BOULDER TV Repeater's REPEATER

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(2ed edition)

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REPEATER STATUS: Don, N0YE, reports that the Boulder ATV repeater is presently working fine. Don is now streaming the TV repeater's weekly, Thursdday afternoon, ATV nets over the BATC server under his own call sign. Don reports, "I have added the 146.76 MHz voice repeater output onto one of the ATV voice channels when streaming video via batc uk." Details about the repeater are available on our web site: www.kh6htv.com AN-43 gives all the technical details. If you have any questions about the current operations or status of the repeater, contact the assistant. trustee, Don, N0YE.

Future Newsletters: If you have contributions for future newsletters, please send them to me. Jim Andrews, KH6HTV, email = kh6htv@arrl.net

ATV Repeater Streaming: The big news on the inter-net streaming side is the major crash of the BATC web site. On the 20th of March, they sent out this notice. "Yesterday afternoon, along with a number of other Wordpress based sites, the BATC website suffered a significant attack and as a result the BATC website, member's shop and BATC streamer are not currently available." (note: as of the 28th of March, the BATC web site was back up and running)

As a result, some of the ATV groups in California have just set up new You-Tube streaming accounts. A search on You-Tube for "Amateur TV" will give you a whole lot of hits, including the site for the Amateur Television Network (ATN) group and KD6ILO. Don't search for ATV, as that abbreviation now is commonly accepted to mean "all terrain vehicle". WW7ATS, is Seattle, Washington is also using You-Tube.

Don, N0YE, has thus investigated also using You-Tube for our streaming. He discovered that they charge a fee of $40/month to stream. No Way ! Not worth it.

Boulder Hates Radio Towers: The Boulder city and county governments have a weird approach to public safety. They want their sheriff, police and fire depts. to provide great service, but apparently don't want them to be able to communicate. For a really long time, the city of Boulder's police dept. has been trying to enhance their radio communications system. Going back at least ten years, they started this process with the

radio site in Chautauqua Park. That was where our Boulder ATV repeater was located since the early 90s. The police wanted to replace the old telephone pole tower with a new, more rugged metal tower and also to build a larger building to house more communication equipment. Various city departments fought their own police dept. over this proposal. Some of their issues were the fact that the radio site was located within a Boulder city mountain park. Don't clutter up the natural landscape with man made structures. Don't mar our views of the mountains, etc. etc. etc. After several years of back and forth arguments, the city finally grudgingly gave permission to rebuild the tower, but with severe restrictions. They said the old telephone pole could be replaced, but the new tower could not be any taller, but they also added the unreasonable requirement that they could not add any more antennas on the new tower than existed on the old tower. Plus, they refused permission to build a new, larger building. At that time, our TV repeater had four antennas on the tower. We agreed to replace three of these antennas with a single tri-bander (2m/70cm/23cm) antenna and triplexer to free up two antennas for use by the police. The radio shack building was a very small, cinder block building with space inside for only three racks of equipment. Our TV repeater occupied one whole rack, leaving only two rack spaces for the police. The decision by the city to not allow a bigger building for the police was ridiculous. By the summer of 2017, we finally received our eviction notice for the TV repeater. The police desperately needed our rack space and two antenna allocations to enhance their radio system. We eventually were able to more our TV repeater to it's new location a couple of miles south on the mesa overlooking Boulder.

Just now reading this morning's issue (3/29) of the Boulder Daily Camera is a front page article entitled "City: Tower Vital to First Responders". It discusses an upcoming hearing before the Boulder County Commissioners with the city still trying to obtain approval to build a new radio tower east of town on the high hill south of Legionnaire's hill (Arapahoe & Westview Dr.) Back in 2017, they originally wanted to put up a 150ft tower, but got so much flack, they are now requesting a 100 ft tower. Still, there is public opposition saying the tower would mar the Arapahoe Ave. corridor's view. My comment "B-S !"

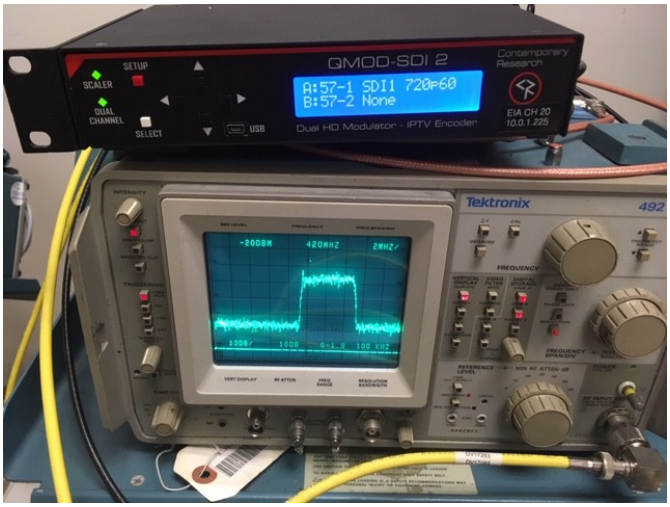
Fellow ATV ham, Bill, K0RZ, says nothing has changed. He worked for the Sheriff's dept. for many years (now retired) as Captain in charge of the 911 emergency dispatch center and radio communications. He said it was always a big fight with both the city and the county whenever they wanted to either modify or put up a new radio tower.

RECENT BCARES ATV ACTIVITIES: On the Thursday, 28 March, ATV net, Pete, WB2DVS and Debbie, WB2DVT reported that they assisted BCARES the previous week providing DATV coverage of the big funeral in Longmont for a Colorado State Highway patrolman.

Pete says -- "BCARES was requested to provide video for the event. It was to provide situational awareness back to a mobile command center near-by. If there was a disruptive incident we would have been able to send video back to the command center. We provided three cameras for the event. You can think of it as the same situation as a CU

football game. It went very well. The somber event was peaceful and the DTV equipment worked well. We had one camera/transmitter deep within the church, and had to have a run of coax to the outside to a Yagi pointing to the mobile command center. We had another camera near a window and the usual whip antenna worked well (with the amplifier on medium power). The third camera was in the parking lot and could roam if needed. I have not heard any feedback regarding how useful it was to BCSO. We provided continuous video from all three cameras."

Pete has served for many, many years as the equipment manager for BCARES. He has kept repaired and in operating condition, all of the various pieces of equipment BCARES owns and stores in the cache at the 911 center. A big "Thank You" to Pete for his many years of service. For many years, in the cache, BCARES has had a couple of analog, 70cm, ATV packsets, plus an analog, 70cm, portable ATV repeater. Pete now reports that "Matt Holiday, K0DVB, donated two digital camera backpacks and a portable DTV repeater to the BCSO cache. We still have the analog backpacks, but it sure would be hard to go back to them now! Another big "Thank You" to Matt.



NEW ATSC - 8VSB ATV REPEATER: I have recently received this following e-mail from Richard, WD0GIV, in New Orleans, LA.

The WD0GIV ATV repeater is going HD. The input will still be on CH60 438-444 but now you can send in either NTSC or 256 QAM 720P. No matter what comes in it will be output CH57 420-426 8VSB 720P on .1 480I on .2 The .2 will be repeater info only. Yes that is two streams. In order to RX the user will have to down convert as switching to 57 cable puts most receivers in QAM only mode not 8VSB. The system is under construction and to the best of my knowledge it will be the only 8VSB/ATSC system in the state if not the country. The above picture shows the exciter modulator under test.

I do not have a launch date yet. Also if anyone is interested in 8VSB encoders/modulators let me know. I have a very small amount of them with special firmware that allows 8VSB on the "cable" channels of 57 threw 60 (the ATV band) 420 to 444mhz.. It is not normal to do 8VSB on this band. They retail for $2,700 but for Ham repeater owners I have two I

can let go for $1100. There are two HDSDI ins and a analog in, all scale-able. I am keeping two as one on air and one as a spare. Threw some fancy switching and upconverting I will have both analog NTSC and QAM HD in on the same frequency 438-444mhz. This way I can use the same VSB/bandpass filter duplexer. If interested I can send you a block diagram. I am using all broadcast Evertz terminal gear (DA`s,up and down converters, embedders, de-embedders etc.) all in a 3RU 7800 frame.

Gary - WB5PJB The following article was submitted by a fellow member of the Boulder ATV group, Gary Sutton, WB5PJB. Gary lives the farthest away from our TV repeater. He lives in Castle Rock. Here is his brief ham radio bio taken from www.qrz.-com "I have been in the ham radio hobby for over 40 years and enjoy operating a diversity of modes: HF digital & CW, VHF/UHF digital, SSB, FM & ATV, microwave on 10GHz SSB and optical communications. Also enjoy using computers and microcontrollers in ham radio applications and writing software when time permits. Always have more projects than I have time (or money) to do. Currently living in Castle Rock, CO located about halfway between Denver and Colorado Springs. I am active in our local ARES group and enjoy the challenge of providing emergency communications."

VIDEO TRANSMISSION USING IP WITH OFF-THE-SHELF DEVICES
Gary Sutton - WB5PJB

Introduction

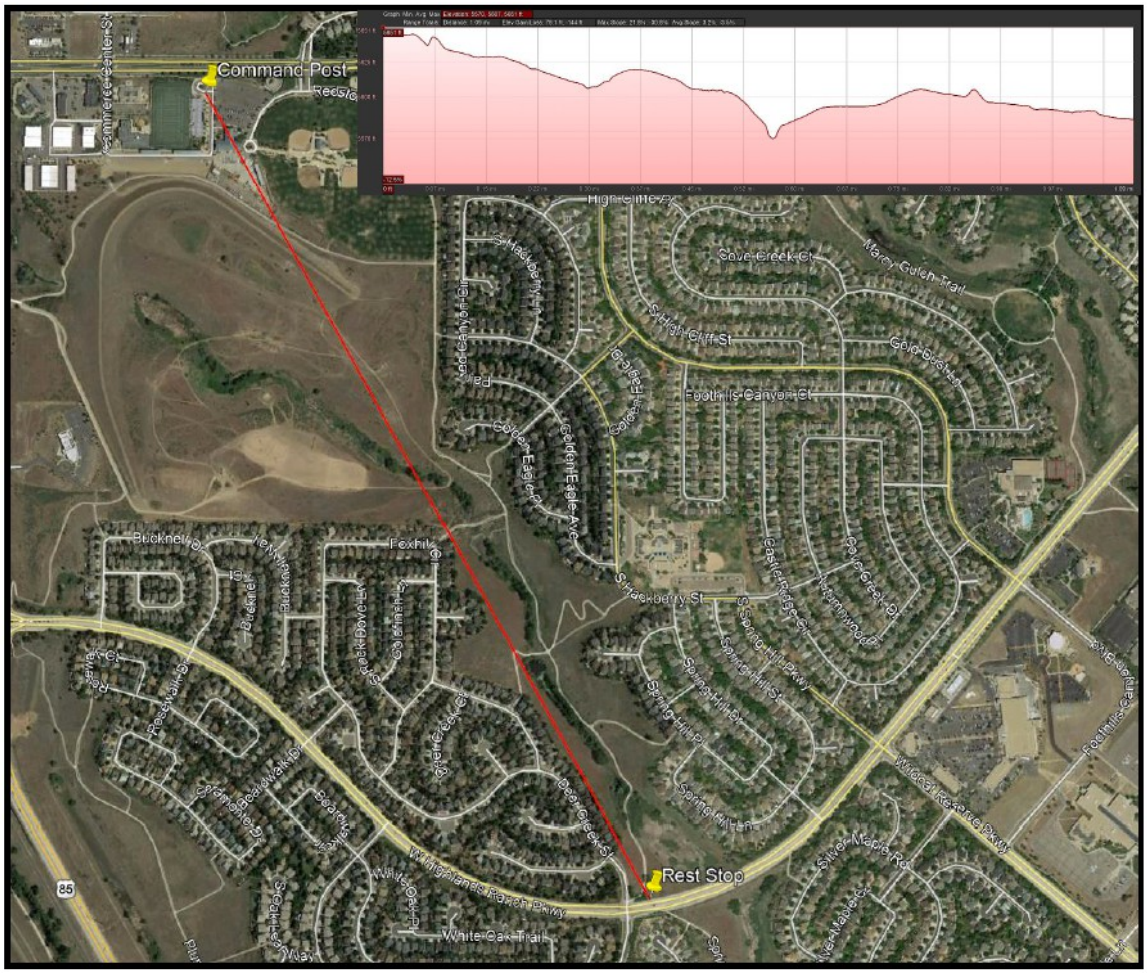
While live full-motion video using NTSC or one of the DVB variants has now been a mainstay of amateur radio for years, there is an alternative to those transmission protocols that can sometimes be more beneficial to use in public events where amateur radio is providing support communications and the geographic area of the event is relatively small. Using Internet Protocol (IP) as a medium for video transmission has proven to be a successful means of getting live images from temporary field locations back to a Command Post.

Many of us have IP cameras in our homes for security reasons, and they make convenient tools for checking our property from anywhere in the world if Internet access is available. In public outdoor events where amateur radio is providing support communications to a served agency, the same technology may be used in an ad-hoc wireless network to send live video images to a central Command Post. The task for hams is to setup such a network and make it reliable enough to handle full-motion video from one or more IP cameras. With the availability of off-the-shelf products from companies such as Ubiquiti, Mikrotik and others, the hardware tools are available to hams to setup wireless networks that have the ability to convey video information from IP cameras setup in various locations around the geographic area of the event. While this may sound fairly easy to do on the surface, there is a combination of RF knowledge and networking knowledge required by hams to successfully accomplish this task. The off-the-shelf products operate in the microwave bands assigned to amateur radio operators, so being familiar with microwave antennas and propagation is important, as well as, understanding how to setup a network with switches and routers, and administering IP addresses and host names. Pre-planning is essential to increase the chances of a successful outcome and understanding the limita-

tions of these devices will help you to not overreach on expectations. The purpose of this article is not to get into the details of the Ubiquiti or Mikrotik products, but to give an example of a simple outdoor event where a single IP camera feed located a mile away is used to send full-motion video to operators in the Command Post. This particular event is a 5K walk/run held each Thanksgiving morning in Highlands Ranch. A rest stop is located one mile away from the Command Post (CP) and the desire is to have video in the CP showing the activity at the rest stop.

Step 1

Step one was to investigate the feasibility of such a request based on the geography of the area. As stated above, the RF transmissions would be using either the amateur radio 13 cm band (2.4 GHz.) or the 5 cm band (5 GHz.) because those are the frequencies used by the off-the-shelf products. A physical site visit to both the rest stop location and the CP location, along with Goggle Earth analysis of the path between the two locations, made the possibility look somewhat favorable for obtaining a successful microwave path. As it so happens, a length of open space land existed between the two locations, so any blockage of microwave RF from houses would be minimal. Likewise, no land features would significantly protrude into the Fresnel zone (https://en.wikipedia.org/wiki/Fresnel_zone) of the path between the two microwave transceivers. There were some trees and tall bushes in the path, which would definitely be
protruding into the Fresnel zone, so that raised some concern. Experience with using microwave frequencies around trees has shown that trees and their leaves love to absorb microwave energy, so there is always some concern when there are a lot of trees in a microwave path. The only advantage we would have is that this was a Thanksgiving day event, so the deciduous trees had dropped their leaves. Overall, it was determined that the RF path had a reasonably good chance at success, and this was an amateur radio endeavor, so experimentation to see if something works or doesn't work is all part of the fun.



Goggle Earth© map and elevation profile of the path between the rest stop and the CP.

Step 2

Step two was to pick the RF and camera hardware. The RF choice was between using 2.4 GHz. or using 5 GHz. This was an easy decision because there was no budget for new equipment, so based on the hardware that was on-hand, 5 GHz. was the chosen band to use. As a note, we have done this event with video for several years and we have always used 5 GHz. The camera source has evolved over the years, with initially using an analog NTSC camcorder camera (provided by the Douglas County Sheriff's office) combined with an analog-to-digital IP converter to using strictly an IP camera that streams H.264 or MJPEG video out a network port.

Step 3

Step three was to gather the necessary accessory parts and pieces to make a complete operational setup. This involves power sources, tripods, masts, cables, etc. This step needs special attention in pre-planning, as there is nothing worse than getting everything setup in the field and then finding out a cable is missing that keeps the whole system from functioning. It is advisable to create a detailed checklist of the various parts and pieces that will be required and check off all of the items as you load them into your vehicle for

transport to the site. The checklist can also be used at the end of the event to make sure all of the items have been retrieved.

Step 4

Step four was to plan and pre-test the operational functionality of the entire system. This includes configuring all of the IP devices with appropriate IP addresses and subnet masks. This includes the camera source, the RF transceivers and the laptop at the receiving end that will display the video. Setting the devices up in a test scenario at home and testing the video path prior to going on-site can help guarantee a smooth implementation in the field. It doesn't totally eliminate the "it-worked-on-the-bench" scenario, because you can't account for all of the variables that can happen in the field on the day of the event, but it does increase the chance of success significantly. It is during this step that knowing how to configure and use the off-the-shelf RF transceivers comes into play. The details of configuring these devices is beyond the purpose of this article, so for the purposes of keeping this to an overview of using video over IP, it is sufficient to think of the transceivers as a wireless data path similar to using a Wireless Access Point (WAP) in your home or work, except it is working over a much greater distance.

Implementation

The actual implementation of this very simple video system has gone quite well over the years. Some of the initial concerns about vegetation causing an issue with the microwave signal have been alleviated, as the 5 GHz. signal makes the one mile path with no problem.

Initial site visit raised some concern over the vegetation in the microwave path.

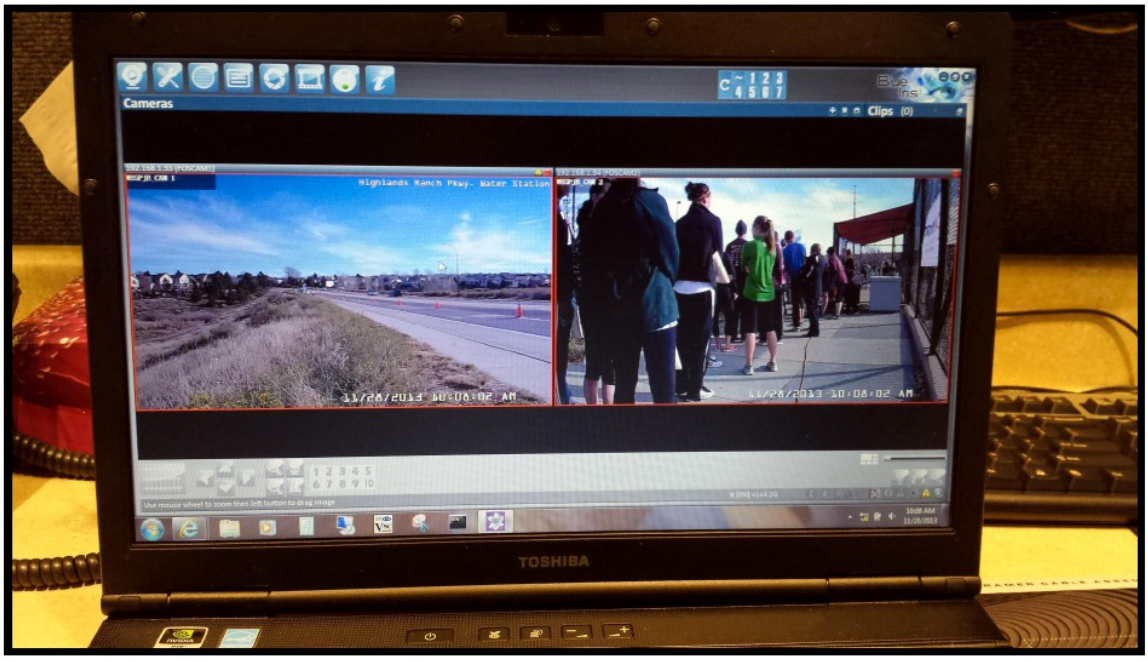
Setup of the equipment in the field has been relatively easy and we have had no issues with the hardware itself. The transceivers we have used (both Ubiquiti and Mikrotik) are designed to be used outdoors, so extreme temperatures or wet conditions should have no affect on their operation.

First year setup at the rest stop using a Ubiquiti PowerStation on a short mast and an analog NTSC camera that was converted to IP.

At the rest stop, we have switched from using the analog camcorder camera to using an IP camera. There are some advantages using the camcorder camera in that it has good zoom capabilities and can also record audio and video locally, so in some instances an analog camcorder might still be a valuable asset. The advantage of the IP camera is the quicker setup, fewer parts to make it work and better video quality compared to the analog-to-IP converter. At the Command Post, we have primarily used a laptop running either Blue Iris or VLC Media Player software. The Blue Iris software is primarily a security camera software and it has the ability to work with most IP cameras on the market and is regularly updated. It is not freeware, but it has always performed well for this task and has worked out better than some of the free software we have tried. RF-wise at the

CP, we have primarily used a very small and lightweight transceiver mounted either on a push-up mast or on top of the stands of a stadium that happens to be next door to the CP.

At the CP, a Ubiquiti 5 GHz. NanoStation on a push-up mast to the left of the dual band V/UHF vertical antenna.



Blue Iris software running on a laptop in the CP.

This past Thanksgiving (2018) we used an IP camera at the rest stop and another on top of the stadium looking down on the Start/Finish area. The stadium camera was a PTZ camera, so that offered the ability to remotely pan, tilt and zoom - easy to do with IP camera systems.

Summary of experience

Over the years of using IP for video transport at this particular event, the success rate has been 100 percent. Using IP cameras for video and Ubiquiti or Mikrotik for RF transmission is not exactly plug-and-play, however. It does take some upfront planning to make the system function properly and there are a number of configuration settings that can be gotchas if they aren't set properly. The RF reliability of the Ubiquiti and Mikrotik devices is excellent. They simply work. If you can get a good microwave path, then the chances of the devices "seeing" each other RF-wise is good. Issues arise when the RF paths are anything less than perfect. Data rates will drop off very rapidly as the signal strength between two nodes is reduced. The nodes may show they are connected to one another (a "connection" requires very little bandwidth), but if the signal strength isn't very strong, they may not be able to provide adequate bandwidth for video. These are low power devices, relatively speaking. Typically the power output of the device is a Watt or two, at best. The antenna may provide a lot of gain, such that a higher EIRP is obtained, but that comes at the cost of a more narrow antenna beamwidth, which begins to eliminate an easily obtainable omnidirectional setup that has decent gain. A high gain omnidirectional setup may be obtained by combining multiple transceivers at a location and pointing them in different directions, but that comes with greater complexity in system setup and higher cost. These are microwave devices that operate at a wide bandwidth, so it must be kept in mind that their useable working distance is limited. Where you might be able to get a 70 cm or 23 cm DVB-T signal out of a not-so-prime RF location, these off-the-shelf transceivers may not work at all. Like anything else in a ham radio operator's communications toolbox, the off-the-shelf IP transceivers can serve a useful purpose as video transmission devices if used properly within their limitations.