so good. Things have improved dramatically. Now a 200mw signal from me 14 miles away produces a P3 signal into the repeater. Not bad.

However, now I found another unsolved problem. I find that the 200mw 439 signal is OK during the day but at approximately 7 to 8PM each day something blocks the incoming signal such that it takes over 10 watts to barely overcome it. Strange. The next morning it is OK again and throughout the day but about 7:30PM it gets blocked by some unknown source. I need to make a trip there with my Spectrum Analyzer but due to ongoing building repair work, I've not been able to go there after hours. I have a clue though that I'm hoping will be the issue. The rooftop building beacon light contains an LED bulb located about 5 feet away from the 439 receive antenna. LED lamps have been known to produce RF interference and since the interference starts about dusk and goes away at dawn, just maybe I've located it. I'll see soon. If that's true, it is probably causing interference to some of the commercial radios there too. If that's the case, I'll bet it gets fixed REAL FAST. We'll see.

NEWS FLASH!!!! I just tested the possibility of the LED interference by cycling them on and off during the day. No change so it's back to the drawing board. The interference is a DVB-T like signal with steep skirts and reasonably flat "top of the haystack" signal about 500KHz wide that drifts from about 436 to 441MHz varying in strength. Now I need a portable receiver/antenna system to track it down. Are there any volunteers out there that can assist me some evening????? It's difficult to do alone.

I've done no more investigation into the possibility of locating a link to Dayton at Jones road in South Vienna. Dave Pelaez, AH2AR, determined it IS possible but that was before the trees grew leaves in the Spring. We decided to re-test sometime after the Dayton Hamvention. That needs a re-visit.

Last, I'm quite disappointed with the 147.48 net participation lately. Are we getting tired of the Tuesday night nets? Should we move it back to 8PM? Check in and voice your concerns. We have had only one or two check-ins the last few weeks.

That's all for now. More later, Stay tuned!
...73 WA8RMC

ATV NEWS FROM OTHER CLUBS

Boulder Colorado:

The TV repeater is again functioning normally. However, due to rebuilding of the repeater currently in process, a temporary repeater is in service thanks Jack, K0HEH & Don, N0YE. It's a portable unit, 70cm only. Ch 60 in / Ch 57 out. DVB-T only. No control functions. It cannot be toned off. Don is streaming the TV repeater's weekly, Thursday afternoon, ATV nets over the BATC server (https://batc.org.uk/live/) under his call sign N0YE. Direct questions about current operations or repeater status to either Jim, KH6HTV or the assistant. trustee, Don, N0YE.

Colorado Springs:

The Village 7 ARC in Colorado Springs is putting on a demonstration of amateur television this weekend. Field Day activities will be televised live. The transmission covers most of El Paso county and will be continuous for the most part with a few hour-long breaks in the morning and evening. It may be received with a vertically polarized antenna, preferably a Yagi, hooked to a TV tuned to cable channel 59. Audio will be on 434.0, 438.5, and 146.85 MHz FM. Talk in on the AD0TP repeater 146.85 PL 156.7. This operation is only temporary for this weekend. Input is on 2434 FM vertical sector panel. Output is 434 AM vertical at about 10 watts into a 4el Yagi. No plans to keep it up because of site issues. Working well so far. You may try listening to 434 NFM on a Yagi up there see if you can pick up the carrier up there in the north land. CWID every 10 min and repeater audio on there.73 de Dan KE7TBB.

Pueblo Colorado:

The Pueblo, Colorado ham club is moving forward with their new ATV/DTV activities. They are now planning to install an ATV repeater on a high hill to the north-east of the city on the CSU-Pueblo campus. The call sign will be the club's historic call sign of W0PHC (i.e. Pueblo Ham Club). The trustee is Bill, K0CGQ. They just recently placed an order with Jim, KH6HTV, to build for them a basic, 70cm, in-band, DVB-T repeater. It will use a single 70cm antenna along with the new, ATV-DPX Duplexer. Other key components will include the Hi-Des models HV-110 receiver and HV- 320E modulator, KH6HTV model 70-9B, 10 Watt amplifier, ATV-BPF-441, ARR P432VDG preamp and Astron 13.8Vdc power supply. It will all be assembled on a single 19", relay rack, open shelf.

Delaware/Philadelphia area:

ATV group in Delaware and Philadelphia area have been running digital ATV over the last year and a half. Last month the local coordinating council T-MARK put out a draft band plan with comment period ending on the 9th of July. In the 70cm band, the draft mentions in the repeater ATV frequency section "Analog TV Only" and "No Digital TV". "Digital TV use on 440 has been Prohibited" They are proposing to allow analog and digital simplex/remote base and hot spots among other uses to overlay our ATV channel in the 438-440 MHz segment. We sent out a notice via the Digital ATV Forum and contacted some of the well-connected ATVers for help. We received help with our response to T-MARK from other ATN chapters. Our group has two linked repeaters in Ebright and Darby about 18 miles apart with Darby being closer to Philadelphia. Perimeters: Input: 439.25 MHz LVSB Output Ebright: 423 MHz DVB-T 2 MHz B/W Output Darby: 421.25 MHz VSB Antennas: Omni Horiz. Polarity We link from Ebright to Darby on 1252.0 MHz FM and from Darby to Ebright on 2420 MHz FM.

Florida Activity:

Wolfgang Snitsar KV4ATV setup a portable ATV station at the 2019 "Blessing of the Fleet" at the St. Andrews Marina April 20, 2019. This allowed the event officials to see the crowds for public safety. Part of the event was seen by some of the community on shore and on yachts by tuning onto cable channel 59 with their TV sets hooked up to an antenna. Wolfgang used his MFJ 5-watt ATV transmitter on 434.0 MHz with a J-pole antenna to transmit the event. Later, Miss Florida, Nicholette Jennings stopped by to pose for a photo and see what ATV is all about. Wolfgang and his son Vlad are coming to the ATNCA BBQ and to pick up a used Chevy Suburban and bring back antennas and other equipment for the repeater under construction.

California:

Our group is getting ready for our BBQ on August 10th at Tom WB6HYH's QTH in Rancho Cucamonga. We usually have this as a joint Nevada and California BBQ, sometimes we are surprised when a car pool from Arizona shows up. This year Wolfgang Snitsar KV4ATV and his son Vlad will be to

California to attend. Tom has his famous BBQ ribs. Could this be the reason for such a long trip?

HAMVENTION ATTRACTS HAPPY CROWD

Dayton Hamvention®, hosting the 2019 ARRL National Convention, chalked up its third year at its new venue, the Greene County Fairgrounds and Expo Center in Xenia, Ohio. Amateur Radio's largest annual gathering took place May 17 - 19. Hamvention officials have not yet released a 2019 attendance figure, but last year's show drew 28,417 -- the third largest attendance ever. For many hams, Hamvention offers an opportunity each spring to renew old acquaintances and make new ones, and for manufacturers to debut their latest and greatest gear.

"These were some of the biggest crowds I've seen since Dayton Hamvention relocated to Xenia," ARRL Product Development Manager Bob Inderbitzen, NQ1R, said.

Hamvention visitors enjoyed largely comfortable weather, with some drizzle on opening day. By all accounts, the crowd was animated and amiable. This year marked the first that Hamvention offered free Sunday admission.

"Dayton Hamvention 2019 was a fantastic event and was a great setting for the ARRL National Convention," said ARRL President Rick Roderick, K5UR. "Thank you to everyone for stopping by the ARRL exhibit area to visit with ARRL officials, staff, and volunteers. It's always a pleasure to be able to have a face-to-face QSO with everyone. Isn't ham radio great? The greatest hobby in the world!"

ARRL President Rick Roderick, K5UR.

A free ARRL/Dayton Hamvention mobile event app helped visitors navigate the landscape of exhibitors and forums. Attendees also used the app to follow the hourly prize drawings, connect with other visitors, and view maps of the sprawling fairgrounds. The new app got a positive reception.

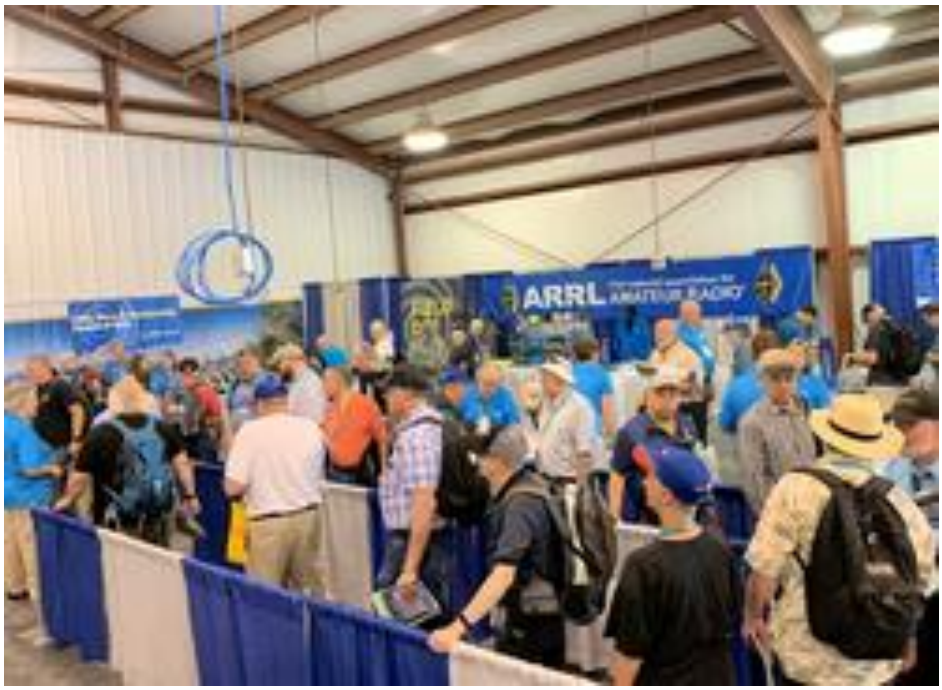
The Nashua (New Hampshire) Area Radio Society (NARS) -- the 2019 Dayton Hamvention Club of the Year -- led the "ARRL Spotlight on Radio Clubs and Mentoring" forum. NARS members described the ways the club builds and maintains a strong and active membership through its website, licensing classes, and programs that fit members' schedules. The success rate for licensing classes is 93%, and the club retains 70% of active members. Instructors from the ARRL Education & Technology Program shared resources available for introducing radio science and wireless technology.

Members of the Nashua (New Hampshire) Area Radio Society received the Dayton Hamvention® Club of the Year Award. At ARRL's invitation, NARS hosted an interactive exhibit to serve as a model for other clubs to emulate. (L - R) Scott Andersen, NE1RD; Jamey Finchum, AC1DC; Fred Kemmerer, AB1OC; Brian McCaffrey, W1BP; Anita Kemmerer, AB1QB; Dave

Dayton Hamvention 2019 Attendance Approaches All-Time Peak

The Hamvention Executive Team announced July 15 that attendance at Dayton Hamvention® 2019 was 32,472, the second-largest ever. This marks the highest attendance recorded since Hamvention moved from Hara Arena to the Greene County Fairgrounds and Exposition Center in Xenia, Ohio. This year's attendance also approached an all-time Hamvention high. Attendance at the show peaked in 1993, while Hamvention was still being held at Hara Arena, at 33,669, before the 1996 change in date from April to May. Last year, Hamvention welcomed 28,417 visitors in its second year in Xenia. Attendance in 2016 for the show's final year at Hara was 25,364. Hamvention hosted the ARRL 2019 National Convention, and both embraced the theme of "Mentoring the Next Generation."

"Our early indications were that 2019 would be a big year, and it lived up to our expectations," Hamvention General Chair Jack Gerbs, WB8SCT, said. "Our more than 700 volunteers worked hard to ensure that we presented a great show for our visitors. It wouldn't have been possible without them. I also want to thank all our vendors and visitors and hope they will all be back next year."



Hamvention officials suggested that a small factor behind the increased attendance might have been the free admission on Sunday, an effort to allow local non-hams to experience Hamvention. Free Sunday admission is expected to be continued next year.

The world's largest Amateur Radio exposition, Dayton Hamvention is sponsored by the Dayton Amateur Radio Association (DARA) every third full weekend in May. Hamvention 2020 will take place on May 15, 16, and 17. Read more.

50 YEARS LATER: TV'S LONGEST EVER REMOTE REMEMBERED

Re-printed with permission from TV Technology Magazine July 2019 (www.tvtechnology.com) It's very appropriate that we recall that most memorable time in our history. July 20, 1969 was when they touched down on the moon!
...WA8RMC

A 239,000 mile long "camera cable." James E. O'Neal Jul 16, 2019

SEVERNA PARK, Md.—On the evening of July 20, 1969, when Neil Armstrong set foot on the moon and proclaimed that his action amounted to "one small step for man and one giant leap for mankind," it signaled the beginning of a new era in space exploration and was viewed live by perhaps the largest television audience ever—more than half a billion people.

For those of us who witnessed this event live, the images coming back from the moon are etched in memory forever. The successful landing and return of the spacecraft climaxed more than a decade of the so-called "space race" with the Soviet Union, and even though the Soviets played first hand with the launch of Sputnik in 1957, America trumped it mightily with Apollo 11.

Would Armstrong's lunar excursion have been believable without live video?

It's conceivable that an audio broadcast might have convinced some individuals, but radio, by its very nature, plays to the theatre of the mind. Hadn't Orson Wells one evening in 1938 convinced a large share of the CBS radio audience that Martian forces had landed in Grovers Mill, N.J., just by putting together the right mix of dialog and sound effects?

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The Apollo camera was tested in one of numerous prelaunch simulations

No, television had to be part of the lunar mission, or it wouldn't have been that credible. But how to get live video of the event back to earth and a global television audience?

Remember, this was the decade of the 60s when broadcast gear was big—switchers and microwave links were stuffed full of vacuum tubes, video recording was done on 2-inch tape and cameras had heads weighing hundreds of pounds and were backed by CCUs and support electronics that ate heavily into rack space.

WESTINGHOUSE GETS THE NOD

In the 1960s, the two recognized suppliers to the broadcast industry were General Electric and RCA. However, neither had, nor was planning to, make any sort of small, lightweight camera.

Stan Lebar in 1969 with the Westinghouse color and monochrome cameras used in the manned lunar mission.

This is where Westinghouse Electric and one Stanley Lebar entered the picture. At the time, Westinghouse had a reputation for manufacturing mainly consumer devices—electric ranges, hot dog cookers, and TV sets. To a lesser degree the company was identified as a supplier of a limited range of broadcast products such as transmitters and power tubes. But there was another side to the Pittsburgh giant—military electronics. Westinghouse supplied a lot of battle-hardened electronic gear to the Pentagon, including some small black and white television cameras for use on ships and helicopters. Westinghouse also had something that many companies didn't at the time—a facility for fabricating custom integrated circuits solely for use by the company.

And to make the hand even more attractive, Westinghouse had created a very special television camera pickup tube; one that could run circles around conventional image orthicons and vidicons in terms of size, sensitivity, S/N and lag. This was the secondary electron conduction, or SEC, tube. It had an outstanding dynamic range and was so sensitive that, without stretching the truth too much, it could make pictures of the proverbial black cat in a coal bin at midnight.

These facts weren't wasted on the small group of NASA officials who were promoting video from space on the Apollo missions, and in particular the planned manned lunar landing. If a compact, reliable and high performance camera were to be constructed, it would need a tube such as the SEC, along with a customized chip set to drive it.

"We had all of the building blocks that they were looking for at the time," said Lebar, who would be tapped to head up the Westinghouse camera program for the Apollo missions. "NASA concluded that we were the only company that could do it."

Lebar, whose career track had been in airborne radar, not video, reflected that even though the camera would be a sole source procurement, Westinghouse still had to deliver a written proposal to the government.

"We were already working on tracking sites," he said. "And I had a trip to South America scheduled in 10 days. But we pulled a team together and put together the proposal in a week. I'd already left for Ecuador when they called me and told me to get to Houston to negotiate a contract for the camera with NASA. That was in July of 1964."

Lebar, who now lives in the Baltimore suburb of Severna Park, Md., said that under the contract that was hammered out, Westinghouse had to initially deliver 10 camera engineering models.

And the space camera couldn't be just reverse engineered from existing circuitry either. Other NASA specs spelled out the impossibility of using 525-line, 60-field video.

"They told us that we had only 500 kilohertz of bandwidth for video," Lebar said. "This limited us to 320-lines and 10 frames per second with no interlace.

"Also, the camera had to have an environmental range of from plus 300 degrees to minus 250 degrees Fahrenheit. The specs covered every environmental aspect that the LEM (lunar excursion module) and moon surface would see."

Lebar and his team soon set to work on designing the unusual camera, but found the NASA specs, especially those defining video performance to be extremely confining.

"Several managers commented up front that 'this was a dog,'" Lebar said. "Ten frames per second and 500 kHz of bandwidth don't make good images. We were fighting for at least an additional 250 kHz. And you have to remember that standards conversion technology was very primitive then; we had to convert this 320-line, 10 fps video to something that the networks could broadcast. RCA made an image converter to work with a camera they had—it was basically a 525 camera shooting a CRT displaying slow-scan video images. Not the best quality."

With such a contrivance being the state-of-the-art for standards conversion, Lebar and his team knew that every fraction of a dB in camera S/N performance was precious.

"When we built the camera, we went to extreme lengths to keep the noise down to an absolute minimum," he said. "We knew that a lot of noise would be added in the optical conversion and in relaying the video around the world from the tracking stations."

The Westinghouse team did deliver a workable camera in time to be used on some of the Apollo missions leading up to the one now planned for July 1969; the one that would actually put a man on the surface of the moon.

However, early that year, it seemed that the camera might not be a part of that trip after all.

NOT MISSION-CRITICAL

"George Lowe, who was head of the Apollo program, called a meeting to decide if we really should fly a camera to the moon or not," Lebar said. "It was a big meeting—all the sub-system people were there, and all of the astronauts.

"It was being argued that it [the camera] served no scientific purpose, so it shouldn't be carried to the moon. The NASA attitude then was that it was a 'fifth wheel.' They termed it 'non-mission critical.'" (This meant that no damage would result whatsoever if the camera failed or had to be jettisoned for some reason.)

"However, the old timers made it know that this was not the case—that NASA shouldn't miss the opportunity to televise the mission."

Lebar remembered that it was really mission commander, Neil Armstrong, who cinched the deal. Armstrong ruled the roost and stated that he wanted the camera aboard. That was that. There would be live video.

SIX PEOPLE, SIX CAMERAS

In addition to operating over a wide range of temperatures, the Apollo camera had to be special in other ways too. Lebar recalled that NASA insisted on an automatic light control system—something unheard of then in live broadcast cameras. Also there was a lot of concern about the 8 kV that the SEC tube needed. Arcing was feared to be a major concern in the high vacuum conditions encountered on the moon. Special alloys had to be developed for use in connectors exposed to vacuum conditions too.

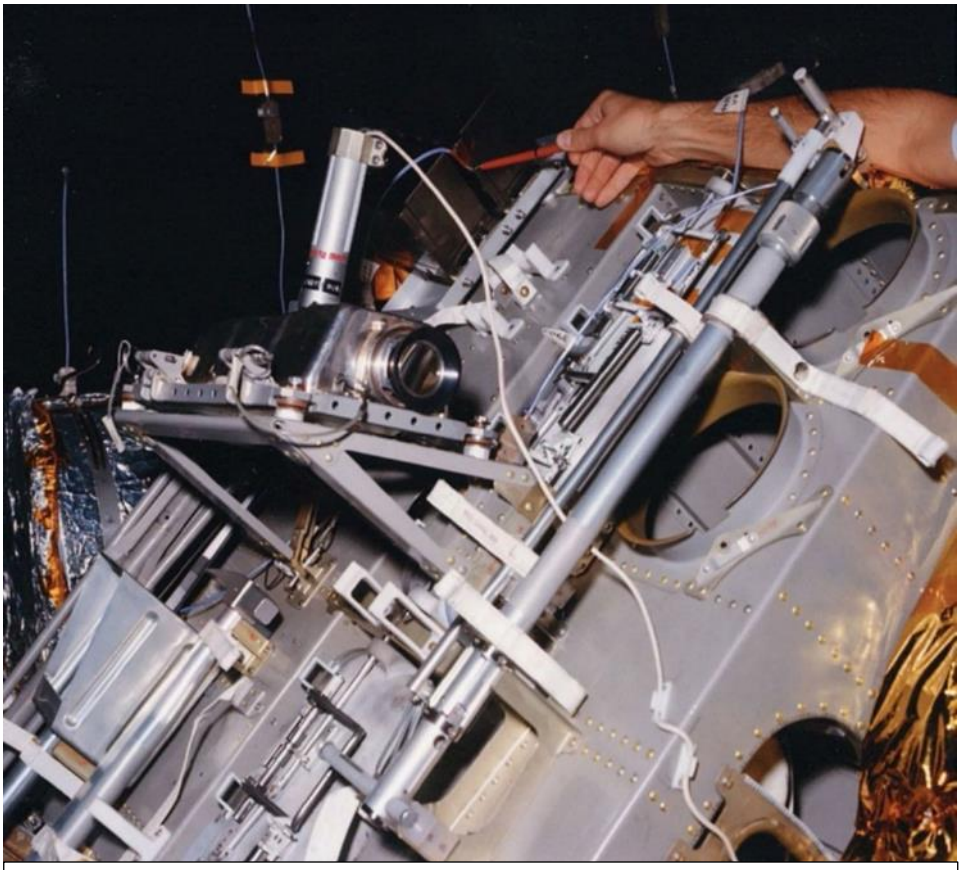
A special group of Westinghouse employees—all women—were hand selected to assemble the cameras going aboard the spacecraft.

"We even brought in a psychiatrist to help in selection of the people used to build the cameras," Lebar said. "We chose six top people for the job—one camera per person. This was so that one person made every decision involving construction of the camera. The women treated the cameras like they were their own children."

The finished cameras were inspected by three of Westinghouse's top QC people and a government inspector.

"When it was finally time to get ready for Apollo 11, we all got very nervous," Lebar said. "There was not going to be any backup camera inside the lander. We had some very high level NASA people at the plant at this time and they asked me if I believed that the camera would really work."

Lebar had to admit that his answer was a bit evasive. "I told them that my program manager had done everything possible to make it a success," he said. "We believed that the camera would be successful, but we did worry a lot about the connectivity back on earth—the landline connections."



The Westinghouse Apollo 11 camera is shown here on a bracket that folded out when the spacecraft landed, allowing viewers on earth to see Neil Armstrong's exit from the lunar module.

Actually, the situation might be painted as a bit more dire. Lebar recalled that the president of his division of Westinghouse had an independent contractor conduct a study of the potential for failure or success of Apollo's video component. The study indicated only a 50 percent probability of everything falling into place.

"We were worried about the corporate image being on the line then," Lebar said. "The company slogan was 'You Can Be Sure If It's Westinghouse.' We really had to be sure."

Actually, on a personal basis, there was a lot more at stake for Lebar. He'd been informed by corporate management that if the camera failed for any reason, he would be the Westinghouse employee that would have to stand in front of the cameras and reporters and explain to the world why there was no video.

"And I didn't really want to have to do that," Lebar said.

LIVE FROM THE MOON

The big night—July 20, 1969—found the Westinghouse team as ready and confident as possible that the camera would deliver video from space as planned. However, as with any complicated and multifaceted project, there is always the nagging uncertainty that something might not quite work out as planned.

Lebar waited out the evening in a lab at the Houston Manned Spacecraft Center or MSC (later renamed the Johnson Space Center). Video gear had been set up for monitoring the moon "remote" and he recalled his experiences after the LEM set down safely and Houston gave approval for the first moonwalk, shortly before 11 p.m. EDT.

“Suddenly this railroad train was coming at you very fast,” said Lebar. “What if this thing doesn’t work? What am I going to say? Both Westinghouse and NASA had asked me to be the point person if a failure occurred. The corporate image was on the line. It was difficult beyond all belief.”

The order was given to power up the camera, and Lebar crossed his fingers and rubbed his rabbit’s foot once more.

“The camera was on the LEM’s ‘porch’ looking out at the ladder and was in total darkness, so there was no video,” Lebar said. “Armstrong had to pull a ‘D’ ring to open the door. About two seconds after the turn-on command was given, I saw a sync pulse on the monitor and thought ‘it looks like it’s going to work.’

“All the tension and agony drained out of me when the door was opened and I saw video and realized that we were successful. Then I was in seventh heaven.”

However, the video that was making its way across 239,000 miles of space and several thousand more of terrestrial linkage was far from perfect.

“The image was bad, very dark,” said Lebar. “Someone at the [Goldstone, Calif.] tracking station was adjusting the [scan] converter. The image actually went negative for a while.”

Lebar found out later that the Goldstone video technician was new to the job and had never operated the optical converter before that evening.

“He just turned every knob he could and then froze up,” said Lebar.

(Actually, the first images reaching terrestrial television viewers were inverted top-to-bottom, as the camera was initially resting upside down. Its top plate was the only flat surface and this was the way the camera rested until Armstrong removed it and began to carry it by the pole-type handle on its underside. The inversion was correctible by flipping a switch on the converter.)

“Someone said that they were getting a better picture from the tracking station in Parkes tracking station in Australia [actually a radio telescope installation],” Lebar said. “We switched over to Parkes and never went back to Goldstone.”

Due to the primitive image conversion technology, contrast was blocked up and a lot of noise was added to the picture; so much so that the images took on a ghostly, ethereal look—quite different from the video being pumped out from the ABC, CBS and NBC studios in New York that evening. However, this seemed to fit correctly into the scheme of things.

“The comment was made then that if the video had looked like the live television everyone was used to, no one would have believed that it was coming from the moon,” said Lebar.

Now that he, Westinghouse, NASA, and the world at large was assured that the $1 million camera was actually working as planned, Lebar took time out to ponder what had been going through his mind that evening.

“I had very mixed emotions,” he said. “Worry, success when the sync pulse came up, then distress when the image wasn’t that good, then happiness when the switch to Parkes was made.”

Even after 40 years, Lebar says that he still hasn’t been able to completely sort out his emotions from that very special evening.

“I just know that I never want to go through this again.”

Asked if he had made any special comments or proclamations about the event at the time, Lebar revealed that he had summed up the moment very simply.

“I just said that I thought it was great.”

What else does Lebar remember from that evening of evenings?

“There was an all-night party at the King’s Inn motel near the MSC,” he said. “Westinghouse rented several rooms there on a yearly basis and the celebration was held in the motel’s restaurant. They served champagne all night long. At seven in the morning they fed breakfast to anyone still standing.”

By
James E. O'Neal

DOHERTY AMPLIFIERS WHAT ARE THEY?

Background

For years ATV power amplifiers have been class A for low level stages used for least amount of distortion and class AB for low distortion and better efficiency as PAs. In the analog days, most ATV stations used off the shelf linear amplifiers that were typically used for SSB, CW and FM modes based on land mobile UHF transistors that were designed for class C use but biased to try and move the transistor into class AB. They were OK for analog but still had some objectional distortion because their power curve was not linear enough. When digital ATV came on board, these amplifiers would not reproduce a digital ATV signal properly.

Some of the class AB bipolar RF power modules would work at greatly backed off power levels but the newer MOS or LDMOS power modules worked better due to the LDMOS FET's ability to better handle the short duration peaks in the RF envelope. For broadcast TV service, analog RF power amplifiers worked well for the transition to DTV. Most of these UHF amplifiers were IOT tubes with solid state IPA drivers.

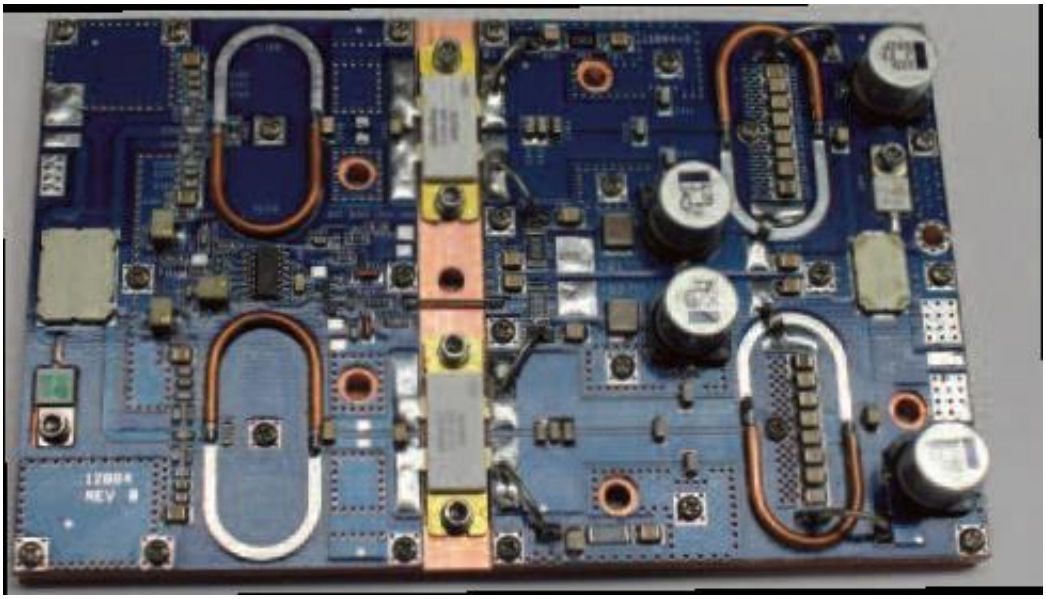
Solid State transmitters at the time had poor efficiency and were usually limited to low and medium power. About ten years ago LDMOS 32 volt transistors became the transistor of choice allowing their use in broadcast amplifiers to obtain 25 percent efficiency. Many of the older broadcast UHF RF amplifier modules and pallets were now surplus. Many ATVers have used these for DATV. In the case of broadcast TV service, the AC power to RF power efficiency with solid state with its poor efficiency and resulting large electric bills, broadcasters still favored the use of IOT and tetrode final amplifiers.

About four years ago 50 volt LDMOS push-pull FETs were introduced that improved gain, output power and efficiency to the 35 % range. These new 50 volt LDMOS devices are used in the newest high-end power amplifiers made by W6PQL and others for high power ham radio UHF and VHF amplifiers. In order to reach or surpass IOT or tetrode amplifier efficiency a new amplifier was designed. The Doherty amplifier greatly improved efficiency surpassing the IOT and tetrode amplifier.

How they work

First let's review existing push pull solid state UHF power amplifier technology. The amplifier stage is usually a push pull, that is, it's a balanced set of FETs or bipolar transistors with one amplifying the positive half of the of the RF cycle and the other the negative half. Each transistor is biased for class AB mode so the transistor is turned on enough so no RF envelope transition distortion takes place.

Push-pull is how most audio power amplifiers work and give fair to good efficiency. In the case of DTV modes there is a high peak to average level difference usually in the 6 to 8 dB range and is why an amplifier rated for 100 watts in SSB or CW will only achieve about 15 to 20 watts average digital power. This backed off power gives about 30 percent efficiency while at saturation efficiency is near 65 percent. The UHF push pull amplifier has a great amount of symmetry when looking at the amplifier board as seen below.

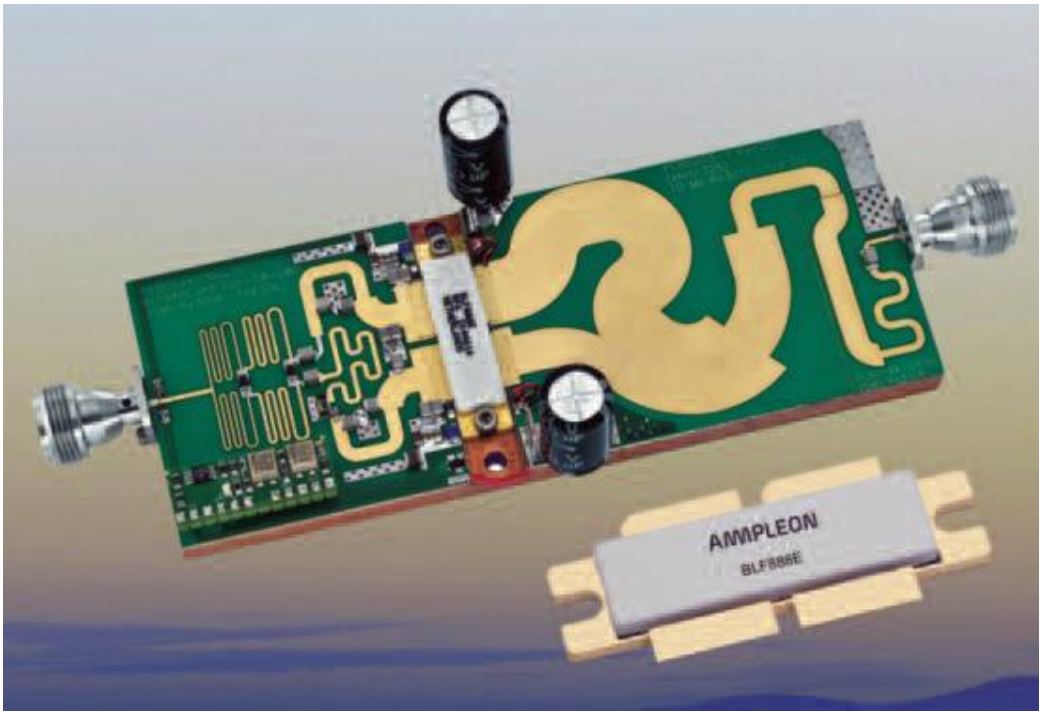


Push Pull UHF RF Pallet

Doherty amplifiers on the other hand look asymmetrical. They still employ two transistors, but each is optimized and

biased for different parts of the power curve. The main or carrier transistor is biased class AB as a single ended amplifier and is used to amplify the lower level or average power level of the DTV signal. The other transistor known as the peak transistor is biased class C and its bias is set to keep the transistor turned off until the peak part of the signal starts. This level is about 6 to 7 dB below amplifier saturation. This greatly improves efficiency. Doherty amplifiers only amplify the positive half of the RF waveform. The resulting negative clipping causes harmonic distortion and a low pass filter is required to reduce harmonic distortion. The filter also restores the negative half of the waveform.

Doherty UHF Amplifier Pallet



One more enhancement to discuss, the carrier transistor will saturate at about 25 percent of full pallet saturated power. What is needed is a way to pull the carrier transistor into peak amplifier mode only during the peak part of the signal but remain as class AB during the bottom 25 percent of the power curve.

The peak transistor when in conduction during peak RF drive is used to pull up the carrier transistor into peak mode allowing more power to be generated as well as power sharing between FETs. This is done by placing a quarter wave strip line (transmission line) between the carrier and peak transistor.

This is due to the quarter wave line inverting the load impedance to a lower level to the carrier transistor (like adding more loading to your HF amplifier). The lowering of this impedance allows the carrier transistor to supply more RF current thus its saturation level has been raised to match the saturation level of the peak transistor.

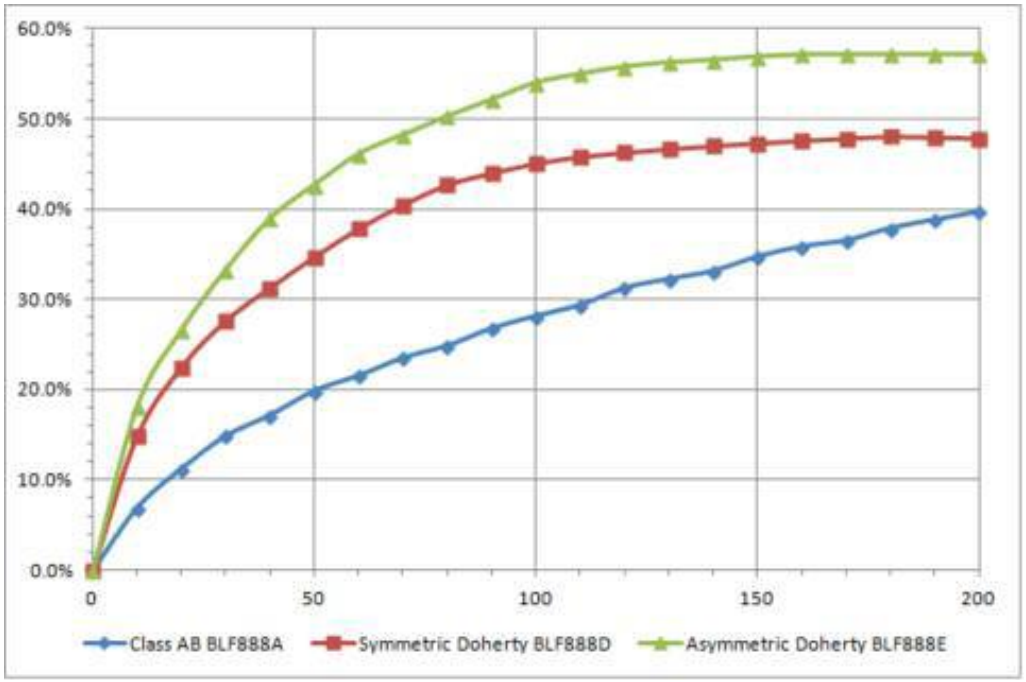
The quarter wave phase inverter on the output of the carrier transistor delays the signal 90 degrees so another 1/4 wave line is needed on the input stage of the peak transistor or a 3 dB (0 and 90 degree outputs) hybrid splitter is used so the signal at the T junction is back in phase.

Some Doherty designs use a dual transistor with the peak side having 1.5 times higher power rating for even better efficiency. Note the difference in efficiency between class AB push pull and Doherty

using balanced transistors (symmetrical) and transistors with the peak transistor rated for higher power (asymmetrical).

It is possible to convert an existing push pull RF pallet that has two push pull stages in parallel into a narrow bandwidth Doherty amplifier by removing the output 3 dB hybrid and placing a simple tee connection in its place.

Because the quarter wave lines are now far away from the transistor output tabs, off frequency use from the quarter wave lines and hybrids will cause faster phase shifting.



Bias modifications: The transistor used for the peak amplifier will need to have its bias adjusted for class C. This allows the use of an existing pallet to be converted to a Doherty high efficient amplifier. A harmonic filter would need to be added as well.

It should be noted that for most DATV use, class AB push pull amplifiers run backed off. It's still the easier way to go as pre-distortion is not needed for the lower power levels typically used.

For DATV DXing and a high-power repeater output, Doherty amplifiers may be worth looking into. An exciter with adaptive pre-distortion is recommended when using Doherty amplifiers to make best use of the added efficiency at the higher drive levels used due to some increased distortion as compared with class AB push pull amplifiers.
…73 Mike WA6SVT

KENNEDY SPACE CENTER TRIP

Seamus and I visited Kennedy Space Center in June which was an incredible time. We saw the Space Shuttle Atlantis, and had a chance to meet one of the astronauts, Dr John-David Bartoe. Dr. Bartoe is a licensed ham, W4NYZ, and he told us about operating amateur television from the shuttle. According to him, this was long before any regular television or video service.

We then visited the Saturn 5 Rocket Center, where they are celebrating the 50th Anniversary of the Apollo 11 mission to the moon. One of my favorite exhibits was the lunar rover with its television camera, radio, and antenna. The camera was remotely operated so NASA could watch the blastoff of the lander as it returned to the command module. Here is a cool video from the Curious Droid found on you tube: https://www.youtube.com/watch?v=hPOjkSYv3lA.

It seemed ATV related so we thought we would share…
73,
…Troy, AC8XP, and Seamus, KE8GTT

29TH ANNUAL COLUMBUS HAMFEST

The Aladdin Shrine Center, The Aladdin Audio Unit, and the Voice of Aladdin Amateur Radio Club, invites you to the Columbus Hamfest. Saturday August 3rd, 2019. The hamfest is held the 1st Saturday of August, at the Aladdin Shrine Center. Vendor setup at 6 am, open to the public from 8 am, until 2 pm.

The Aladdin Shrine Center has moved!
It is now located in Grove City APRS Marker - W8FEZ

Admission
$5 admission, 12 and under is free.

Flea Market
Flea market spaces are an additional $10 each. Sell from the trunk of your car, or, if selling inside, table and chairs are included. Fist come first served.

Forums
TBA

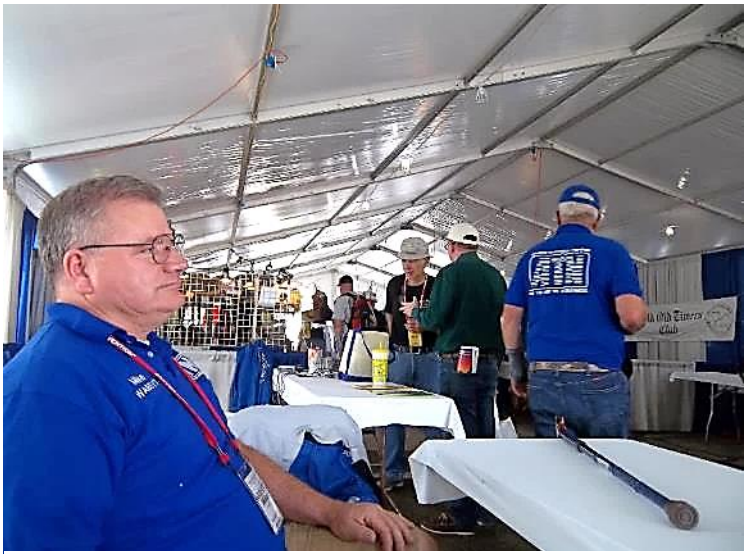
VE Testing
Get an amateur radio license, or upgrade. VE Amateur Radio Testing will begin at 9:00am. Walk ins are welcome. ARRL Testing Fee $15. Cash or Check only.

QSL Card Checker
Dave Vest K8DV will be there to check QSL cards (authorized for 160M). For Hamfest information email W8FEZ@arrl.net

2019 Columbus Hamfest Flyer pdf
Aladdin Shrine Center
1801 Gateway Circle
Grove City, Ohio 43123

HAMVENTION ACTIVITY

There were numerous people wandering around the Hamvention that deserve a second look but below are a few of the notable ones I found as I was sitting in the ATN booth observing the passersby. Note that we are still in a portable tent set up for the Hamvention to accommodate the extra vendors and groups wanting a table and space to sell their "stuff". The "tent" really isn't that bad. It was supposed to be replaced with a permanent structure but it hasn't happened yet and maybe never will. Oh, well…



Well, well, well! I caught Mike Collis, WA6SVT, relaxing in the ATN booth just about ready to doze off. Gary, W6KVC, with his back toward us is headed back to look for more "goodies".

I'm not quite sure what this is. It looks like he got a bargain at the "antenna" table.

Unknown person with an array of stuff attached on his helmet. I wonder if he will wear this all 3 days here???? Is he checking for aliens?

...WA8RMC

HAMVENTION FRIDAY NIGHT ATV DINNER

This year's ATV dinner was a huge success! We had over 35 people in attendance which, I believe, is a record. For those of you that missed it or just chose to not attend, you missed out on good ATV discussions. We had a round table discussion from the participants about happenings around the country as well as a great dinner hosted by the China Garden Buffet restaurant. It started about 6:30PM and lasted till after 9PM that night. Plan to join us next year.

Ron Cohen, K3ZKO, describes ATV activity in his area.

Gary, W6KVC, describes the live internet connection to the ATN repeater while Mike, WA6SVT coordinates activity.

Bill Brown, WA8ELK, discusses his balloon launch adventures.

The pictures above and to the right are of the various people in attendance. The 35+ people had a great time sharing their experiences and describing the ATV activity in their area.

Of particular note but not pictured, we found that a person traveling the farthest from the Dayton area was from Fairbanks, Alaska.
…WA8RMC

HAMVENTION ATV FORUM

I was pleasantly surprised about the large turnout for the ATV forum this year. A rough count showed that over 100 attended. In addition, interest in digital ATV was intense. That's a good sign for I have seen low interest in the recent past. This year we were well represented with speakers supplying DATV information.

We started with a short introduction and then introduced Gordon West, WB6NOA. Gordo always has a knack of being able to "wake up the crowd", so to speak, so the following material won't be met with snoring. He did a warm up with fun audio sounds and one liners.

Next Mel Whitten, K0PFX, talked about exploring the world of High Definition Digital Television. Mel explored the current digital ATV gear available and how it can be used to assemble a high-performance station.

Next Mike Collis, WA6SVT, described the new features of the California ATN network and DATV repeater system.

Last, I gave a wrap up and talked about the DATV MiniTiouner DVB-S/S2 receiver module.
…WA8RMC

LOCAL HAMFEST SCHEDULE

This section is reserved for upcoming Hamfests. They are limited to Ohio and vicinity easily accessible in one day. Anyone aware of an event incorrectly or not listed here; notify me so it can be corrected. This list will be amended, as further information becomes available. To see additional details for each Hamfest, Control Click on the blue title and the magic of the Internet will give you the details complete with a map! To search the ARRL Hamfest database for more details, CTL click ARRLWeb: Hamfest and Convention Calendar …WA8RMC.

07/21/2019 | VAN WERT HAMFEST

Location: Van Wert, OH
Type: ARRL Hamfest
Sponsor: Van Wert Amateur Radio Club
Website: http://w8fy.org

07/28/2019 | Portage Hamfair '19

Location: Ravenna, OH
Type: ARRL Hamfest
Sponsor: Portage Amateur Radio Club
Website: http://hamfair.com

08/03/2019 | Columbus, Ohio Hamfest

Location: Grove City, OH
Type: ARRL Hamfest
Sponsor: Voice of Aladdin Amateur Radio Club
Website: http://www.columbushamfest.com

08/10/2019 | DX Engineering Hamfest

Location: Tallmadge, OH
Type: ARRL Hamfest
Sponsor: DX Engineering
Website: https://www.dxengineering.com/DXEFes

08/17/2019 | GARS 2019 HamFest

Location: Germantown , OH
Type: ARRL Hamfest
Sponsor: Germantown Amateur Radio Society
Website: http://www.WG8ARS.org
Location: Ravenna, OH
Type: ARRL Hamfest
Sponsor: Portage Amateur Radio Club
Website: http://hamfair.com

09/08/2019 | Findlay Hamfest

Location: Findlay, OH
Type: ARRL Hamfest
Sponsor: Findlay Radio Club
Website: http://www.findlayradioclub.org

09/21/2019 | OHKYIN ARS Ham.

Location: Cincinnati, OH
Type: ARRL Hamfest
Sponsor: OHKYIN Amateur Radio Society
Website: http://www.ohkyin.org

09/22/2019 | Cleveland Hamfest and Computer Show

Location: Berea, OH
Type: ARRL Hamfest
Sponsor: Hamfest Association of Cleveland
Website: http://www.hac.org

10/12/2019 | NWOARC Fall Hamfest

Location: Lima, OH
Type: ARRL Hamfest
Sponsor: Northwest Ohio Amateur Radio Club
Website: http://www.nwoarc.com

11/02/2019 | GARC Hamfest

Location: Georgetown, OH
Type: ARRL Hamfest
Sponsor: Grant Amateur Radio Club
Website: https://www.facebook.com/Grant-Amateur-Radio-Club-1775764122477536/?modal=admin_todo_tour

11/03/2019 | Massillon ARC Hamfest

Location: Massillon, OH
Type: ARRL Hamfest
Sponsor: Massillon Amateur Radio Club
Website: http://www.w8np.org

TUESDAY NITE NET ON 147.48 MHz SIMPLEX

Every Tuesday night @ 8:00PM WA8RMC hosts a net for the purpose of ATV topic discussion. There is no need to belong to the club to participate, only a genuine interest in ATV. All are invited. For those who check in, the general rules are as follows: Out-of-town and video check-ins have priority. A list of available check-ins is taken first then a roundtable discussion is hosted by WA8RMC. After all participants have been heard, WA8RMC will give status and news if any followed by late check-in requests or comments. We usually chat for about ½ hour so please join us locally or via internet at https://batc.org.uk/live/wr8atv/. Click on WR8ATV.

ATCO TREASURER'S REPORT - de N8NT

OPENING BALANCE (04/20/19)	$ 3666.44
RECEIPTS(dues)	$ 30.00
PayPal fees	$ (1.18)
Spring Event food	$ (185.38)
CLOSING BALANCE (07/20/19)	$ 3509.88

ATCO REPEATER TECHNICAL DATA SUMMARY

Location: Downtown Columbus, Ohio
Coordinates: 82 degrees 59 minutes 58 seconds (longitude) 39 degrees 57 minutes 47 seconds (latitude)
Elevation: 630 feet above the average street level of 760 feet (1390 feet above sea level)

TV Transmitters: 423.00 MHz DVB-T, 10 W contin, FEC=7/8, Guard=1/32, Const=QPSK, FFT=2K, BW=2MHz, PMT=4095, PCR=256, Video=256, audio=257
427.25 MHz Analog VSB AM, 50 watts average 100 watts sync tip (cable channel 58)
1258 MHz 40 watts FM analog
1268 MHz DVB-S QPSK 20W continuous. SR=3.125MS, FEC=3/4, PMT=32, Video=162, Teletext=304, PCR=133, Audio=88, Service =5004)
Channel 1 is fed from all receivers. Channel 2 is fed direct from 439.25 analog receiver.
2397 MHz Mesh Net transceiver 600mw output (channel 1 minus2). ID is WR8ATV-2
10.350 GHz: 1 watt continuous analog FM
Link transmitter: 446.350 MHz: 5 watts NBFM 5 kHz audio. This input is used for control signals.

Identification: 423, 427, 1258, 1268 MHz, 10.350 GHz transmitters video ID every 10 min. with active video and information bulletin board every 30 minutes.
423 MHz digital, 1268 MHz digital & 10.350 GHz analog - Continuous transmission of ATCO & WR8ATV with no input signal present.

Transmit antennas: 423.00 MHz - 8 element Lindsay horizontally polarized 6dBd gain "omni"
427.25 MHz - Dual slot horizontally polarized 7 dBd gain "omni" major lobe east/west, 5dBd gain north/south
1258 MHz - Diamond vertically polarized 12 dBd gain omni
1268 MHz - Diamond vertically polarized 12 dBd gain omni
2397 MHz - Ubiquiti dual polarity omni 13dBi gain slot for channel 1 minus2 MESH Rx/Tx operation
2397 MHz - Comet Model GP24 vertically polarized 12 dBd gain omni (Used for experimental Mesh operation)
10.350 GHz - Commercial 40 slot waveguide horizontally polarized 16 dBd gain omni

Receivers: 147.480 MHz - F1 audio input with touch tone control. (Input here = output on 446.350)
439.000 MHz - DVB-T QPSK, 2MHz BW. Receiver will auto configure for FEC's and PID's. (Input here = output on all TV transmitters)
439.250 MHz - A5 NTSC video with FM subcarrier audio, **lower sideband**. (Input here = output on all TV transmitters & also direct to 1268 MHz DVB-S output channel 2.)
449.975 MHz - F1 audio input aux touch tone control. 131.8 Hz PL tone. (Input here = output on 446.350).
1288.00 MHz - F5 video analog NTSC. (Input here = output on all TV transmitters)
1288.00 MHz - DVB-S QPSK SR=4.167MS, fec=7/8. PIDs: PMT=133, PCR=33, Video=33, Audio=49 (Input here=output on all Transmitters)
2398.00 MHz - F5 video analog NTSC. (Input here = output on all TV transmitters) (inactive at this time because of MESH on 2397)
10.450 GHz - F5 video analog NTSC. (Input here = output on all TV transmitters)

Receive antennas: 147.480 MHz - Vert. polar. Diamond 6dBd dual band (Shared with 446.350 MHz link output transmitter)
438.00/439.250 MHz - Horizontally polarized dual slot 7 dBd gain major lobe west (Shared with 438 & 439 receivers)
1288.00 MHz - Diamond vertically polarized 12 dBd gain omni (shared with analog and DVB-S receivers)
2398.00 MHz - Comet Model GP24 vertically polarized 12 dBd gain omni (inactive at this time because of MESH on 2397)
10.450 GHz - Commercial 40 slot waveguide horizontally polarized 16 dBd gain omni

Auto mode Input control:

Touch Tone	Result (if third digit is * function turns ON, if it is # function turns OFF)
00*	turn transmitters **on** (enter manual mode-keeps transmitters on till 00# sequence is pressed)
00#	turn transmitters **off** (exit manual mode and return to auto scan mode)
264	Select Channel 4 Doppler radar. (Stays on for 5 minutes) Select # to shut down before timeout.
004	Select 10.450 GHz receiver. **(Always exit by selecting 001)**
003	Select room camera **(Always exit by selecting 001)**
002	Select roof camera. Select room cam first then 002 for roof cam. (**Always exit by selecting 001**)
001	Select 2398 MHz receiver then 00# for auto scan to continue

Manual mode Functions:

00* then 1 for Ch. 1	Select 439.25 analog /438 digital receiver (if video present on digital, it is selected. Otherwise analog)
00* then 2 for Ch. 2	Select 1280 digital receiver
00* then 3 for Ch. 3	Select 1280 analog receiver
00* then 4 for Ch. 4	Select 2398 receiver
00* then 5 for Ch. 5	Select video ID (17 identification screens)

01* or 01#	Channel 1 439.25 MHz scan enable (hit 01* to scan this channel & 01# to disable it)
02* or 02#	Channel 2 1288 MHz digital receiver scan enable
03* or 03#	Channel 3 1288 MHz analog receiver scan enable
04* or 04#	Channel 4 2398 MHz scan enable
A1* or A1#	Manual mode select for 439.25 receiver audio
A2* or A2#	Manual mode select for 1288 digital receiver audio
A3* or A3#	Manual mode select for 1288 analog receiver audio
A4* or A4#	Manual mode select for 2398 receiver audio
C0* or C0#	Beacon mode – transmit ID for twenty seconds every ten minutes
C1* or C1#	No function at this time
C2* or C2#	No function at this time

ATCO MEMBERS AS OF July 2019

Call	Name	Address	City	St	Zip	Phone
KD8ACU	Robert Vieth	3180 North Star Rd	Upper Arlington	OH	43221	614-457-9511
KC3AM	Dave Stepnowski	735 W Birchtree Ln	Claymont	DE	19703	
AH2AR	Dave Pelaez	1348 Leaf Tree Lane	Vandalia	OH	45377	937-264-9812
W8ARE	Terry Meredith III	6070 Langton Circle	Westerville	OH	43082-8964	
K9BIF	Charlie Short	415 West Pike Street	Goshen	IN	46527-0554	
VK3BFG	Peter Cossins	14 Coleman Road	Melbourne	Au	03152	
N9BNN	Michael Glass	6836 N. Caldwell Rd	Lebanon	IN	46052	
WB8CJW	Dale Elshoff	8904 Winoak Pl	Powell	OH	43065	614-210-0551
N8COO	C Mark Cring	2844 Sussex Place Dr.	Grove City	OH	43123	614-836-2521
N3DC	William Thompson	6327 Kilmer St	Cheverly	MD	20785	301-772-7382
K8DMR	Ron Fredricks	8900 Stonepoint Ct	Jennison	MI	49428-8641	
W8DMR	Bill Parker	2738 Florbunda Dr	Columbus	OH	43209	
WA8DNI	John Busic	2700 Bixby Road	Groveport	OH	43125	614-491-8198
N8DUK	Ron Reynolds	2173 Noe Bixby Rd	Columbus	OH	43232-4131	
WB8DZW	Roger McEldowney	5420 Madison St	Hilliard	OH	43026	614-405-1710
KB8EMD	Larry Baker	4330 Chippewa Trail	Jamestown	OH	45335-1210	
N8FRT	Tom Flanagan	6156 Jolliff St.	Galloway	OH	43119	
W8FZ	Fred Stutske	8737 Ashford Lane	Pickerington	OH	43147	
WB4IR	Bob Holden	7725 Tressa Circle	Powell	TN	37849	865-314 - 4285
WA8HFK,KC8HIP	Frank & Pat Amore	P.O. Box 2252	Helendale	CA	92342-2252	760-503-8106
W8KHP	Allen Vinegar	2043 Treetop Lane	Hebron	Ky	41048	
WA8KKN	Chuck Wood	5322 Spruce Lane	Westerville	OH	43082-9005	614-523-3494
WB9KMO	Rod Fritz	8334 E. Culver Street	Mesa	AZ	85207	
WA8KQQ	Dale Waymire	225 Riffle Ave	Greenville	OH	45331	937-548-2492
WB8LGA	Charles Beener	2540 State Route 61	Marengo	OH	43334	
W8MA	Phil Morrison	154 Llewellyn Ave	Westerville	OH	43081	
KA8MID	Bill Dean	2630 Green Ridge Rd	Peebles	OH	45660	
N8NT	Bob Tournoux	3569 Oarlock Ct	Hilliard	OH	43026	614-876-2127
W8NX, KA8LTG	John & Linda Beal	5001 State Rt. 37 East	Delaware	OH	43015	740-369-5856
KB8OFF	Jess Nicely	1888 Woods Drive	Beavercreek	OH	45432	
W6ORG,WB6YSS	Tom, Maryann O'Hara	2522 Paxson Lane	Arcadia	CA	91007-8537	626-447-4565
N8OCQ	Bob Hodge Sr.	3750 Dort Place	Columbus	OH	43227-2022	
AE6QU	Ron Phillips	2227Via Puerta unit N	Laguna Woods	CA	92637	
WA8RMC	Art Towslee	438 Maplebrooke Dr W	Westerville	OH	43082	614-891-9273
W8RUT,N8KCB	Ken & Chris Morris	2895 Sunbury Rd	Galina	OH	43021	
KB8RVI	David Jenkins	100 Miller Ave Apt 108	Ashville	OH	43103	614-853-0679
W8RWR	Bob Rector	135 S. Algonquin Ave	Columbus	OH	43204-1904	614-276-1689
W8RXX, KA8IWB	John & Laura Perone	3477 Africa Road	Galena	OH	43021	614-579-0522
WA6RZW	Ed Mersich	34401 Columbine Trl West	Elizabeth	CO	80107	
WA6SVT	Mike Collis	PO Box 1594	Crestline	CA	92325	
NR8TV	Dave Kibler	243 Dwyer Rd	Greenfield	OH	45123	937-981-1392
KB8UWI	Milton McFarland	115 N. Walnut St.	New Castle	PA	16101	
WA8UZP	James Reed	818 Northwest Blvd	Columbus	OH	43212	614-297-1328
KB9VGD	Gary Oaks	472 Storle Ave	Burlington	WI	53105-1028	
KC8WRI	Tom Bloomer	PO Box 595	Grove City	OH	43123	
AA8XA	Stan Diggs	2825 Southridge Dr	Columbus	OH	43224-3011	
AC8XP,KE8GTT,KE8HPA	Troy,Seamus Bonte	5210 Smothers Road	Westerville	OH	43081	
AC8YE	Larry Howell	1163 Cloverknoll Ct	Columbus	OH	43235-4008	
KB8YMQ	Jay Caldwell	4740 Timmons Dr	Plain City	OH	43064	
KC8YPD	Joe Ebright	3497 Ontario St	Columbus	OH	43224	
KD8YYP	Anna Reed	818 Northwest Blvd	Columbus	OH	43212	
WB8YTZ	Joe Coffman	233 S. Hamilton Rd	Gahanna	OH	43230-3347	
N8YZ	DaveTkach	2063 Torchwood Loop S	Columbus	OH	43229	614-882-0771
W8ZCF	Farrell Winder	6686 Hitching Post Ln.	Cincinnati	OH	45230	513-218-3876
N8ZM	Tom Holmes	1055 Wilderness Bluff	Tipp City	OH	45371	

ATCO MEMBERSHIP INFORMATION

Membership in ATCO (Amateur Television in Central Ohio) is open to any licensed radio amateur who has an interest in amateur television. The annual dues are $10 per person. Additional members within an immediate family and at the same address are included at no extra cost.

ATCO publishes this Newsletter quarterly in January, April, July, and October. It is sent to each member without additional cost. All Newsletters are sent via Email unless the member does not have an internet connection. Dues payments are as of the date paid and will expire on the same month/year on the due date year.

Your support of ATCO is welcomed and encouraged.

Membership expiration notices will be sent out via Email starting 30 days prior to expiration date.
NOTE: Dues records on your individual portion of the ATCO website are listed as the date money is received and shows due one year from that date.

ATCO MEMBERSHIP APPLICATION

RENEWAL ○ NEW MEMBER ○ DATE _____
CALL _____
OK TO PUBLISH PHONE # IN NEWSLETTER YES ○ NO ○
HOME PHONE _____
NAME_____
INTERNET Email ADDRESS_____
ADDRESS _____
CITY _____ STATE _____ ZIP _____-_____
FCC LICENSED OPERATORS IN THE IMMEDIATE FAMILY
_____
COMMENTS_____
_____
_____
ANNUAL DUES PAYMENT OF $10.00 ENCLOSED CHECK ○ MONEY ORDER ○

Make check payable to ATCO or Bob Tournoux & mail to: Bob Tournoux N8NT 3569 Oarlock CT Hilliard, Ohio 43026. Or, if you prefer, pay dues via the Internet with your credit card. Go to www.atco.tv and fill out the "pay ATCO dues" section. Alternately, you can use the ATCO web site www.atco.tv/PayDues.aspx directly. Credit card payment is made through "PayPal" but you DO NOT need to join PayPal to send your dues. Simply DO NOT fill out the password details and there will be no "PayPal" involvement.

ATCO CLUB OFFICERS

President:	Art Towslee WA8RMC	Repeater trustees:	Art Towslee WA8RMC
V. President:	Ken Morris W8RUT		Ken Morris W8RUT
Treasurer:	Bob Tournoux N8NT		Dale Elshoff WB8CJW
Secretary:	Mark Cring N8COO	Statutory agent:	Stan Diggs AA8XA
Corporate trustees:	Same as officers	Newsletter editor:	Art Towslee WA8RMC

NEW MEMBER(S)

Let's welcome the new members to our group! If any of you know anyone who might be interested, let one of us know so we can flood them with information. New members are our group's lifeblood so it's important we aggressively recruit new faces.
No new members this time.

ATCO Newsletter
c/o Art Towslee -WA8RMC
438 Maplebrooke Dr. West
Westerville, Ohio 43082

FIRST CLASS MAIL

REMEMBER...CLUB DUES ARE NEEDED.
CHECK THE
MEMBERS PAGE OF ATCO WEBSITE FOR THE EXPIRATION DATE.
SEND N8NT A CHECK OR USE PAYPAL IF MEMBERSHIP IS EXPIRED.