ATCO NEWSLETTER

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

ATCO WA8RUT REPEATER UPDATE

Here we go again! One enhancement and one problem! The enhancement is the rooftop camera addition and the problem is a malfunctioning repeater controller. Oh well, it's good to find that there's always something to do around here. Learn more as you read further.

ATCO HAM IN THE SPOTLIGHT

This time I made a trip out to Bud Nichol's place, KC8ASD. He is well on his way to a first class ATV station postponing, for the moment, an adventure into the world of HF ham radio. I heard rumors that it's due to Jay, KB8YMQ that he selected ATV first! Good work Jay. Now we have to convince Bud that there is nothing on the "DC" bands of significant value. (Just kidding, guys). To help boost Bud's P5 ATV signal is a new Teletec amp that is really doing a super job. To help launch the signal, a very nice tower (about 60 feet I'd say) sits behind the house and surrounded by large fields. If I had that much room, I'd

have a 200-foot fire tower planted there. How's that sound, Bud?

ACTIVITIES ... from my “workbench”

Why is it that when I'm least likely to be able to do antenna work, that's when I think about what needs to be done? Probably because I didn't want to do it in the first place and now I've got a good excuse for delay! I say that as I watch the snow fall, the wind blow and the temperature drop into the single digits. With my feet firmly planted upon the hot air register, I caught a glimpse of the snow plow pass by outside while staring at my computer monitor inside. How thankful I am to be able to do this rather than shovel snow. Back to work…

This time, there's not a lot of bench work activity. Oh, I could talk about how I helped my neighbor weld an exhaust pipe on his car or how I machined parts for another neighbor's model RC airplane or…OOPS, let's get back on track! ATV is the name of the game here.

I know you're sick of hearing me talk about the rooftop camera project but…now it's installed and working, almost. I was able to complete it, test it and install it just before the cold weather set in thanks to Mother Nature providing warm weather into early December. The camera is functional but the positioning electronics are not yet complete. At least now I can work on that part and install it when complete in warm surroundings. I've completed about half of the hardware part of the controller while Bob Tournoux, KF8QU generously offered to write the software needed. I've now got all of the parts to put it together so maybe within the next month or so I can have it operational. At this time, the camera is pointed toward the AEP building downtown in a fixed position. If you want to see what it looks like just put the repeater in manual mode and select channel 4. (By the time you read this, we probably will have switched the repeater controller so I won't confuse you with the proper touch-tones here. Just monitor the Tuesday night nets for progress).

It's a good lead in for the next topic is in fact the repeater controller. We are presently using a VS90 controller while Dale, WB8CJW works upon improving the VS100. ("It's in the shop for a lube job and oil change"). Dale's doing a number of things including adding separate video level thresholds for each input, improving the video carrier detection circuitry, power supply upgrade and adding additional video input selection modes. Before this work could be completed, the VS90 decided to rest a while and quit working. When Dale and I decided to fix the VS90, we found that it needed to be removed from service. To do this would completely disable the entire repeater and because the controller is partially working, we decided to leave it in place and accelerate the repair of the VS100. We'll swap the units as soon as possible. In the meantime, only video inputs on 439.25 MHz will be recognized. The 900, 1200 and 2.4GHz inputs are not scanned and touch-tone access on 147.45 is ignored. Sorry, more news as it develops.

In the midst of the above activity, I've also had some time to investigate 2.4GHz components. I asked a vendor that has 4 watt 2.4GHz bricks advertised, for a price quote. He has just responded that the ones I selected are now obsolete so I'm back to square one. They are sending me, however, specs on a new series of "bricks" to replace them. As soon as I find anything worthwhile, I'll let everyone know. As I read more about components for the 2.4GHz band, I find new things popping up every day. This is a very popular band for the future of amateurs, commercial, consumer electronics as well as the military so big things will happen soon. Just wait and see.

News flash! We've just been given permission to rebroadcast the radar signal from a local TV channel. As soon as we work out the details, I'll report more, but at least now I can finish the retrofit of the old airport link transmitter that we used a few years back. I've got the required components to change the transmitter from 910 AM to 915 FM and change the controlling input from 147.45 to 446.350 MHz. We'll work actively on this project to insure operation well before the spring bad weather shows up. When complete, we'll have access to 24-hour operation weather radar images out to the 60-mile range. More next time.

That's all for now, folks! Sorry I couldn't report more but other activities have had priority.
…WA8RMC

IT'S DUES TIME AGAIN

This is the worst part about doing the Newsletter…Asking for money. However, it's the only income our club has at the moment. So look at it as a $10.00 subscription to the ATCO Newsletter which in itself, is worth it. Your donation not only pays for printing/mailing costs but it also funds the Spring and Fall Events with prizes and food. So this year send in your dues early so I won't have to ask later in the year if you forgot. Check your mailing label. If it says 99 or later, you're OK till then. If it says 98, please send in your check. Thanks.

…Art, WA8RMC

TECH TALK…Let's learn something technical

OK, allow me to ease you into the following subject matter. It's rather long and somewhat redundant, but it's important to expose the many viewpoints of an up and coming topic - DIGITAL TELEVISION. We've been talking sparatically about this for a year now…mainly at the Spring and Fall events…but haven't stressed the point so far. However, now it's time to give this subject serious consideration. It will definitely become the future of ATV. How soon? Good question, but remember that us hams are notoriously cheap, so the technology must mature a bit before the majority of us jump in…unless something forces the issue! (Can you say "intermod"?) Now before you read on, please let me clear the air a bit so you don't become misled from the start. I'm referring to digitized analog NTSC video here and not HDTV (High Definition Television) that has been in the works for about a decade now. With that in mind, just how is the best way to digitize and transmit video? Well, one could get exotic and propose a whole new format requiring sophisticated packetized data with handshaking to produce an error free exact reproduction of a transmitted ATV signal or…maybe something simpler that uses existing hardware and computer software that is cheap…er, "inexpensive". Read and digest the many viewpoints so at a future Tuesday night net or the upcoming Spring event, we can try to sort it out and help drive the logical avenue toward implementation.

Here's food for thought. By digitizing the data, we can reduce the bandwidth and therefore preserve our precious spectrum as well as make longer transmission distances possible (higher receiver signal / noise ratios). We have been looking for a way to link our signal to other nearby repeaters so this might be a way to start and test different approaches. In fact, lets try hard to be the ***FIRST*** *repeater in the country to use digital TV. OK, go for it!!!…WA8RMC.*

DIGITAL TELEVISION…a very intense discussion.

The subject of Digital Television has brought about a very intense discussion on the Internet lately. It started as simply a "for consideration" topic and eventually sparked the thought process of many. I too believe that it is the up-and-coming topic for the next few years. When you think about it, the bands are crowded, interference is building to almost intolerable levels and digital everything is creeping (well, maybe storming) into our everyday lives. Les Rayburn KT4OZ, I believe, was the one that started the ball rolling last November. It went like this:

This month's issue (*November 1998*) of CQ VHF's discussion about wireless ATV has really intrigued me, so I thought I'd try to stimulate some debate on the list. Our company was one of the first interactive media groups to embrace streaming audio and video almost four years ago now. We have had Real Video available on our clients web site since just a few days (literally) after the technology was released to developers. As such, I'm pretty familiar with what "state of the art" is in streaming video. Despite advances, the video streams at 28.8K connection speeds still look like slide shows but at 56.6K or better connection speeds, you would be amazed at the quality of video that is possible. However, unless I am mistaken the 9600 baud "Fast FM" packet mode is still the fastest digital protocol that is available for use on the ham bands until you get into the laser area. (This is a frequent complaint of the packet crowd)

While it is certainly possible to create MPEG or Real Media video files and send them as "file attachments" to each other now. In my book, that isn't digital TV at all. I think for this to become viable, we have to be discussing the possibility of sending real time video streams via wireless transmission methods over long distances. At present, I don't see how that would be possible without a change in the rules in regards to digital techniques. Let's look at some of the advantages to this mode of ATV over our current analog methods:

1. We could develop error checking in the video streams that would request lost packets to be sent again (like AMTOR, for instance) that could make this mode superior for DX contacts.

2. Reducing our bandwidth's from 6mhz to say 1mhz or even 500khz would mean that our signals could reach much farther. It would also make our mode more "spectrum friendly".

3. Antenna's and amplifiers would become less critical (due to reduced bandwidth required) which would reduce the cost of ATV operation.

4. Digital techniques really appeal to the younger generation of hams. Video streaming has exploded on the Internet and many young people already have a good base of knowledge on creating this type of content via their computers.

So, where do we go from here? Well, we could experiment with sending digital streams over laser beams. (Would that qualify as the first digital ATV contact?) but I think we must go a step further and involve the ATNA in trying to have the FCC rules changed to allow for faster baud rates for our digital modes. *(ATNA is going to look into this subject very soon. WA8RMC).*

What do you guys think?
…Les Rayburn, KT4OZ

The responses follow in time oriented order:

I find your comments interesting. For several years the gentleman from Wyman sought to reduce bandwidth & encourage new techniques. I need to check the rules, but I believe that the 9600 speed is mainly a limitation of the limited bandwidth on two meters. Since the FCC has always had a procedure to request an experimental mode of operation, and since we ATV's are already on 70cm, why not try for 115.2K transfers? I also believe that any true digital ATV contact will require a duplex channel to request in real time, missed packets. This ack/nak channel would need to only be a 5KHz wide slice of spectrum, since even a 9600 or 1200 TNC could be used as the ack/nak devices. My proposal then would be to request a STA of the FCC for such 115.2K channels, use standard internet type protocols, with amateur style TCP/IP networks and use a 5Khz ack/ nak channel for real time closed loop response. Just think how many ATV channels one could have in our current 6MHz 439.25MHz channel? Also for all of you who are thinking why change, just remember that when HDTV takes over in the next several years, TV as we know it will be non-existent. The time has come. What do you think?
… Neil WA2WIM wa2wim@ismi.net

I think the max data rate is 56kBd and 100 kHz per 97.305 and 97.307(6) and (8). HDTV isn't here yet, and even when it does it probably will not replace ATV on 70 cm since the energy covers the whole 6 MHz rather than most of its energy within the first MHz and other modes being able to work within it. In the high density areas like here in Los Angeles, there is no way to put a HDTV signal in without wiping out many other mode users. Some sparsly poplulated areas might be able to do it on a freq like 420-426 or 426 -431 MHz. The big factor is cost and hams are notoriously cheap. I think as long as the current camcorder and TV set is working, there will be ATV as we know it now. The digital or half/fast SSTV methods will have to prove themselves both as to being close enough to the video quality in movement, resolution, color and sound to be acceptable and at a price that is affordable before there will be any big switch. However, there is plenty of room for experimentation and would be great for show and tell at hamfests.
…Tom O'Hara W6ORG

I will admit to not being up to speed. But, a question comes to mind in talking about digital ATV. How do you initially connect? How do you know who to send to? I thought that with TCP/IP and handshaking you had to have an addressee? Can you not transmit CQ in the blind? How would that work with the "back" channel being full of lost packets and no-hits? Current ATV allows you to find the limited amount of people out there-How can digital? I like the idea, just need clarification!
…Ken Williams, KE4BWV ke4bwv@bellsouth.net

Ken, that is a very good point. Initially, I think we would have to settle for skeds and "activity nights". But this is not uncommon in many areas of ham radio. For instance, most ATV activity occurs through repeaters and is centered around nets. And our EME friends rely almost exclusively on scheduled contacts. This is an acceptable tradeoff for what we would gain in more efficient use of transmitter power and reduced bandwidth. With more sophisticated software protocols it should be possible to develop networks of digital TV, much like packet radio functions today with digipeters and the like. Also, with short compressed files (like CQ calls) store and forward mailboxes could become an option as well. BTW, there is a nice resource page devoted to high speed packet applications that addresses modems, TNC's, and RF equipment for the various bands. Check it out at: http://www.ampr.torun.pl/packet/hispeed/hispeed.html. But it is important to consider questions like the ones that Ken and Tom have raised on this issue. Certainly there will be difficulties and it may be that taking fast scan to the digital environment is not viable. Let's keep the ideas flowing.
…Les Rayburn, KT4OZ

Ken mentions some good points, but they all have proven solutions. What I envision is a APRS type addressing protocol where packets of Digital pictures can be sent to either a beacon ie: CQ or connected service: ie a station. This would also preserve the ability to have round tables etc....It sounds like if we are going to do this we need to form a Digital Amateur Television protocol group to start writing the syntax, much like what TAPR did with the original packet TNC-1 boards. (My TAPR Beta TNC-1 is around here somewhere, Hi)
…Neil WA2WIM

APRS uses short UI packets addressed to no one (actually it uses addresses but they have nothing to do with who receives them- they just carry info, like what version of the pgm is active). It relies on the theory that missing a few packets is no big deal. There'll be another one along shortly with similar or identical information. Trying to use Unconnected packets for digital TV would probably be very detrimental to the integrity of the whole file. Your idea of a new protocol would certainly be valid. I suppose if it was a broadcast, it could use some type of forward error correcting (think FLEX paging).
…Ralph, N4NEQ BSRG.org

The September/October 1998 edition of IEEE Network has a relevant article titled "A Survey of Packet Loss Recovery Techniques for Streaming Audio". It appears on page 42. The article surveys several packet loss recovery techniques and issues related to delays in an IP multicast channel. A classic problem for IP multicast is that such networks are shared networks - you generally cannot (yet) reserve

bandwidth for your application's data requirements (unlike, say ATM networks). Extending IP multicast into the radio environment only makes the situation a little worse :-) "Interleaving" is a forward error correction technique that is valuable, especially in broadcast applications (due to latency issues). A problem in streaming media is that the loss of one packet drops a "hole" in the middle of an audio or video channel. Using interleaving, you take slices from several packets and combine them into new packets. So each packet received might consist of 1/10th of each of 10 packets. If you lose one packet, you've lost just 10% of each of 10 packets, not an entire data packet. The idea is that you can still reconstruct something useful out of the remaining 90% of data, so you don't end up with a "hole" in your audio or video. You can also combine (in fact probably want to) interleaving with forward error correction (FEC). The use of FEC enables you to reconstruct the missing 10% (in my example) of the remaining packets. Anyway, there are many fascinating solutions available for handling data loss in streaming audio and video transmissions. The articles describes numerous techniques. I've also received word from n8gnj that a 56 kbps radio network has been constructed in parts of Puget Sound, and that the group behind it has plans to eventually extend this to the multi megabit per second range. This points to the need for hams to invent or leverage existing technologies to begin deploying fast data radios. Fast wireless data enables the invention of all kinds of new applications including digital audio, scaleable digital video, routable digital video, interfacing and distribution over the Internet, even linking of ATV systems across the country or the world. This is especially interesting as costs of broadband Internet access come down e.g. ADSL and cable modem technology is happening now. Such broadband wired connections could provide a backbone for the wireless side of new amateur applications in digital wireless.
…Ed, KF7VY

the PACSAT broadcast protocol is ideal for this. It was the perfect answer to the broadcast bulletin traffic for BBS's several yearas ago. It would be perfec for distributing big pcicture files. In fact, it does it all the time. Just look at all the IMAGES coming down from the 4 PACSATS that have cameras on board... It does this very effeciently...
…Bob, WB4APR

A few more thoughts ...

(1) One email to me noted that Barnes & Noble sometimes carries IEEE publications (I didn't know that), although B&N didn't seem to have IEEE Network. If you are interested in reading the Sep/Oct 98 IEEE Network article on packet loss recovery techniques in streaming media, probably the best place to find IEEE Network is in either a corporate library (if you work in a technical field) or a college library. IEEE Network does NOT have their articles online. (I'm member of both IEEE and IEEE Communications Society and subscribe to IEEE Network.)

(2) I've coined the term "Amateur Digital Video" or ADV as a shorthand to describe digital TV for amateur radio use. I thought also of Ham Digital TV (HDTV) and Amateur Digital TV (ADTV) but those acronyms are already taken! So I ended up with ADV to describe the use of digital techniques for Amateur Radio communications with images. I plan to write this up at my web site, http://hamradio-online.com (in spite of its professional appearance, this is a non-commercial web site - no ads, nothing to sell).

(3) It seems to me that ADV developments can and should leverage analog ATV. For example, ADV experimenters can convert their signals to ATV and relay via existing ATV repeaters. Similarly, ATV enthusiasts can uplink to ATV repeaters where another ham might receive the transmissions and encode them digitally. Under such a process, analog ATV and ADV would co-exist for quite a while and provide for interesting experimentation and use of existing infrastructure and equipment..... The more I think about this, there are all kinds of neat applications of ATV and ADV.
…Ed, KF7VY

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…73 Neil WA2WIM

There may be a way around this, and this is something I've been thinking about for quite a while. Four years ago, I migrated from the world of DOS and Windows (and bugs, crashes, and viruses) to Linux, and I think Linux has some features that could be very advantageous in developing a amateur DTV communications protocol. First of all, Linux supports TCP/IP as well as AX.25 (plus LOTS of other protocols). It also supports a feature known as "Serial IP Load Balancing", that allows users to bind modems and phone lines together to work as one point-to-point link. If it's possible to transmit two 57k data streams on separate 70-cm frequencies, then it is possible to combine both streams at the receiver and realize double the data throughput. If 4 channels are used, then we're looking at 2 megabits/second throughput without exceeding the legal bandwidth for each channel. Another advantage for using Linux is that it is designed to work on a wide variety of hardware platforms, from supercomputers, to Intel-based PCs, to PowerPCs, to Pilot Palmtops (imagine digital ATV on a Palmtop!). I think portability is important in what we do as amateur radio operators. Since Linux supports AX.25, it should come as no surprise that some of the OS's developers are hams. There's a wealth of talent and expertise that can be tapped into. And all the software is free.

…John, KD2BD

How did we go from a Digital TV discussion to a discussion of Windows vs Linux? I believe you'll also find that Windows 98, Windows NT4 and Windows 2000/NT5 also support multiple modems. The biggest problem now is finding an internet service provider that will allow you to use multiple modem technology. The amateur community, at least locally, is way behind on transmission speeds. Locally, everything is still running at 1200 baud, including backbones. 9600 is a joke. Why are we still playing with these speeds? I think there is two reasons. One is that hams are basically cheap. If it's going to cost a few bucks then most don't want to be involved. The other reason is, there seems to be no experimenting on amateur radio these days. Most hams these days are happy to take a radio out of the box, plug it into 12 volts and an antenna and get on the air and talk. Several years ago, I saw an advertisement in a commercial two-way radio magazine for a modem that would take the data from a computer and transmit it over a standard 5 Khz radio at 14,400 kbps. This was back when everyone was just beginning to talk about 2400 and 9600 baud amateur packet. From what I remember, these units came prewired for several Motorola radios, but stated they would also work with many amateur radios. The company was in New Mexico from what I can remember. I cut the advertisement out of the magazine and showed it to the local packet guru's. They never investigated any further, saying "it probably costs too much". As I said, this was several years back, I'm sure there is something faster and better out there now. What I'm wondering is, why are we talking about doing all this on our 430 MHz band? As crowded as it already is, I can't imagine trying to tell the local coordinators that I'd like to use two or three or four 430 MHz frequencies for digital TV experimenting.... I already know the answer/reaction. With the proliferation of the Wavecom units, we should be looking at trying to experiment with those, or maybe a 10 Ghz gunnplexer. How about surplus microwave gear that can be converted to ham frequencies? There is lots of bandwidth on the microwave frequencies. My problem in the past with ATV was that there seemed to be no way to get information. With the Internet as it is today, this should no longer be a problem. Just my thoughts.

…Rick, K6SIX rick@k66.com

I am personally very enthusiastic about digital TV on Amateur bands. In my opinion, TCP/IP is not the way to go. It has a fairly high overhead for the handshake and does not support casual viewing or roundtables. We should adopt a protocol that is "broadcast" in nature. Using unscrambled MPEG-2 gets my vote. Anyone know if there is an economical MPEG-2 encoder chip set in the market or in the works? Decoder cards for PCs are getting affordable. I envision using the digital initially to link analog repeaters, creating regional networks. As the technology is better understood, then the appliance operator should be able to get a box to hook to their PC (over USB or IEEE-1394) or analog system (NTSC, PAL, SECAM, ... I/O. We need a TAPR type activity to design these systems. One way is to take up a collection and fund a University Graduate student to do it as a project. Let's keep the discussion going.

…John Hays, K7VE john-email@hays.org ATNA Region 7 Representative.

TCP/IP is definitely not the protocol of choice. However, I am concerned about the bandwidth necessary to support MPEG 2. Remember, when we are discussing digital television that are many variables that effect the bandwidth required for transmission:

1. Frame rate: Analog television is 30 frames per second (fps) while it is very common to encode digital video at 15 or even 10 fps. There is a quality loss, but bandwidth would be reduced.
2. The size of the frame of the video is a variable as well. In analog, full screen is the only way to go. Again, in the digital world you can send much smaller screen sizes, for instance 640 pixels by 480 pixels would save bandwidth over a 800 X 600 screen. In reality, screens are usually much smaller than this when being sent over the bandwidth challenged Internet.
3. You can also reduce the number of colors transmitted, from millions of colors, to say 256 or even 64. Again, loss of quality but less bandwidth required.

I think we would have to develop some standards. They might vary for weak signal or DX transmissions where you would send 16 color, 10fps etc. But could be near broadcast quality for local repeaters or simplex MPEG-2 encoders and the far superior MPEG-3 encoders are both coming down in price, however, they remain expensive. Real Media has the advantage of being able to accept baseline .AVI, Quicktime, or MPEG files and then perform its conversion for playback without regard to platform. For now at least, Real Media gets my vote. It is the proven leader in compression technology in limited bandwidth situations. It is also less expensive. John's comments on 70cm repeaters being used for mixed mode works well with the suggestion here that the digital transmissions be used to "link" regional repeaters together. John is also correct that reducing our bandwidth, even on 70cm makes us more, not less attractive to coordinators. I do think that our experiments will need to be conducted much higher though until the kinks are worked out. I would recommend 2.4ghz, due to inexpensive equipment being available for this band. Though 900MHz has the advantage of transverters with 28MHz IF's being available. (Most 2.4ghz transverters require a 144mhz IF, which is not compatible with most of the high speed modems.) The important thing is that we take the first steps towards our digital future, right now on this list! Discussions just like this, followed by pioneers experimenting with various techniques, and then hammering out standards will lead to widespread use of this technology. Let's keep the discussion going indeed. Wonderful, detailed comments by all!

…Les Rayburn, KT4OZ

I think we're comparing apples to oranges here. Digital TV is most definitely not RealVideo, NetMeeting, MBONE, etc. The streaming video apps that sit on top of IP will naturally expand into wireless HAM IP networks- no need to standardize on one; and there's absolutely NO reason to waste time trying to invent a data protocol better than IP. The original poster was asking about true Digital TV. The same b/w that's being used today for an ATV channel could carry a digital broadcast instead; but let's think about a variable compression ratio instead of resolution and color depth- you'd adjust bits per Y and C and bit rate anyway... right? So, we have two things to do:

1) Build megabit wireless networks - not really related to this list...
2) Discover how we're going to adapt to the future TV broadcast standards or invent our own.

Obviously everyone has in mind these two concepts converging, but that's a long way from here in the commercial world (nearest thing would probably be Broadcast MPEG-2 over ATM, side by side with AAL5 data stuff) and even further away from a ham's budget, especially as these motion based compression standards get more and more asymmetric. If IP does "win", then the Internet at large will have developed a way to handle an MPEG whatever constant bit rate stream.

…Ryan Brooks, N9YBX ryan@inc.net

Ed's comments about the two types of digital television could not have been better stated. Ryan Brooks made some interesting points, but I do think that the commercial DVB systems are going to be out of reach for all consumers and many content providers for some time to come. Our company purchases over 1million dollars a year in new equipment, mostly in high end video post production technology. We have elected to pursue a path that will allow us to upgrade to HDTV when the demand for the product is there, but have not purchase equipment that is HDTV ready now. I think it will be some time before anyone on your block owns a digital television, perhaps not until early in the next century. It is simply not affordable to think about amateur's getting into that type of transmission system either. Ed makes a great point that we can use largely "off the shelf" technology to move ATV into the digital realm. The fact that it would be directly scaleable to the Internet was not something that I had thought of. It raises some very interesting possibilities:

1. Wouldn't it be possible to use a Real Video stream to feed the input of an analog repeater today? Allowing hams to send ATV transmissions from almost anywhere in the world? I know that something like this is being done on many 2 meter repeaters now via the Internet. It could also be a simple as a "file transfer" of MPEG or Quicktime movies too, if the hams and the repeater groups both had access to high speed Internet connections. The advantage to Real Media is that it could approach a "real time" transmission. Anyone want to try this? I'm up for it!
2. Likewise, this technology could be used to link repeaters together by using the Internet has the relay. It would be a hybrid digital/analog system for awhile but boy would it be fun!! And lastly, the fact that TCP/IP is being attacked by some of the best minds in the computer industry is very valid. There really is no need to reinvent the wheel. In large part, Quicktime, MPEG, Real Media are all scaleable and can adapt to changing bandwidth conditions. I doubt that 9600 baud would be valid, but anything faster than 28.8 could certainly deliver some version of "digital ATV". Kudos to both Ryan and Ed. Let's keep the ideas coming!

…Les Rayburn, KT4OZ

Regarding digital TV, there seem to be two kinds of "digital TV" that people are talking about.

1) broadcast "digital TV", similar to DVB on Echostar/DirecTV, DTV, etc.
2) the use of digital networks & technology to transmit moving pictures, not necessarily going after "broadcast" quality or mode".

My comments are directed towards category (2) of routing moving pictures over data networks. While there are significant problems in the use of TCP/IP for broadcast functionality, there are also pluses: anyone who who has a personal computer - or notebook PC or handheld PC - equipped for Internet access is already well up the curve for receiving digital TV. I've been playing with QuickTime 3.0 & RealPlayer on the Macintosh and RealPlayer and Windows Media Player on the PC side - clearly it makes sense to leverage the existing body of tools than to reinvent a bunch of new stuff. There are many tools out there for encoding video streams to match the available bandwidth - and many tools for decoding those streams on the client side. I have not looked into the details of streaming technology but some of these methods are probably using UDP packets over IP to implement broadcast streams. The advantage of sticking with standard Internet protocols is that amateur digital TV could also be routed over the Internet. You could also then use low cost, off the shelf equipment like handheld PCs for receivers. With solutions scaling to the bandwidth, its easy to start experimenting with 9600 bps, 56 kbps, 768 kbps, 1+ Mbps solutions. And best of all, its not necessary to re-invent tons of stuff, which due to low volumes ends up being made of unobtanium. Lots of commercial parties are doing "digital broadcast TV" using DVB/MPEG2. MPEG encoders, though, are not going to be cheap for awhile. Further, DVB (38 Mbps transmission rate) is probably outside the scope of amateur budgets! The place we can offer contributions to the state-of-the-art is by creating simple, low cost solutions that can be widely deployed. Regrettably, perhaps, that means using IP-based protocols. But lots of people in industry and academia are working to solve TCP(& UDP) /IP bottleneck problems - with hundreds of millions of users of TCP/IP, TCP/IP isn't going away - instead, a lot of effort is going into fixing TCP/IP network problems. Let's leverage all the investment that others are doing to create low cost, flexible, scaleable, widely deployable, Internet linkable ham digital TV.

… Ed, KF7VY http://hamradio-online.com

Giving this some further thought, it seems clear that whatever RF-to-PC hardware is developed, it probably should interface to the PC through an ethernet connection. Linux can route AX.25 packet frames through an ethernet adapter, so TCP/IP would not have to be used. Ethernet has been termed the "RS-232 of the 90s". Further information is available at:

http://sunsite.unc.edu/mdw/HOWTO/AX25-HOWTO.html
http://sunsite.unc.edu/mdw/HOWTO/HAM-HOWTO.html

Some of the networking HOWTOs also discuss some ham radio applications. I think the protocols used would have to differ depending on whether one is engaged in simplex communications, or through a repeater in a "roundtable QSO". For a simplex point-to-point link, regular AX.25 may provide all that is needed, but a repeater (like a packet cluster) has to service many users simultaneously, so perhaps the FTL0 "broadcast protocol" as used by Pacsat satellites might be more suitable. Pacsat satellites transmit their downlink data as unconnected <UI> frames. Groundstations do not need to acknowledge the frames received. Each packet contains information regarding the fraction of the file that is being broadcast, as well as its position in the complete file. Groundstations missing portions of the transmission may request the missing pieces (file holes) be transmitted by the satellite. In this way, the satellite never waits to hear any ACKs from any station. If reception is good, there's never any reason for a groundstation to ACK back to the satellite, and the throughput is much faster than regular packet radio. So, maybe the person transmitting the repeater would need to use standard AX.25, but the repeater could use FTL0 in sending what it receives out in a "broadcast mode" that doesn't require reception of ACK frames from its users. Just some thoughts I had while trying to fall asleep last night.

… John, KD2BD

I think the max data rate is 56 kBd and 100 kHz per 97.305 and 97.307(6) and (8). HDTV isnt here yet, and even when it does it probably will not replace ATV on 70 cm since the energy covers the whole 6 MHz rather than most of its energy within the first MHz and other modes being able to work within it. In the high density areas like here in Los Angeles, there is no way to put a HDTV signal in without wiping out many other mode users. Some sparsly poplulated areas might be able to do it on a freq like 420-426 or 426 -431 MHz. The big factor is cost and hams are notoriously cheap. I think as long as the current camcorder and TV set is working, there will be ATV as we know it now. The digital or half/fast SSTV methods will have to prove themselves both as to being close enough to the video quality in movement, resolution, color and sound to be acceptable and at a price that is affordable before there will be any big switch. However, there is plenty of room for experimentation and would be great for show and tell at hamfests.

…Tom O'Hara W6ORG tomsmb@aol.com

Just to follow up on what Chris-WA4LSW said about hams using existing Technology to begin our steps into digital television:

1. I have heard of a group of packet folks out in the bay area who may have already used CU-SEE-ME (An internet based video conferencing system) over a high speed 56K packet network. To my knowledge, this would be the first amateur digital television QSO! I'm trying to follow up on this and see if it's true.
2. While the idea of using CU-SEE-ME to communicate with other hams over the Internet holds no appeal for me, I do think that the idea of using the internet as a relay between existing ATV repeaters is great. Also the idea of using the Internet as a gateway to those repeaters makes a lot of sense too. Just think, you could have a QSO on your local repeater with an ATV ham in Germany tonight! The 2 meter FM crowd is already doing this and there's nothing to stop us. Use CU-SEE-ME or Real Media as an alternate repeater input!

3. I've been having some discussions with the folks at TARP about their experiments into Spread Spectrum on 2.4ghz. Now to try this we'd have to be accepted into their FCC STA to conduct the experiments but after that it should be possible to try Digital ATV using simple Wireless LAN cards! Many hams who have played with these things are getting 14 mile range out of them while staying with Part 15 guidelines, much more for the folks who are running Part 97 under the STA. We've purchased a few cards and already been accepted into the STA, hope to begin experimenting soon. We'll be using Real Media Servers, and using TCP/IP protocols. I'll keep you posted.

…Les Rayburn, KT4OZ

Using a couple of IBM Wireless LAN PCMCIA cards operating on 2.4ghz, myself and Tom Askew, KB5IHI were able to exchange Real Video files containing our callsigns and other information today at around 6:10PM CST. The PCMIA wireless LAN cards are inexpensive. We purchased ours for less than $30 bucks each on the Internet. Most use either "Intergal" or "Patch" style antennas and can have range of up to 1,600 feet at 100mw. In our tests using two laptop computers, we were able to transmit successfully down to the corner about 800 feet away. We set up both laptops to run http Apache Server and the Real Media Basic Server (free for personal use) we then configured the LAN cards to use TCP/IP protocol and simply typed in IP addresses into web browsers. When the streams were detected, the web browsers would launch the Real Media Players and we were able to have a QSO. At 28.8 encoding, it was even possible to have two way (Full Duplex) QSO's but at 56K encoding the stream broke often. The Wireless LAN cards had a rated bandwidth of 512K but much of this is taken up by the protocol functions. One way QSO's at virtually any encoding speed were possible, and high quality video (P5) was exchanged out to our maximum distance. Please note that these transmissions would have been perfectly legal under Part 15. However, as we plan to add power and high gain antennas, we took the extra step of joining the Special Temporary Authorization of the TAPR. This will allow us to do several things that would otherwise be illegal: I.E. Use a frequency hopping sequence that differs from the FCC's guidelines for amateur use. For more information: http://www.tapr.org . Look under "Spread Spectrum". I still believe that high speed packet networks are the best route towards Digital ATV on a wide scale, however, we were eager to experiment with digital ATV, and to begin exploring options for networking. These cards are very inexpensive and therefore, we tried the spread spectrum route first. Some amateurs in the TAPR spread spectrum STA have had ranges out to 14 miles using these cards with small power amps and gain antennas. We hope to try some of the "coffee can" ATV antennas soon and see what kind of range we can achieve here. Any body out there have access to a high speed 56K packet backbone that so we could try this out on packet too?

…Les Rayburn, KT4OZ

Before you bump up the radiated power above Part 15 limits, you will need to change the spread spectrum frequency range to stay within the 2390 to 2450 MHz ham band. The high data rate part 15 devices probably use the whole Part 15 2400 to 2483.5 MHz in order to get enough channels (75 minimum) at the wide bandwidth - 15.247 & 15.249. You have to make sure your sidebands don't go above 2450 MHz, so I suggest making the limits 2391 and 2449 and just hop less channels.

…Tom W6ORG tomsb@aol.com

Tom is correct about this - watch those band limits. An alternative is to use 902-928 MHz Part 15 wireless LAN cards rather than 2.4GHz cards. At 902-928, the Part 15 band is the same as the Amateur band. At 2.4GHz, the Part 15 band is wider than the ham band and adding power to a Part 15 device might end up becoming an out of band transmission.

…Ed, KF7VY http://hamradio-online.com

Upon return from my vacation, I read with interest the thread about "Digital ATV". At first I was somewhat appalled about the notion of putting video on "unproto" packets - something that would be an unfortunate misapplication of the technology, but the notion of just using unencrypted MPEG streams would seem to be more reasonable. About the maximum baud rates: 19600 on 2 meters (even though the "standard is 19200" but who cares) with 56 k baud on 220 and 70cm. Keep in mind that the rules specify symbol rates, not bit rates. Therefore, if one were to run something like 1024-ary modulation scheme (10 bits-per-baud) and somehow confine its bandwidth appropriately, one could actually run just under 200 k bits-per-second. Of course, the link budget for this sort of circuit would be unrealistic, not to mention the likely cost of the modems. On the bands above 450, there are no restrictions on the allowable data/baud rates per se: Anything is allowed as long as the other rules are followed (i.e. noninterference, allowable modulation schemes and codes, etc.) As for the suggestion that we as amateurs use the proposed "ATV" (Advanced TV) schemes that the terrestrial broadcasters are using, I feel that this would be unrealistic. This system was designed with bandwidth constraints in mind. As far as performance goes, it is rather poor, actually. A few db of ripple across the passband, and a few extra degrees of incidental phase modulation, and you have blown your Eb/No away: Considering how most amateur television AM signals look as far as amplitude and phase response, I don't hold too much hope that it would work well at all - even the broadcast industry is dubious about the ultimate workability of the terrestrial schemes... I would suggest that the modulation scheme used for space-based delivery systems (i.e. direct-to-home satellite) be used, namely QPSK. This is reasonably robust and spectrum-efficient and really fairly difficult to screw up in an amplifier chain. One just needs to take reasonable care in short-term stability of the converter chains in the transmitter and receiver (very easy to do, fortunately) and implement decent tracking demodulators (also quite easy to do...) and you are all set. As far as how the video should be represented, I think that anything is fair game for experimental use. But from a truly practical standpoint, our options are somewhat limited at this point. In my opinion, having worked with compressed digital video broadcasting for the past several years, the absolute minimum bit rate for "reasonable" quality video and audio, using an MPEG scheme, would be at T1 rates (about 1.544 megabits-per-second.) This still results in many visual artifacts that many people might find

objectionable, but it would certainly be tolerable for amateur use. (Notice that I haven't mentioned frame rate until now - For the most part, frame rate is irrelevant when discussing an MPEG encoder that is worth anything... Data rate has to do with updates of picture elements and how fast how much detail can be resolved more than a "frame rate.") While they are "neato," software-based video conferenceing systems shouldn't really be strongly considered as the basis of the "ultimate" system... at least for now... Until affordable processing horsepower increases by another order of magnitude (which should be pretty soon...) the CODECs based on dedicated hardware have the edge. I would propose looking at something like CCIR-601 for a start. This is an MPEG-like video compression "standard" that works pretty well and is well implemented on some pretty inexpensive chips (such as the Analog Devices ADV601 and related series (see http://products.analog.com/products/info.asp?product=ADV601 for a bit more information...) I would be interested if anyone has evaulated the $200 "video pipe" evaulation board based on this chip mentioned on this page. It would be interesting to see how practical it would be to transcode CCIR-601 to a DVB-compliant bitstream (with audio) to allow the use of commercially-available DVB-compliant satellite recievers (such as the Echostar receivers) which, like most modern satellite receivers, already can tune the 23cm amateur band...). I welcome comments, of course...

…Clint Turner, KA7OEI turner@vsat.ussc.comI came across the following URL while editing my web browser's bookmarks, and thought I'd share it with the group. It shows that folks have been thinking about digital ATV standards for quite some time: http://www.amrad.org DigitalTV.html. This particular page is sponsored by the Amateur Radio Research and Development Corporation (AMRAD). Food for thought...

…John, KD2BD

(If you have access to the Internet, I highly recommend reading their viewpoints but it's too much to include here. I believe I've already overdone it! WA8RMC)

FORT WAYNE HAMFEST…so you missed it, huh? Here are Henry's views!

The old cameras with the huge remote control zooms were in the ticket barrel room, in the middle (Sunday). The $35 color CCD pin hole cameras were in the same room at one of the bigger flea tables, (looked like 6-8 tables) amongst a lot of computer stuff. There were other video cameras, VHS camcorders and stuff under $100 all over the place. I saw 1 10 watt PC tx for $200, and a Wyman for $100 in the fleas only room. There was some tricked out cameras (right angle lenses, quad split stuff in the flea only room and after talking with the guy most of the prices dropped 50%. I found two CATV UHF channel modulators which could be retuned to ATV for $25 each (Channel Master units) and by 2 PM, you could get lots of stuff for taking it away or very cheap. If I had been in a buying mode I could have filled my ENG truck but the wife would have gotten suspicious when the back end was suddenly lower than the front from the boat anchors!

Several ATV / Video goodie tables. 16-160 F .8 (yeah, big glass) C mount lenses, with remote control, attached to a B&W camera (which you could throw away) after $10. Color chip cameras from $35. At the other end, Wavecom Jr's for $169. I didn't have the heart to tell the guy they are about half that most anywhere else. Excellent turnout. If you are within the drive distance, you should really make this a "must" on your hamfest list.

…Henry KB9FO

NEW MEMBER SECTION

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 him or her with information. New members are the lifeblood of our group so it's important that we actively and aggressively recruit new faces.

K8STV Jim Carpenter, Columbus

COLOR CRT'S…are they becoming obsolete? You betcha!

FLATTER, BRIGHTER--AND EASY TO MAKE? A new screen technology has the industry charged up. In a crowded room, amid the clink of champagne glasses, a woman stares at a new kind of postcard, thinks for a minute, and says "Wish you were here." On the way home that evening, she slips the card into a mailbox. A few days later and half a world away, a friend flicks a switch on the card, hears the clink of the glasses, and watches the sender and her friends jostle in front of the card. He chuckles, and forgives the cliche.

"Video postcards" won't be ready in time to commemorate that big millennium party you're planning. But they may arrive early in the next century, thanks to a global race to perfect a powerful new kind of flat display. The screens are known as OLEDs, for organic light-emitting diodes. They'll be light and bright, ultrathin and flexible, and easier to produce than most other types of flat screens for computers and TVs. Since the diodes can also act as photodetectors, the new screens may someday be able to capture & store images as well as play them back.

POSSIBILITIES. That's the concept behind video postcards. And the technology has inspired many other flights of engineering fancy. Designers at Philips Electronics--a leading player in this budding field--have sketched out newfangled laptops with screens like delicate sails that furl, so they take up less space. Marketeers at Cambridge Display Technology, an OLED startup in Cambridge, England, talk of long, thin, luminescent ceiling panels that could replace the heavy lighting fixtures on jetliner ceilings. Product designers also talk of giant video screens that consumers could one day roll like wallpaper across an entire living room wall. From "smart maps" linked to databases on the Net to glowing neon stock tickers or poetry banners stitched into T-shirts, "the possibilities are literally endless," declares Cambridge Display CEO Daniel R. Chapchal.

Like the more common light-emitting diodes that are used for dot-matrix-style message boards at airports, OLEDs rely on materials that give off light when tweaked with an electric current. But these new screens are far more versatile than the crystalline arrays that make up message boards. In OLEDs, the light emitting materials are deposited in films and combined with a matrix of electronic circuits that switch on individual picture elements, or pixels. The first applications for such screens are unglamorous backlights for liquid crystal displays (LCDs) in notebooks. But within two years, OLEDs will start competing with LCDs in handheld computers, cell phones, and camcorders.

For more exotic applications, like furling notebook screens, many researchers are banking on a plastic variety of OLED sometimes called light emitting polymers. Here, the glowing organic materials consist of long, repetitive chains of large molecules that are suspended in solution and spun or sprayed onto a substrate. No fewer than 65 companies have jumped into the field, including Philips (PHG), Lucent Technologies (LU), DuPont, and Dow Chemical (DOW), as well as a host of Japanese giants. "This is probably the hottest research area in the whole field of flat panel displays," says David E. Mentley, VP for display industry research at Stanford Resources Inc. in San Jose, Calif.

ELEGANCE. For now, Mentley chalks off wall-size screens to hyperactive imaginations. But even without them, he says, OLED sales are likely to soar from almost nothing today to $400 million by 2004. That's small change compared with sales of LCDs, which will hit $12.4 billion this year, but OLEDs are on a steep ramp-up. "I don't think there has ever been a new display technology that went from nothing to 65 players in just three or four years," he says.

The excitement is easy to explain. Despite the efforts of display titans such as Sharp, NEC, Toshiba, and Hitachi, LCDs have never been an elegant solution to the flat-display challenge. They consist of many layers of materials and electronics, assembled in a long and costly series of manufacturing steps. More important, liquid crystals don't actually emit light. They simply shutter light passing from a fluorescent tube at the back of the screen through a complicated array of polarizers and color filters. And LCDs rarely look good viewed from the side.

Compared to all that, an OLED is elegance itself. It requires just a few layers of glowing material. And just as ink pigments come in many colors, different organic molecules emit their own light, in different colors, when excited by a voltage. So it's good-bye to filters, polarizers, or backlights. What's more, the molecules can be deposited on substrates using straightforward techniques borrowed from inkjet printing. These don't require expensive vacuum-manufacturing gear found on LCD production lines. The resulting screens look great from any angle.

Some of the first OLED breakthroughs came from Eastman Kodak Co. research labs. In the mid-1980s, the company patented techniques for depositing small organic molecules on a substrate. Today, Kodak maintains a team of about 40 OLED researchers. And it has licensed its technology to Pioneer Electronics (PIO), which has demonstrated a full-color, 5.2-inch display for car stereos.

FAST MOVES. But the biggest breakthrough came in 1989, when Cambridge University physicist Richard H. Friend and his colleagues discovered light- emitting organic polymers. They formed Cambridge Display Technology to turn these into OLEDs, licensing the technology to Philips, Seiko Epson, and Hoechst, while doing joint-development work with DuPont. Seiko developed an inkjet production technique and quickly demonstrated 2 inch prototypes. Now, Seiko is gearing up to make OLED screens for notebooks. Says physicist Friend: "We've been able to move much faster than I ever thought possible".

…Business Week website (www.businessweek.com): By Neil Gross in New York Forwarded by KB9FO 10/16/98

A CABLE MODULATOR FOR AN ATV TRANSMITTER?

Question: I'm looking for an inexpensive way to quickly get on 70CM ATV. I read in a back issue of ATVQ about a guy who used an inexpensive cable modulator and a small brick amp to get on 440 without much cash outlay. Has anyone had success with this? Any advice on other inexpensive transmitters for someone just getting their feet wet?
…Les Rayburn, KT4OZ

#1 Answer: The modulator plus brick route is a good one, but not necessarily inexpensive. (Unless you already have the cable modulator, on the right frequency). There are some fairly inexpensive 430 MHz ATV transmitters on the market. Groups near you, that to use as a resource include: **Gulf Coast** http://www.angelfire.com/al/gcats/ **Huntsville** http://hiwaay.net/~bbrown/tvatv.htm
Atlanta http://www.bsrg.org/aatn/aatn1.html and of course: http://atna.ampr.org
…73 de John K7VE

#2 Answer: I have done it!! If you don't have a commercial modulator (VSB, adjacent channel type) the cheapest way is using a PICO CAM-25HY Agile Modulator (Cable channels 30 - 70) feeding a Motorola Cass A CATV Hybrid amplifier MHW 5342A (or a PICO CA30 CATV Amplifier) which in turn drives a Class AB 50 mW input brick amplifier. I use a M57721M for about 7 Watts Peak sync output but you could use a higher output one. I get a beautiful (Excellent) picture this way.!! You can purchase the CATV Modulator and Amp from ATV Research (www.atvresearch.com) CATV Agile Modulator lists there for $ 89, PICO CA30 AMP for $ 99. You can purchase the Hybrid amp and "Brick" (49.95 and 54.45) from RF Parts (www.rfparts.com) The reason why you need an amplifier between the modulator and the "Brick" is that this economical modulator only puts out 25 dB mV (or 8 uW) and you need to bring the power up to 58 dB mV (10 mW) in order to drive the smallest "Brick". Of course you could also use MIMICS or any other type of linear amplification in between, but I did it the other way with surplus CATV stuff that I had from work. Commercial modulators cost around $ 400 but can give you the power you want to drive the "Bricks" directly (60 dBmV Output ones) plus they will be more efficient since they don't transmit as much of the unwanted lower sideband (VSB) Not related to these companies.
…Juan Zuloaga HK4BMG

#3 Answer: I've read a number of responses to these questions and I just wanted to throw a couple comments in on the CATV-VSB modulator method. I have used this method myself and as others have stated, it does work. However linearity of the amplifier stages following the CATV modulator is very important. Stages must be conservatively driven Class A or even more conservatively driven class AB amplifiers in order to preserve the lower sideband and lower audio carrier suppression. Even then, you are likely to have sideband re-growth as a result of the IMD performance of the amplifiers. A VSB filter after all the amplifier stages may still be needed. Remember, "A great looking picture" does not tell you much about what your transmitted spectrum looks like. Verify your "clean signal" with a spectrum analyzer before putting it on the air! Hope it works out for you.
…Steve Muther WF6R stevem@w6yx.stanford.edu

#4 Answer: HK4BMG is quite right. That line up will work for a total cost of about $240 if you cannot scrounge the cable modulator. ATV Research is a good reputable source for these items also. However you need to make sure you drive each amp within its linear region so as not to squash the sync and color burst. Most cable modulators do not have adjustable sync stretchers or level sets that would allow you to get the most out of the brick amps, but there is really not much difference if say you get a 10 watt brick and you have to run it at 5 watts pep. But if you wanted to go to higher power with one of the ham 70cm amps and not have adjustable drive and sync stretching, you would most probably distort the video to sync ratio quite a bit. I suggest, if you find one other than the one specified, that you check the rated power output on cable channels 58, 59 and 60 and if it is variable and has adjustable sync or pedestal control so as to best match the added amplifiers. Those that have gone this route also claim you can get more out because you start out with VSB. Strictly true, but insignificant. Actually this only amounts to less than 1 dB in the first amp and less in the second since the amount of power cut off in the lower vsb is less than 5% of the total power and assumes you drive at the max possible power point. The intermod component of the higher power amps usually reinserts the lower sideband components anyway. I think the most significant factor for hams is if they can get a cable modulator for next to nothing at a swap meet or other source, and are willing to call around, obtain the proper truly linear amps and assemble the system. If you enjoy building systems then this is a good way to go.
… Tom O'Hara W6ORG

#5 (and last) answer: *In summary, the cable modulator is a good idea if you choose the modulator carefully. First, get one that is the agile type. That is, a synthesized one that can change channels by switch and not by crystal. Next, select one with at least +10dBm output (10mw) with a level adjustment and, most important, have a good idea of what you're doing and be willing to experiment with home construction. A brick amplifier must be added to the modulator output to obtain enough useable power, which could be tricky and is beyond the scope of discussion here. Finally, if I haven't scared you enough, and you're STILL determined, contact me and maybe I can help work things out. Happy construction!!!*

MORE WAVECOM Jr. STUFF…boy, this band is fun!

The WCRI-2.4 ($35) Receiver Interface board with repackaging info for the Wavecom Jr. 2.4 GHz FM ATV receiver is now in stock. This stuffed, soldered and tested board has two squelched variable volume speaker amps and S-meter output which is great for antenna alignment. There is also DC coupling to the antenna input coax to power an antenna mounted Down East Microwave preamp for optimum sensitivity. This board also comes with complete conversion info and CAB247 die cast aluminum box drill drawing template or use your own chassis that is at least 5x7x2.5".

2.4 GHz might be a more practical way to go for an alternate ATV repeater input vs. 1200. With the Wavecom Jr.'s and the P. C. Electronics interface board set up it comes out less cost, and currently few decent 1200 MHz ham transmitters seem to be on the market. Since HFT disappeared and HATS doesn't offer their kit anymore (most of the others I know actively market to the bootleggers so I cannot in good conscience suggest any of them).

The Wavecom JR's have been used in So. Calif., Phoenix AZ, Columbus OH, Troy MI, and other areas for an alternate repeater input, point to point links, and other line of sight ATV applications thanks to the low cost of these license free Part 15 transmitters - $65 transmitter only from ATV Research, 1-800392-3922. Bill Parker, W8DMR, did some original work that was published in the Spring and Fall 1997 issues of ATVQ, and also there is a lot of info on WB4IUY's web site: www.ipass/~teara/atv4.html. You should be able to get 25 to 50 miles line of sight DX with the 50-100 mw converted output and the Conifer dishes at both ends.

For transmitting, complete ham conversion info comes with the WCI-2.4 TX interface board ($39) including overlays and wire list to repackage the two boards into a CAB247 die cast aluminum box with the added mic and line audio pots and connectors. The Wavecom Jr. TX module conversion consists of removing the 9 dB RF output attenuator (3 chip resistors) and adding a solder jumper. A resistor is also added to increase the sound subcarrier injection to about -15 to 18 dBc for better weak signal recovery. The TX WCI-2.4 board has a 18 dB amp on it to give 50-100 mw out and bolts to a Type N connector. There is also a dual (stereo) mic and line variable gain amps on it for more audio flexibility - same audio circuit as used in all our ATV transmitters. I am working with two manufacturers to provide a 1 watt or so antenna mounted amp which is powered through the coax. There is a dc decoupler on the board to power the amp. We suggest Bob Myers for the 23 dBd Conifer 24" dish antenna and feed (about $80 - 602-465-0936, email: bmyers@primenet.com or web site www.primenet.com/~bmyers/) and ATV Research for the Wavecom JR's ($65 TX only and $120 with receiver - 800-392-3922, www.atvresearch.com). You might find others under different brand names or special purchases by other hams on the remailers.

The stock Wavecom's are four channels on 2434, 2453, 2473 and 2411 MHz. Only channel 1 and 4 are in the ham band. The 2434 is used as primary for ham use since this channel comes up every time the power is applied. However, Brian Miles, WB7UBB, will supply a replacement PIC16C54A that has all 4 channels in the ham band (2398, 2412, 2428 and 2442), comes back on the last channel selected when turned off, for $25 each plus $5 shipping and handling. The transmitter and receiver use the same PIC, so if you change one, you need to change the other to match. Mail your check or MO to him at 12015 N 34th St., Phoenix AZ 85028. He will do other frequencies on request. Email him at wb7ubb@home.com. I'd appreciate any info or comments from other users that might be incorporated and passed on in the application notes that will go with the boards.
… Tom O'Hara W6ORG P. C. Electronics tom@hamtv.com

*For the record, because of the mention of the Wavecom frequencies above, I thought I'd insert this excerpt from KB9FO about the commercial frequencies adjacent to our 2.4GHz Ham band (also published in an earlier issue of the ATCO Newsletter).*WA8RMC.

Since many of you are now getting the 2.4 GHz ATV bug, here is where we broadcasters are using:
Channel 1 1999.0 (1990.5-2007.5)
Channel 2 2016.5
Channel 3 2033.5
Channel 4 2050.5
Channel 5 2067.5
Channel 6 2084.5
Channel 7 2101.5
Channel 8 2458.5 (2450.0-2467.0)
Channel 9 2475.5
Channel 10 2492.0
Channels 8, 9, 10 are no longer being authorized but stations that were on these are "grandfathered". In Y2K we are supposed to lose 1900-2050 to another service, so we will be squeezing the channels narrower to try and accommodate everyone. Here in Chicago, each news

station has 1 primary channel (usually shared) and 1 secondary channel (always shared). The channel numbers refer to the numbering used to ID the 2 GHz band. Letters are used for ITFS and other services in the spectrum neighborhood.
…Henry KB9FO

VHF/UHF CENTURY AWARD CHANGE PROPOSALS…is this an ATV boost?

The American Radio Relay league awards the VHF/UHF Century Club Award, also known as VUCC, for establishing contact with a minimum number of "Maidenhead" grid squares. Grid squares are designated by a combination of two letters and two numbers. For instance, my home is located in Shelby County; Alabama and I live within grid EM63.

The award is difficult to earn but is made easier by the fact that the higher you go up in frequency, the fewer grids you must work to earn the award. Again, an example, if you operate ATV on 440mhz, you must currently work other stations in 50 grids to qualify. Impossible, you say? That's true, but if you operate on 2.4ghz, you need work only ten grids to qualify. Working ten grids on 2.4ghz would still be tough, but it could be possible to do so.

The Amateur Television Association of North America (ATNA) is currently reviewing a proposal asking for the ARRL to amend the current rules for the VUCC program to allow for the wide bandwidth of ATV transmissions and allow more of us to pursue earning this landmark award. The proposal is outlined in detail below. But first, let's cover some of the basics:

The VUCC is the most sought after award for the hard core weak signal operator. During major contests like the VHF Spring Sprint many operators can work the necessary stations to qualify for the award in a single weekend! Endorsements are also available for additional contacts, however, at the moment no special mode endorsements exist, meaning there is no "CW Only" type endorsement available.
The official rules can be downloaded from the ARRL web site at: http://www2.arrl.org/awards/vucc/. Briefly, the rules state that the award is available to ARRL members in Canada, the US possessions, and Puerto Rico, and other amateurs worldwide. Only those contacts dated January 1, 1983 and later are eligible for VUCC purposes.

The current minimum number of grid squares needed to qualify for each individual band award is as follows:
50-144 MHz-and Satellite-100 Credits, 222 and 432 Mhz-50 Credits, 902-1296 Mhz-25 Credits, 2.3 Ghz-10 Credits, 3.4Ghz-and up including Laser (300 Ghz)- 5 Credits

Contacts through repeaters currently do not count, and contacts with airborne mobile stations are also forbidden. Stations who claim to operate from more than one grid square simultaneously, such as in the corner of four grid squares must be physically present in more than one grid to give multiple square credit with a single contact. Operators should be willing to provide proof of their exact location at the time of the QSO if called upon to do so. Global Positioning System (GPS) readings are fine for this purpose.

In practical terms, our weak signal counterparts actively chase grid squares by a combination of techniques. "Mountaintopping" from the intersection of four grid squares is very common, allowing for operators to pick up four grid squares with a single contact. Another favorite involves launching "DX-peditions" to rare grid squares where little or no VHF activity may be present.

Due to the wide bandwidth of an amateur television signal, VUCC would currently be all but impossible on 440mhz even for the best-equipped DX station. Working 50 grid squares on ATV would simply not be practical unless the population of active DX-equipped stations rose dramatically. Even working five grid squares on 10Ghz would prove quite a challenge, but perhaps it would be possible with a team of two really dedicated groups moving from mountaintop to mountaintop using pre-arranged schedules and coordination via HF or cellular phones.

This is where the current ATNA proposal comes into play. If the ARRL could be convinced to amend the rules for VUCC adding a special ATV endorsement with unique requirements, we might lure hundreds of weak signal operators into trying this mode. It would also encourage more active ATV enthusiasts to upgrade their stations to make them capable of making DX contacts or to invest in equipment for the higher bands in order to "chase paper".

In addition to this, the ATNA should be encouraged to contact the organizers of major VHF/UHF contests, such as the VHF Spring Sprint and seek to have special "multipliers" added for contacts via ATV. These two factors alone might potentially double the number of hams on ATV overnight. This would be a worthy goal for our new national organization.

The current proposal before the ATNA leadership recommends the following changes to the American Radio Relay League VHF/UHF Century Club Award:
It is suggested that a special endorsement to the VUCC award be established that would allow for the special requirements of this mode of communication. This unique endorsement would have many advantages to the amateur community:

1. More amateurs becoming active in Fast Scan Television Mode, resulting in greater use of our UHF bands.
2. Attract newer and younger people to amateur radio by exposing them to "video" modes that they can relate to already.

3. Provide incentive for more active ATV enthusiasts to build or buy equipment for the higher frequencies providing growth for equipment sales and spectrum usage.
4. Provide incentive for more active ATV enthusiasts to join the ARRL and support it's worthwhile efforts.
5. Encourage more ATV enthusiasts to upgrade their stations for DX operations, rather than repeaters and local nets.

It is further recommended that the band requirements be modified for this endorsement in recognition of the wide bandwidth inherent in fast scan television and the resulting penalties in performance versus other modes of communication.

We recommend reducing the band credit requirements as follows for those stations using Mode A5:
440MHz- 20 credits, 902MHz and 1296MHz-12 credits, 2.3Ghz-7 Credits, 3.4Ghz and higher-5 credits

(It should be noted that five credits represents the lowest practical number, as operating from the intersection of four grid squares makes working four grids a simple task regardless of wavelength.)

It is further recommended that contacts via repeaters be allowed on all bands above 440Mhz. We also propose a special "ATV P5" award endorsement for amateurs who earn the ATV award on five or more of the bands available for television communication.

Applicants who submit contacts for any other VUCC award or endorsement other than the new ATV endorsement would have to continue to meet the existing standards for contacts, including those contacts that may have been made using amateur television.

Such changes to the rules structure are not without prescient. Currently special consideration is given to satellite operators, for instance, due in large part to their active national organization, AMSAT.

It is not hard to imagine the benefits of having twice as many stations active in ATV. Many of us cannot work a single other amateur station and most are limited to local contacts via simplex or repeater. There are simply not enough stations active to make it worthwhile for many to invest in building stations capable of making contacts beyond a few miles. This proposal has the power to change all that. How many of us would be willing to buy that bigger amp or a longer beam if we knew that there were four or five operators in that grid just beyond the horizon?

Imagine the race to become to the first person to earn the VUCC on each of our bands or the first to earn the special "five band" endorsement! And if we could couple this award with ATV multipliers for the major VHF/UHF contests, we might find our airwaves full of new faces.

If you'd like to see this proposal succeed, there are several steps that you can take right now. First of all, join the American Radio Relay League and the Amateur Television Association. For only $5 per year, the ATNA is the best possible use of your dollars for the future of ATV. ARRL membership is a good idea for all hams, regardless of how you might feel about the politics.

Then email your ATNA representative and let them know that you support the VUCC proposal. Recommend changes. And them let them know that you expect them to fight hard to see the league make the changes to the award program. Not only is this a chance for all of us to be heard, but it's also a chance for the ATNA to increase it's own visibility and prestige.

After ATNA makes it's formal proposal to the ARRL, write or email your league representative and let them know that you expect them to pressure the league into adopting the proposal. Make it clear that you plan to vote in the next district election and that your vote will reflect your feelings on how well they represented your interests. Email the league leadership, up to and including the league president and let them know that you support the proposal.

Other simple steps include adding your grid square to your ID tape, test patterns and QSL cards. Encourage your local ATV group to exchange grid squares during contacts. You may have already worked several grids without even knowing it. When you chart the path of your ATV balloon, let us know what grid squares it passed over and how many grid squares reported receiving it's signals. And then after the rules are amended, get on the air and make sure that your grid is represented. This is especially important during major contests. Personally, I cannot stand "paper chasing" or contests, but I still endorse this proposal. Increasing activity on ATV benefits everyone, even those of us who would not seek the awards.

Talk about the need for multipliers in major contests to your weak signal buddies. Point out to them how simple it would be to work your station using a Wavecom Jr. and how that juicy multiplier might help their score in the next contest. Wouldn't it be great to call "CQ ATV" on 2.4ghz and actually get an answer? It can happen but only if we are all willing to get involved. I urge you to contact your ATNA representative today and let them know that you support the VUCC proposal.

If you would like more information, including links to email addresses, ATNA membership, ARRL membership or details on the VUCC award, simply go to our new web site: http://www.cqatv.com. We've provided a handy, one stop source of links to your elected representatives for the ARRL and ATNA, as well as details about the proposal. Visit the site today.
…Les Rayburn, KT4OZ lowga@traveller.com

ISS HAM GEAR INCHES CLOSER TO SPACE

The first Amateur Radio gear to be used on the International Space Station has moved a bit closer to its rocket ride into space. Although the inauguration of Amateur Radio aboard the International Space Station--ARISS--is at least a year away, the so-called Phase 1 ham gear is on a tight proveout and delivery schedule and is due at Kennedy Space Center in Florida by January 20.

Delays in the ISS program have put off the first crew deployment until next January. The first crew will consist of US astronaut William M. Shepherd, as the expedition commander. Shepherd is studying for his ham ticket. Accompanying him will be Russian cosmonauts Yuri Gidzenko and Sergei Krikalev, U5MIR. All three have previous space flight experience. The crew has been training for their launch on a Soyuz vehicle and a planned five-month mission on the ISS.

The interim ISS ham gear package will consist of Ericsson 2-meter and 70-cm hand-held transceivers set up for FM voice and packet operation, plus power supplies, cables, and accessories. Ericsson donated the commercial transceivers for the project, while the Italian ARISS team is providing the external antennas.

At this point, the equipment and accessories have been checked out in an end-to-end integration. Additionally, the transceivers have undergone EMI testing to ensure that they will not cause problems for other ISS onboard equipment. The radios also still must be programmed and labeled in accordance with NASA procedures and protocols for space flight. AMSAT members who happen to work for NASA at Goddard Space Flight Center have been doing the EMI testing.

Preparing to carry Amateur Radio gear for use aboard the ISS involves careful attention to detail all along the way. Crew safety is the primary consideration, but cost and crew time--and aggravation--also are important. "Because of the high cost of space travel, it's critical that hardware be thoroughly tested and documented," said Will Marchant, KC6ROL, AMSAT's human spaceflight hardware manager. "Flight crews frustrated by buggy hardware are also less likely to want to participate in Amateur Radio operations."

The qualification process also requires multiple versions of the same equipment. In this case, six complete hardware systems will be fabricated and configured. The complement includes one flight system, a flight spare, systems for training both in the US and in Russia, one for development and testing, and one spare.

ARRL Educational Services Manager Rosalie White, WA1STO, a member of the Space Amateur Radio EXperiment (SAREX) Working Group, said she was pleased that NASA was taking no chances during the qualification testing of the ham gear. "I think it's great that they're taking the time to do a detailed examination," she said.

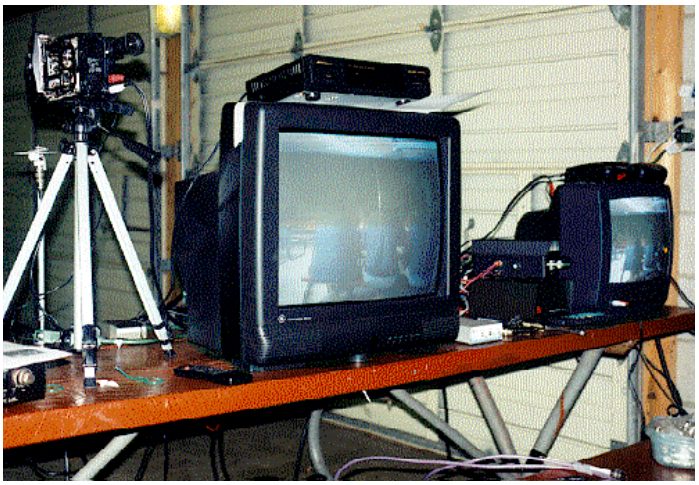
Getting Amateur Radio a permanent berth in space aboard the ISS has involved efforts in several countries. The primary players include the US, Russia, the UK, France, Germany, Italy, Canada, and Japan. "The ARISS team is truly an international, democratic, organization and is cooperating to provide human spaceflight Amateur Radio operations to the entire ham community well into the next decade," said Marchant.

Amateur Radio has been manifested aboard the ISS as "necessary crew equipment." The cost of providing just the interim Phase 1 amateur gear for use aboard the ISS is expected to exceed $60,000. The total cost of putting Amateur Radio aboard the ISS is expected to approach $700,000, with funds coming from the ARRL and AMSAT as well as from NASA.

Still unclear at this point are the actual frequencies and the call signs the crew will use from the ISS. The ultimate ISS ham radio complement--Phase 3--will include equipment to operate from HF through the microwave bands with SSB, CW, FM, packet, ATV, compressed ATV, and SSTV capabilities. The German team will supply a digitalker and full duplex repeater. Once aboard the ISS, Amateur Radio will serve as an educational tool through worldwide school contacts and as an outreach to the general public.
(*I'm anxiously awaiting more details about the ATV portion of this task! …ED)*
…ARRL volume 18 no.2 letter.

ATCO FALL EVENT MINUTES

The Fall Event of 1998 was again blessed with good attendance and weather. (It rained as we were finishing but at that point we had already declared it a success). John Busic WA8DNI helped me to provide plenty of food for all of us. (Thanks for helping out John). After filling ourselves with food, we settled down to have a business meeting and discuss matters such as Proposed repeater links to nearby repeaters, Dayton ATV activity and 2.4GHz status. Also, as required in our charter, an officer election was held. Brace yourselves, you're stuck with the same officers again in 1999. They are me, Art Towslee WA8RMC president, Ken Morris, WA8RUT vice president, Rick White, WA3DTO secretary and Bob Tournoux, KF8QU treasurer. Other activities included an extensive door prize list. I don't believe that anyone went home empty handed. So if you weren't there, you really missed out. Plan now to attend our upcoming Spring event about the first of May. Date to be announced. The pictures below illustrate very well the fun we all had.



The attendee list is as follows: KB8TRP, WA8HFK, WA2POH, W8STB, W8PGP, KB8TCF, WA8DNI, KE9SX, N8LRG, KB8WBK, WB8EHW, KB8YMQ, K8AEH, KF8QU, K8STV, WB8CJW, KE8PN, W8DXF, N8KQN, KA8MID, WA8RUT, WA8RMC plus a few non hams.

The picture in the lower left cluster above is the equipment that WA8RUT brought in for show and tell. It is also part of the equipment to transmit the proceedings to the repeater so the people unable to attend could watch from home.
…Art WA8RMC

ATV DISTANCE RECORDS…looks like 2.4GHz is up for grabs!

The following data was extracted from the Swiss ATV web page. If this is correct, the 2.4GHz ATV record has not yet been established. Get out your Wavecoms, build your best antenna and who knows…an ATCO member may make the record! I believe we have a good shot at this if we use our 2.4GHz repeater output as a start…WA8RMC.

The SWISS ATV association has taken the task to register all records in relation with amateur television and this at a world level. Our information sources are coming from the owner of records themselves that send us reports of their QSO and also in reading specialized ham magazines. In each case, we try to obtain a maximum of useful information directly from owners of the record QSO. The following panel gives the actual state of ATV world and European records. To able to compare, the narrow band (SSB/CW) world records are given for each band.

Frequency	Narrow band record	ATV record
411 GHZ	50 m, DB6NT-DL1IN, 6 january 1998	No ATV record registered
241 GHz	2.1 km DB6NT/p-DF9LN/p, 26 june 1995	No ATV record registered
145 GHz	53 km DB6NT/p-DL6NCI/p, 7 april 1997	No ATV record registered
76 GHz	114 km HB9MIO/p-DK4GD/p, 7 july 1997	No ATV record registered
47 GHz	203 km IK3NWV/I3CLZ-I4QIG, 31 mai 1998	69 km, 10 may 1998 at 07h00, F1JSR-F6FAT
24 GHz	398 km F5CAU/p-F6BVA/p, 26 october 1997	279 km, 27 april 1997 at 04h31, JF2AGB/p-JA3UMZ/JA2
10 GHz	1911 km VK5NY/p-VK6KZ/p, 30 december 1994	821 km, 26 june 1998 à 23h23, TM2SHF-EA5/HB9AFO/P
5.7 GHz	3980 km N6CA-KH6HME	140 km, 23 august 1998 F1JSR (JN36FG, 20W) and F6FAT
2300 MHz	3980 km N6CA-KH6HME	No ATV record registered (ATV at 85,000 meters high 23 November 1996, rocket by KC6CCC Black Rock, Ne. ATV 2417 MHz, power 1W.)
1200 MHz	2617 km G6LEU-EA8XS	602 km, 4 july 1994 at 05h30 UTC
430 MHz	4041 km KC6CCC-KH6HME	4041 km KC6CCC-KH6HME, details unknown

HAMFEST CALENDAR

This section is reserved for upcoming hamfests for as far in advance as we know about them. 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. I maintain some fliers that compile this list so for additional info Email me at towslee@ee.net. This list will be amended as further information becomes available.

January 16 Dial Radio Club, Middletown, OH Hank Greeb, N8XX 6580 Dry Ridge Rd., Cincinnati, OH 45252 513-385-8363
January 17 Nelsonville, OH Russ Ellis, N8MWK 8051 Oregon Ridge, Glouster, OH 45732 740-797-4166
January 24 Tusco ARC, Dover, OH Howard Blind, KD8KF 6288 Echo Lake Rd. NE, New Philadelphia, OH 44663 330-364-5258
February 7 Northern Ohio ARS, Lorain, OH Mike Willemin, W8EU 331 Courtland St., Elyria, OH 44035-3116 440-324-4574
February 14 Mansfield, Ohio, Intercity ARC, Pat Ackerman N8YOB 63 N. Illinois Ave Mansfield, Oh 44905 419-589-7133
February 27-28 Cincinnati, OH William Tittle, KA8LAY 3038 Bracken Woods Ln., Cincinnati, OH 45211-7338 513-661-1861
February 28 Teays ARC, Circleville, OH Roy Ulko, KG8EK 132 West Main St., Circleville, OH 43113-1620 740-477-8310
February 28 Cuyahoga Falls, OH Carl Hervol, N8JLQ 11192 Cottingham Circle NW, Uniontown, OH 44685 330-497-7047
March 14 Conneaut, OH Jack Marttila, KA8TUU 697 Broad St., Conneaut, OH 44030 440-593-3353
March 21 Maumee, OH Brenda Krukowski, KB8IUP PO Box 273, Toledo, OH 43697-0273 419-243-3836
March 28 Madison, OH Roxanne 10418 Briar Hill, Kirtland, OH 44094 440-256-0320
April 25 Athens, OH Drew McDaniel, W8MHV 61 Briarwood Dr., Athens, OH 45701 740-592-2106
May 14-16 Dayton, OH Dick Miller, N8CBU PO Box 964, Dayton, OH 45401-0964 937-427-3109 E-mail: chair@hamvention.org

ATV EQUIPMENT SUPPLIERS

Below is a list of manufacturers of ATV equipment that I have found. There is no endorsement of any of the manufacturers listed below so buyer beware. If I or anyone else that I know of, has had any trouble with a manufacturer, it won't be listed. As I get more info, I'll add manufacturers. Likewise, if I hear of any trouble, it'll be removed. Good luck and keep me advised. WA8RMC

Michael Kohlstadt, KD6UJS
has a limited supply of used but working Pacific Monolithics 2.4ghz downconverters and power supplies which will work fine for viewing the repeater.
Phone: 408-926-0430.

Down East Microwave
Antennas, Power Amplifiers, Deluxe Downconverters, microwave parts.
954 Rt. 519 Frenchtown, NJ 08825
Phone: 908-996-3584
Fax: 908-996-3702

PC Electronics
ATV Transmitters, Receivers
Manufacturer/Reseller
2522 Paxson Ln.
Arcadia, CA 91009-8537
Phone: 626-447-4565
Fax: 626-447-0489
tom@hamtv.com
www.hamtv.com

Phillips-Tech Electronics
MMDS, ITFS downconverters and antenna systems
P.O. Box 8533
Scottsdale, AZ 85252
Phone: 602-947-7700
Fax: 602-947-7799

R. Myers Communications
Good, single unit, source for 2.4GHz dishes
P.O. Box 17108
Fountain Hills, AZ 85269-7108
Phone: 602-837-6492
Fax: 602-837-6872

SHF Microwave Parts Company
10GHz Gunn oscillators and Antennas
7102 W. 500 S.
LA PORTE, INDIANA, 46350
Fax: 219-785-4552

DCI Communications
Interdigital filters and cavities
Box 293, 29 Hummingbird Bay
White City, SK, Canada S0G5B0
Phone: 306-781-4451

ATV Research Inc.
TV cameras & related parts
1301 Broadway PO Box 620
Dakota City, NE 68731-0620
Phone: 402-987-3771
Homepage: www.atvresearch.com
Email: atc@pionet.net

GEKCO Inc
TV test signal circuit boards
PO Box 642
Issaquah, Wa 98027-0642
Phone: 425-392-0638
Email: sales@gekco.com
Homepage: www.gekco.com

M2
Antennas
7560 N. Del Mar Ave.
Fresno, Ca 93711
Phone: 209-432-8873

ATV Quarterly (ATVQ)
ATV magazine publisher
5931 Alma Drive
Rockford, Il. 61108
Phone 815-398-2683
FAX 815-398-2688
Email: atvq@aol.com
http://www.cris.com/~Gharlan

Spectrum International
J-Beams, KVG, Micromodules,VSB filters
John Beanland
Phone:978-263-2145.
Email: Spectrum@ma.ultranet.com

A.C. Radio Supply Company
1539 W. Passyunk Avenue
Philadelphia, PA 19145
(215)462-9379
Electronic Parts

Allied Electronics
7410 Pebble Drive
Fort Worth, TX 76118
(800)433-5700
http://www.allied.avnet.com
Electronic Parts House

Amateur & Advanced Communications
3208 Concord Pike Route 202
Wilmington, DE 19803
(302)478-2757 Voice
Battery Network
P.O. Box 5389
Somerville, NJ 08876
(800)653-8294 Voice
(908)534-1792 Fax
Batteries

Bill Barrick Surplus
13 Lafayette Drive
Phoenixville, PA 19460
(215)933-0369 Voice
Electronic Surplus

Black Box
1000 Park Drive
Lawrence, PA 15055-1018
(800)552-6816 Voice
(800)321-0746 Fax
Email: info@blackbox.com
http://www.blackbox.com
Electronic Connections

Brants Electronics
200 Central Avenue
Cheltenham, PA 19012
(215)663-8694
Electronic Parts

Cable X-Perts
416 Diens Drive
Wheeling, IL 60090
(800)828-3340 Voice
(847)520-3444 Fax
http://www.cablexperts.com
Wire and Cable

CCI Communications Concepts, Inc.
508 Millstone Drive
Beavercreek, OH 45434-5840
(937)426-8600 Voice
(937)429-3811 Fax
Email: cci.dayton@pobox.com

Denver Amateur Radio Supply
1233 N. Reading Road
Stevens, PA 17578
(800)891-9199 Voice
(717)336-6060 Voice
http://www.denverradio.com
Amateur Radio Equipment

Directive Systems
RR#1 Box 282 Dixon Road
Lebanon, ME 04027
(207)658-7758 Voice
(207)658-4337 Fax
Antennas

Eagle1 Communications
2106 Rome Drive
Martinsburg, WV 25401
(304)264-9069
Tubes

E. H. Yost & Company
2211-D Parview Road
Middleton, WI 53562
(608)831-3443 Voice
(608)831-1082 Fax
Email: ehyost@midplains.net
Battries

Fair Radio Sales
1016 E. Eureka P.O. Box 1105
Lima, OH 45802
(419)227-6573 Voice
(419)227-1313 Fax
Email: fairadio@wcoil.com
http://alpha.wcoil/~fairradio
Electronic Surplus Equipment

Fertik's Electronics
5400 Ella Street
Philadelphia, PA 19120
(215)455-2121
Electronic Surplus

Future-Active Electronics
41 Main Street
Bolton, MA 01740
(800)655-0006 Voice
(800)645-2953 Fax
Electronic Parts House

G and G Electronics
8524 Dakota Drive
Gaithersburg, MD 20877
(301)258-7373 Voice
(301)977-5378 Fax
Email: k3dua@erols.com

Ham-Buerger Radio
417 Davisville Road
Willow Grove, PA 19090
(215)659-5900
Amateur Radio Store

Ham Radio Outlet
1509 N. Dupont Highway
New Castle, DE 19720
(800)644-4476 Voice
(302)322-7092 Voice
Amateur Radio Store

HBF Electronics, Inc.
6900 New State Road
Philadelphia, PA 19135
(800)426-4230 Voice
(215)338-1100 Voice
(215)338-2840 Fax
Electronic Parts House

Herbach and Rademan
16 Roland Avenue
Mount Laurel, NJ 08054-1012
(800)848-8001 Voice
(609)802-0465 Fax
Email: sales@herbach.com
http://www.herbach.com
Electronic & mechanical Surplus

Hosfelt Electronics Inc.
2700 Sunset Boulevard
Steubenville, OH 43952-1158
(800)524-6464 Voice
(800)524-5414 Fax

Jem Electronics
5401 Oxford Avenue
Philadelphia, PA 19124
(215)743-3030
Electronic Parts

Jameco Electronic Components
1355 Shoreway Road
Belmont, CA 94002-4100
(800)831-4242 Voice
Email: infor@jameco.com
http://www.jameco.com
Electronic Parts

Jensen Tools Inc.
7815 S. 46th Street
Phoenix, AZ 85044-5399
(800)426-1194 Voice
(800)366-9662 Fax
http://www.jensentools.com

Mat Electronics
400 Pike Road
Huntingdon Valley, PA
19006-1610
(800)628-1118 Voice
(800)628-1005 Fax
Email:
sales@matelectronics.com
http://www.matelectronics.com
Radio & TV Parts House

MCM Electronics
650 Congress Park Drive
Centerville, OH 45459
(800)543-4330 Voice
(800)765-6960 Fax
http://www.mcmelectronics.com

Mouser Electronics
958 North Main Street
Mansfield, TX 76063-4827
(800)346-6873 Voice
(817)483-0931 Fax
Email: sales@mouser.com
http://www.mouser.com
Electronics Parts House

Nemail Electronics, Inc.
12240 N.E. 14th Avenue
North Miamo, FL 33161
(800)522-2253 Voice
(305)899-0900 Voice
(305)895-8178 Fax
Email: info@nemal.com
http://www.nemal.com
RF Connectors

Pauldon Associates
210 Utica Street
Tonawanda, NY 14150
(716)692-5451 Voice
ATV Receivers and
Transmitters

Peak Electronics
354-56 W. Lancaster Avenue
Wayne, PA
(610)293-9000
Electronic Parts

Sauder Electronics
261 Mountain Drive
Fredericksburg, PA 17026

(717)865-5001 Voice
(717)865-9470 Fax
Email: sauder@leba.net
Surplus Electronics

S & G Electronics
618 S. 62nd Street
Philadelphia, PA 19143
(215)474-7663
Electronic Surplus

Surplus Al
P.O. Box 215
Hunlock Creek, PA 18621-0215
(717)256-3749 Voice
Surplus Electronic Parts

Surplus Sales of Nebraska
1502 Jones Street
Omaha, NE 68102
(800)244-4567 Voice
(402)346-2939 Fax
Email: grinnell@surplussales.com
http://www.surplusales.com
Electronic Parts

Tech America
P.O. Box 1981
Fort Worth, TX 76101-1981
(800)877-0072 Voice
(800)813-0087 Fax
http://www.techam.com
Electronic Parts House

Techni-Tool
5 Apolio Road P.O. Box 368
Plymouth Meeting, PA 19462-0368
(800)832-4866 Voice
(610)828-5623 Fax
Email: sales@techni-tool.com
http://www.techni-tool.com
Tools

TE Systems
P.O. Box 25845
Los Angeles, CA 90025
(310)478-0591 Voice
(310)473-4038 Fax
RF Power Amplifiers

Tessco Electronics
34 Loveton Circle
P.O. Box 5100
Sparks, MD 21152-5100
(800)472-7373 Voice
(410)472-7575 Fax
http://www.tessco.com
Test Equipment-Antennas-Etc

The R.F. Connection
213 N. Frederick Avenue Suite 11
Gaithersburg, MD 20877
(301)840-5477 Voice
(301)869-3680 Fax
Email: rfc@therfc.com
RF Connectors and Coax

The Wireman, Inc.
261 Pittman Road
Landrum, SC 29356
(800)727-9473
(864)895-4195
Wire and Cable

Trevose Electronics, Inc.
4033 Brownsville Road
Trevose, PA 19053
(215)357-1400 Voice
(215)355-8958 Fax
Amateur Radio Store

TX RX Systems, Inc.
8625 Industrial Parkway
Angola, NY 14006
(716)549-4700 Voice
(716)549-4772 Fax
Duplexers and Filters

Typetronics
P.O. Box 8873
Fort Lauderdale, FL 33310-8873
(954)583-1340 Voice
(954)583-0777 Fax
Vacuum Tubes

Universal Electronic Supply Company
127 - 129 White Horse Pike
Audubon, NJ 08196
(800)327-3528 Voice
Electronic Parts House

Webster Communications, Inc.
115 Bellarmine
Rochester, MI 48309
(800)521-2333 Voice
(810)375-0121 Fax
Electronic Parts

W & W Associates
800 South Broadway
Hicksville, NY 11801-5017
(800)221-0732 Voice
(516)942-1944 Fax
Email: w-wassoc@ix.netcom.com
http://www.wwassociates.com

INTERNET INFO

If you have access to the INTERNET, you may be interested to know of some of the HAM related information that is available. Most addresses listed below are case sensitive, so type exactly as shown. (for comments or additional listings contact me at towslee@ee.net).

http://psycho.psy.ohio-state.edu/atco	Ohio, Columbus, ATCO ATV home page.
http://www.radio-amateurs.com	Ohio, Dayton ATV group
http://fly.hiwaay.net/~bbrown/index.htm	Alabama, Huntsville,Tennessee Valley ATV (Bill Brown WB8ELK)
http://www.ipass.net/~teara/atv4.html	Arizona ATV 2.4Ghz Wavecom page
http://hayden.edu/Guests/AATV/index.html	Arizona, Phoenix Amateurs - AATV
http://www.citynight.com/atv	California, San Francisco ATV
http://www.ladas.com/ATN	California, **A**mateur **T**elevision **N**etwork in Central / Southern
http://w6yx.stanford.edu/~stevem/atv	California, South Bay ATV Group Stanford University
http://www.qsl.net/wb6izg	California, southern ATV Sights and Sounds
http://home1.gte/k4lk	Florida, Tampa Bay ATV Society (TBATS)
http://www.mindspring.com/~rwf/aatn1.html	Georgia, Atlanta ATV
http://ww2.netnitco.net/users/stealth/kens.htm	Indiana KB9I homepage
http://www.mychoice.net/fminton/silatvg.htm	Illinois, Southern, Amateur Television group
http://www.premiernet.net/~hcantrl/	Kentucky, Bowling Green (CKATS)
http://scott-inc.com/wb9neq.htm	Kentucky, Airborn ATV from WB9NEQ in Bowling Green
http://www.smart.net/~brats	Maryland**,** Baltimore Radio Amateur Television Society (BRATS)
http://www.murphysoftware.com/dats	Michigan, Detroit DATS ATV
http://www.njin.net/~magliaco/atv.html	New Jersey, Brookdale ARC in Lincroft
http://www.qsl.net/~no3y	New Mexico, Farmingham
http://www.intercenter.net/triatv/atv-web.htm	N. Carolina, Raleigh.Triangle ATV club
http://www.navicom.com/~satva/satvainf.htm	Oregon, Silverton, Salem ATV Assoc (SATVA)
http://www.lloydio.com/oatva.html	Oregon, Portland ATV (OATVA)
http://www.webczar.com/atv	Oklahoma, Tulsa Amateur TV (TARC)
http://members.aol.com/n3kkm/w3hzu.html	Pennsylvania, York Keystone VHF Club
http:www.usaor.net/users/ka3fzf/index.htm	Pennsylvania, Pittsburg Amateur Television in Pittsburg
http://www.voicenet.com/~theojkat/w3phl.html	Pennsylvania, Phila. Area ATV
http://www.geocities.com/Hollywood/5842	Tennessee, East ATV
http://www.stevens.com/HATS/home.html	Texas, Houston ATV
http://uugate.ampr.utah.edu/utah_atv/utah_atv.html	Utah ATV
http://www.bchfs.org/metrovision/atv.htm	Virginia, Alexandria
http://www.qsl.net/w7twu	Washington, Western Washington Television Society (WWATS)
http://www.ecn.net.au/~sbloxham/index.html	Australia, ATV, VK4GY (large list of other ATV & ham radio sites)
http://ourworld.compuserve.com/homepages/batc	British ATV club (BATC)
http://www.sfn.saskatoon.sk.ca/recreation/hamburg/hamatv.html	Saskatoon, Canada ATV
http://www.gpfn.sk.ca/hobbies/rara/atv3.html	Regina, Canada ATV
http://www.inside.co.uk/scart.htm	UK,Great Britain ATV (SCART)
http://www.cmo.ch/swissatv	Swiss ATV

The following addresses are helpful in searching for many different Ham Radio items on the INTERNET.

http://www.stevens.com/atvq	ATVQ Magazine home page. ATV equipment & article references.
http://www.hamtv.com	PC Electronics Inc. Lots of proven ATV equipment for sale.
http://downeastmicrowave.com	Down East Microwave Inc. Lots of uhf/microwave parts & modules.
http://www.yahoo.com/Entertainment/television/Amateur_television	Listing of some of the available ATV home pages.
http:/www.acs.ncsu.edu/HamRadio	General ham radio info- satellite track, call sign database etc.
http://www.arrl.org/hamfests.html	Current yearly hamfest directory.
http://amsat.org	AMSAT satellite directory/home page.
http://www.arrl.org	ARRL home page
http://www.ualr.edu/doc/hamualr/callsign.html	Search by call sign or name.

http://hamradio-online.com	Ham Radio Online “newsletter” Lot of Ham related information.
http://www.smart.net/~brats/atna.html	ATNA homepage
http://www.ham-links.org	Ham Radio collection database

ATCO REPEATER TECHNICAL DATA SUMMARY

This space of each publication includes the technical information of our repeater. Each time a new feature is brought on line it's added here. Use this as a quick reference for up/down access codes as well as some of the more important parameters of our system.

Main repeater: Location: Downtown Columbus, Ohio

Coordinates: 82 degrees 59 minutes 53 seconds (longitude)
39 degrees 57 minutes 45 seconds (latitude)

Elevation: 630 feet above average street level
1460 feet above sea level

Transmitters: 427.25 MHz AM modulation, 1250 MHz FM modulation and 2433 MHz FM modulation.
interdigital filters in output line of 427.25 & 1250 transmitters
Transmitter Output Power - 40 watts average 80 watts sync tip (427.25)
50 watts continuous (1250)
8 watts continuous (2433)
Link transmitter - 1 watt NFM 5 kHz audio (446.350 MHz)

Identification The 427, 1250 and 2433 transmitters identify simultaneously every 10 minutes with video showing ATCO and WA8RUT with four different screens. Audio identification is 4 sequences of Morse Code.

Transmit antennas: 427.25 MHz - Dual slot horizontally polarized 7 dBd gain major lobe west
1250 MHz - Diamond vertically polarized 12 dBd gain omni
2433 MHz - Comet vertically polarized 12 dBd gain omni

Receivers: 147.45 MHz for F1 audio input control of touch tones
439.25 MHz for A5 video input with FM subcarrier audio (lower sideband)
915 MHz for F5 video link data from remote sites
1280 MHz for F5 video input
2411 MHz for F5 video input

Receive antennas: 147.45 MHz - Vert. polar. Hi Gain "Comet" 12 dBd (also for 446 MHz output)
439.25 MHz - Horiz. polar. dual slot 8 dBd gain major lobe west
915 MHz - Vert. polar. dB Products 10 dBd gain
1280 MHz - Horiz. polar. single slot 3 dBd gain major lobe west.
2411 MHz - Comet vertically polarized 12 dBd gain omni

Input control: Major Touch tones:

	UP	DOWN
beacon (5 min)	*439	#
regional weather radar	697	#
**Local radar(5 min)	264	#
User repeat 1 minute	*45	*22
Touch tone pad tester	#0	#5
Manual mode (ID)	*77 90	*22
(910 input)	*77 91	*22
(439 input)	*77 92	*22
(1280 input)	*77 93	*22
(cabinet cam)	*77 94	*22
5 second ID	#9	*22
Bulletin board	285 pause 92	286
Roof Camera	285 pause 95	286
Reset to scan mode	D37 or #437	

Remote sites: **Local radar (inactive at this time) (915 MHz link output 8 watts)
Aux link at WA8RUT QTH (915 MHz link output 1 watt)
Aux link at WB8CJW QTH (915 MHz link output 1 watt)

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 $10.00 per person payable on January 1 of each year. Additional members within an immediate family and at the same address are included at no extra cost.

ATCO publishes the ATCO newsletter quarterly in January, April, July, and October. The newsletter is sent to each member without additional cost.

The membership period is from January 1ST to December 31ST. New Members will receive all ATCO newsletters published during the current year prior to the date they join ATCO. For example, a new member joining in June will receive the January and April issues in addition to the July and October issues. Your support of ATCO is welcomed and encouraged.

ATCO CLUB OFFICERS

President:	Art Towslee WA8RMC	Repeater trustees:	Art Towslee WA8RMC
V.President:	Ken Morris WA8RUT		Ken Morris WA8RUT
Treasurer:	Bob Tournoux KF8QU		Dale Elshoff WB8CJW
Secretary:	Rick White WA3DTO	Statutory agent:	Rick White WA3DTO
Corporate trustees:	Same as officers	Newsletter editor:	Art Towslee WA8RMC

ATCO MEMBERSHIP APPLICATION

RENEWAL O NEW MEMBER O DATE _____ CALL _____

OK TO PUBLISH PHONE # IN NEWSLETTER YES O NO O 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 O MONEY ORDER O

Make check payable to ATCO or Bob Tournoux & mail to: Bob Tournoux KF8QU 3569 Oarlock CT Hilliard, Ohio 43026

TUESDAY NITE NET ON 147.45 MHz SIMPLEX

Every Tuesday night @ 9:00PM 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 would like to 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. Then a second round follows with periodic checks for late check-ins. We rarely chat for more than one hour so please join us if you can.

ATCO TREASURER'S REPORT - de KF8QU

OPENING BALANCE (10/10/98).....	$ 585.76
RECEIPTS (dues).....	$ 150.00
OTHER INCOME (bank interest).....	$ 2.69
DONATIONS TO REPEATER FUND.....	$ 45.00
EXPENDITURES	
(Fall Event Food).....	$ 96.59
(Postage for October Newsletter).....	$ 41.25

CLOSING BALANCE (01/10/99).....$645.61

ATCO MEMBERS AS OF 10 JANUARY 1999

K8AEH	Wilbur Wollerman	1672 Rosehill Road	Reynoldsburg	Oh	43068	614-866-1399	wilbur.w@juno.com
KC8ASD	Bud Nichols	3200 Walker Rd	Hilliard	Oh	43026	614-876-6135	
WB4BBF	Randall Hash	212 Long Street	Bluefield	Va	24605		
W4/F5BJV	Marcel Pitzini	443 Eastland Drive	Decatur	Ga	30030	404-378-2772	
KC8BNI	Fred Stutske	8737 Ashford Lane	Pickerington	Oh	43147		kc8bni@amsat.org
KC8CNV	Jack Compson	5065 Sharon Hill Dr	Columbus	Oh	43235	451-4054	kc8cnv@ee.net
WB8CJW	Dale Elshoff	8904 Winoak Pl	Powell	Oh	43065	766-5823	dale.elshoff@usiny.mail.abb.com
WA8DNI	John Busic	2700 Bixby Road	Groveport	Oh	43125	491-8198	wa8dni@juno.com
K8DW	Dave Wagner	2045 Maginnis Rd	Oregon	Oh	42616	419- 691-1625	
WA4DFS	Ed Walker	PO Box 150	Mountain City	Tn	37683	423- 727-9611	ebwalker@preferred.com
WA3DTO	Rick White	5314 Grosbeak Glen	Orient	Oh	43146	877-0652	wa3dto@aol.com
WB8DZW	Roger McEldowney	5420 Madison St	Hilliard	Oh	43026	876-6033	wb8dzw@aol.com
KB8EAA,KB8VBF	Rick, Judy Hesket	6261 Maple Canyon Dr	Columbus	Oh	43229	891-3887	rjheskett1@worldnet.att.net
W8EHW	Foster Warren	P.O. Box #32	No. Hampton	Oh	45349		
KB8FF	Dave Tkach	2063 Torchwood Loop S	Columbus	Oh	43229	882-0771	tkack@copper.net
KS4GL	John Barnes	216 Hillsboro Ave	Lexington	Ky	40511	606-253-1178	ks4gl@juno.com
K8GCS	Harry Covault	4820 Archmore Dr	Kettering	Oh	45440	937- 434-5412	k8gcs@megsinet.net
W8GUC	Reuben Meeks	428 Lewiston Road	Kettering	Oh	45429	937- 294-0575	rmeeksjr@megsinet.net
KA8HAK	Jim Reese	1106 Tonawanda Ave	Akron	Oh	44305		
WA8HFK,KC8HIP	Frank, Pat Amore	3630 Dayspring Dr	Hilliard	Oh	43026	777-4621	
W8JND	Richard Knowles	573 Plaza Drive	Circleville	Oh	43113	477-8132	
N8KQN	Ted Post	1267 Richter Rd	Columbus	Oh	43223	276-1820	n8kqn@juno.com
WA8KQQ	Dale Waymire	225 Riffle Ave	Greenville	Oh	45331	513- 548-2492	
N8LRG	Phillip Humphries	3226 Deerpath Drive	Grove City	Oh	43123	614- 871-0751	phumphries@iwaynet.net
KA8MID	Bill Dean	2630 Green Ridge Rd	Peebles	Oh	45660		deanfam@bright.net
KB8MDE	Shaun Miller	5061 County Rd 123	Mt Gilead	Oh	43338	419- 768-2588	kb8mde@bright.net
K8MZH	Leland Hubbell	7706 Green Mill Road	Johnstown	Oh	43031	967-8412	
WD8OBT,KB8ESR,KA8ZPE	Tom Camm & sons	1634 Dundee Court	Columbus	Oh	43227	860-9807	
N8OCQ	Robert Hodge	3689 Hollowcrest	Columbus	Oh	43223	875-7067	
N8OOA	Jeff Clark	9894 Fincastle-Winchester	Sardinia	Oh	45171	937- 695-1229	
N8OPB	Chris Huhn	146 South Hague Ave	Columbus	Oh	43204	279-7577	
WB8OTH	Perry Yantis	1850 Lisle Ave	Obetz	Oh	43207	491-1498	pyantis@compuserve.com
WA2PCH	Craig Stoll	PO Box 1117	Orchard Park	Ny	14127		
KE8PN	James Easley	1507 Michigan Ave	Columbus	Oh	43201	421-1492	jeasly@ee.net
W8PGP,WD8BGG	Richard, Roger Burggraf	5701 Winchester So. Rd	Stoutsville	Oh	43154	614- 474-3884	
KF8QU	Bob Tournoux	3569 Oarlock Ct	Hilliard	Oh	43026	876-2127	rtournou@columbus.rr.com
WA8RMC	Art Towslee	180 Fairdale Ave	Westerville	Oh	43081	891-9273	towslee@ee.net
WA8RUT,N8KCB	Ken & Chris Morris	3181 Gerbert Rd	Columbus	Oh	43224	261-8583	wa8rut@aol.com
W8RVH	Richard Goode	9391 Ballentine Rd	New Carlisle	Oh	45334	513- 964-1185	w8rvh@glasscity.net
WD8RXX	John Perone	3477 Africa Road	Galena	Oh	43021		
WA8SAR	Gary Obee	3691 Chamberlain	Lambertville	Mi	48144		
N8SFC	Larry Campbell	316 Eastcreek Dr	Galloway	Oh	43119	851-0223	larry@psycho.psy.ohio-state.edu
WA8SJV	John Beal	2899 Castlebrook Ave	Columbus	Oh	43026	876-9412	
W8STB	John Hey & family	894 Cherry Blossom Dr	West Carrolton	Oh	45449	937- 859-5295	w8stb@juno.com
K8STV	Jim Carpenter	823 Quailwood Dr	Mason	Oh	45040		
N8TBU	Ed Latham	8399 Fairbrook Ave	Galloway	Oh	43119		
KB8TRP,KB8TCF	Tom, Ed Flanagan	1751 N. Eastfield Dr	Columbus	Oh	43223	272-5784	ed.flanagan@ohcolu.ang.af.mil
WA8TTE	Phil Morrison	154 Llewellyn Ave	Westerville	Oh	43081		
KB8UGH	Steve Caruso	39 South Garfield Ave	Columbus	Oh	43205	461- 5397	scaruso@freenet.columbus.oh.us
WB8URI	William Heiden	5898 Township Rd #103	Mount Gilead	Oh	43338	419- 947-1121	
KB8UU	Bill Rose	9250 Roberts Road	West Jefferson	Oh	43162	879-7482	
WB8VJD	Rick Morris	203 Merton Street	Holland	Oh	43528		
KA8VUQ	Jack Wolff	2682 Hiawatha Ave	Columbus	Oh	43212	263-3092	
W8WAU	Jake Fuller	PO Box 117	No. Hampton	Oh	45349		
N8WLT	James Neymeyer	2879 East Moreland Drive	Columbus	Oh	43209	237-2331	
KB8WBK	David Hunter	45 Sheppard Dr	Pataskala	Oh	43062	740- 927-3883	dhunter147@aol.com
N8XYJ	Dan Baughman	4269 Hanging Rock Ct	Gahanna	Oh	43230	471-1089	
KB8YIO	Ric Wise	1465 25th Ave	Columbus	Oh	43211	291-6508	rwise@columbus.rr.com
KB8YMN	Mark Griggs	2160 Autumn Place	Columbus	Oh	43223	272-8266	mmgriggs@aol.com
KB8YMQ	Jay Caldwell	4740 Timmons Dr	Plain City	Oh	43064		
KB8ZLB	Dave Kibler	243 Dwyer Rd	Greenfield	Oh	45123	937- 981-4007	k154@bright.net
KA8ZNY,N8OOY	Tom & Cheryl Taft	386 Cherry Street	Groveport	Oh	43125	836-3519	ka8zny@copper.net

ATCO Newsletter
c/o Art Towslee-WA8RMC
180 Fairdale Ave
Westerville, Ohio 43081

FIRST CLASS MAIL

REMEMBER...CLUB DUES ARE NEEDED.
CHECK MAILING LABEL FOR THE EXPIRATION DATE AND SEND KF8QU A CHECK IF EXPIRED.