Application Note
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Add Digital Television to Your ARES Tool Kit

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This is a TV success story for a local ARES group. The Boulder County, Colorado ARES group, BCARES, has experienced a lot of success working with our county's emergency services organizations, in particular, fire and law enforcement. BCARES's tool kit includes all of the ordinary ham services, including HF/VHF/UHF voice communications, repeaters and various digital modes on HF/VHF/UHF. PLUS high-definition (1080P) digital Television.

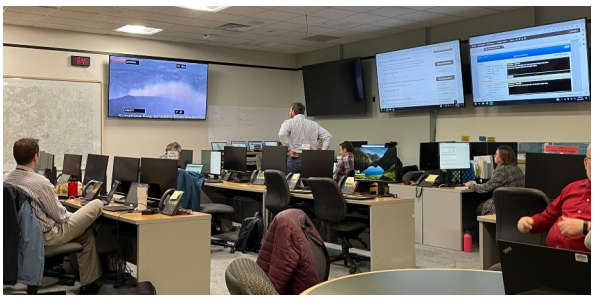

Fig. 1 (left) Officials in Boulder EOC watching BCARES TV coverage of a forest fire. (right) BCARES video of an air drop of slurry on a forest fire.

What Boulder County Public Safety lacked most and BCARES had to offer was --- TELEVISION. Ham television is the one BCARES capability that really excites our served public safety agencies. BCARES started offering analog TV services [1] about 35 years ago, when I was the chairman (E.C.) of BCARES. We added TV at the encouragement of Captain Bill McCaa, K0RZ. of the Boulder County Sherriff's Office. Bill was in charge of all of the Sheriff's communications and computer operations and the county regional 911 center. Over the past years BCARES has received many more requests for assistance using TV than for all other communication modes.

TV offers “Public Safety” information in ways never imagined by us nor our served agencies. Television has come to be appreciated by our served public safety agencies because it provides what they refer to as “situational awareness”. It helps remove the need for many voice communication exchanges for information that is already contained in the video imagery. Television allows the incident commander at the Incident Command Post (ICP) to actually see what is happening at the scene(s) of the incident, be it a fire, flood, hazmat, riot, or SWAT operation. With this information, the incident commander is better able to make appropriate command decisions. Via our 2 meter, TV net controller, the Incident Commander is able to request BCARES cameras provide him with specific images and information. BCARES is able to routinely provide television and all of its other communication services in a completely infrastructure free manner.

Many times every year, BCARES is asked by our local law enforcement and fire departments to provide TV coverage of both real emergencies and also multi-agency training exercises. These have included situations such as large, multi-agency forest fires, flash floods, hazardous materials incidents, civil disturbances, large political demonstrations and protests, Halloween on the Pearl St. mall, University of Colorado football games and SWAT operations. Boulder County ranks as the leading flash flood threat zone in the state of Colorado and BCARES is specifically written into County emergency planning. BCARES also has an office (ham shack) in the 911 center EOC.

BCARES was organized and incorporated by Boulder County and the local ham clubs, in 1977 after the disastrous 1976 Big Thompson Canyon flash flood which claimed 144 lives. The official office of BCARES is in the Boulder City/County Disaster Management , in the county 911 center. BCARES is recognized by the county as being both the ARES and RACES organization for the county.

Fig. 2

BCARES' most shining moment occurred in Sept. 2010 when one of the worst forest fires in Colorado history broke out in Boulder County. The Four Mile Canyon fire burned over 6,400 acres of forest and destroyed 166 homes. BCARES assisted firefighters providing live TV coverage from mountain tops back to the 911 center for a week. At the end BCARES was credited with saving several homes. More details are found in a paper published in the May, 2011 issue of QST [2]

Live TV - not Slow-Scan ! When most hams think of amateur TV (called ATV), they immediately assume slow-scan TV, as found on HF. This is not what BCARES does. Our TV is commercial broadcast grade, real-time, live, video with full color and stereo sound transmissions. It uses state-of-the-art, high definition (1080P) digital TV modulation. Now called for short, DATV. We transitioned from the old analog, NTSC, TV to modern digital TV ten years ago. On the 70 cm ham band, we run full 6 MHz band-width, DVB-T, TV transmissions. We also use the 23 cm band for ATV.

Multiple Channels: There are four ATV channels available on the 70 cm band (Channels 57, 58, 59 & 60). BCARES has the capability of using all four channels simultaneously. Using a quad processor, all four channels are displayed simultaneously in the Emergency Operations Center (EOC) situation room on a large screen video monitor.

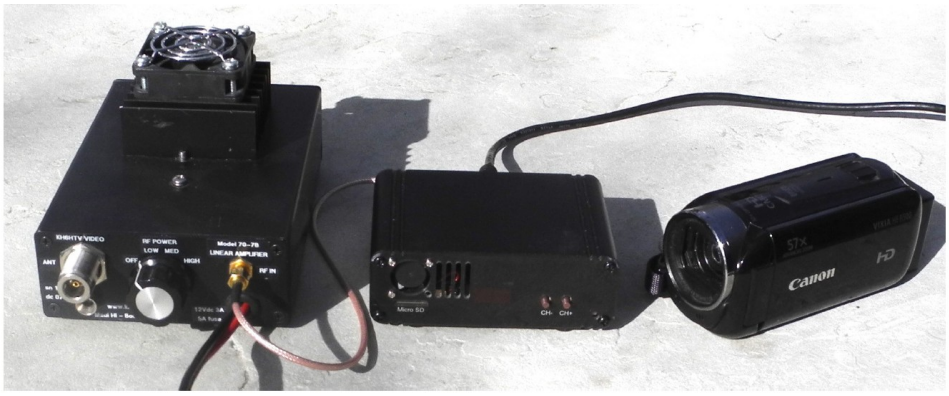

Fig. 3 Typical 70 cm Amateur digital TV transmitter with camcorder

Equipment Required & Cost Considerations:

DATV Transmitter: The cost for a typical amateur TV transmitter is comparable to that of an entry level HF transceiver. Fig. 3 shows the minimal equipment required. We use low cost camcorders as our TV cameras. The box in the middle is a digital TV modulator. It takes the HDMI A/V input from the camera and puts it into the correct DVB-T broadcast format. It also includes a frequency synthesizer covering from 170 MHz to 2.6 GHz. The box on the left is an RF linear power amplifier to boost the milliwatt level signal from the modulator up to 3 Watts. For typical BCARES field deployment, we use a 70 cm rubber duck antenna mounted directly on the camera tripod, plus an LiFePO battery. The battery is capable of running the transmitter in 100% duty cycle for several hours.

DATV Receiver: A DVB-T receiver is quite simple and low cost. All that is required is a consumer grade, set-top box receiver and an HDMI video monitor. The set-top receivers are available for less than $50.

DATV Antennas: We use normal 70 cm band antennas as with other ham rigs. The only key requirement is band-width. The antennas used must be capable of operating over the entire 70 cm ham band.

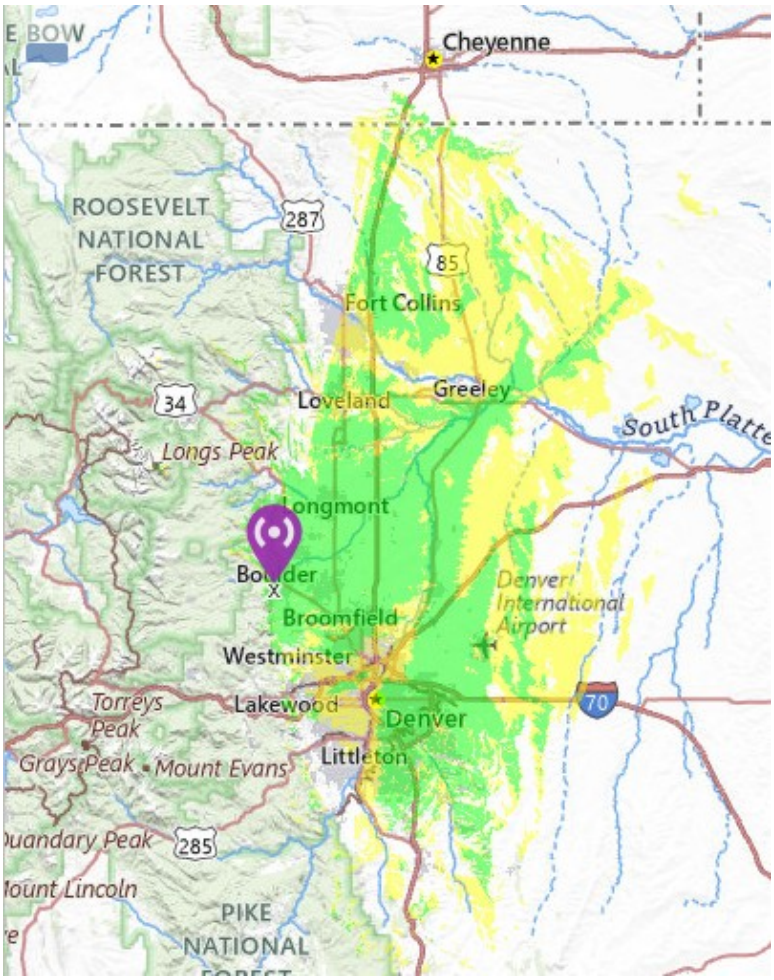

Fig. 4 Coverage map for W0BTV, Boulder, Colorado, 70 cm repeater. Yellow shaded areas are weak signal. Green shaded areas are for strong signals.

DATV Repeaters: Repeaters are also available for digital amateur TV. Their cost is comparable to building a conventional 70 cm FM voice repeater. Boulder has had a TV repeater since the late 1970s. In the early days, it was an analog, NTSC, repeater. Today, it is a digital repeater using the DVB-T format. The W0BTV-TV repeater is located on a high mesa south-west of the city of Boulder. It is 900 ft. above the city and gives coverage over the eastern prairies from Denver north almost to Cheyenne, Wyoming. It does not provide coverage into the mountains. The 70 cm output is on channel 57 (423 MHz). We use vertical polarization.

As evidence of the importance that Boulder sees in having ATV coverage for public safety, BCARES recently received a grant of $30,000 from Boulder County to enhance it's communications networks, including ATV. BCARES has recently purchased two additional DATV repeaters to enhance it's TV coverage of the mountainous western portion of the county. They have not yet been installed in permanent sites.

Additional Reading and Resources: To find out more about ATV and DATV in particular, the first place to go is the "ATV Handbook" [3]. In addition, I am available to give talks with power-point slides and live demonstrations of DATV equipment to amateur radio clubs and ARES groups. Either as an in-person presentation or via zoom.

REFERENCES:

1. "Add Television To Your ARES Tool Kit", Jim Andrews, KH6HTV Video application note AN-9, Oct. 2011, 5 pages

2. "Boulder Hams Fight Forest Fires With Video", Jim Andrews, KH6HTV, QST, May, 2011, pp. 76-77.

3. "ATV Handbook - an Introduction to Amateur TV", Jim Andrews, KH6HTV Video application note, AN-55a, Feb. 2021, 44 pages. (also available at ***www.arrrl.org*** search for "ATV")

4. KH6HTV Video web site, ***www.kh6htv.com*** many application notes on ATV including the above are all available in .pdf format to be down-loaded. Also a supplier of DATV equipment, including transmitters, receivers, and repeaters.