The MINUTEMAN

Official Newsletter *of the* Minuteman Repeater Association

The President's Corner

Our Test Equipment raffle is underway; the response from members who have sold or bought tickets is encouraging so far! Talk it up among your fellow hams. Tickets are available through the club secretary, Frank, KB1FZ. Just drop him a line at the MMRA mailing address and he'll send tickets. Remember also that HRO up in Salem, New Hampshire has tickets; see the add on the back page of this newsletter.

Once we have the funds and get a good service monitor, we intend to share the benefit derived. If another repeater organization is experiencing technical problems that the monitor would help them solve, we will make arrangements to help them out. If an appointment convenient to one of MMRA tech group members who has become qualified to take and use the monitor can be made, we'll help other repeater tech crews. Doing this will be in the best interests of the hobby; quality of operation is critical to keeping our VHF and UHF spectrum clear of interference.

To get a feel for what is involved in maintaining the various components of our repeater systems, take a look at the article on repeaters. If you are not already familiar with all the aspects of a repeater, you may end up with a better idea of what it takes to do it right, and the extent of the job when you have 8 of 'em to keep playing. It's the reason that getting that service monitor is so important to us.

If you spend much time listening to the repeaters, you are beginning to hear a lot of new calls...the No- code licensing program has begun adding to our ranks. As I've listened to a few of the newcomers, I have heard them commenting about being chastised by more experienced hams for a variety of reasons. Most seem to relate to instances where a new ham has done or said something that the experienced guy believes to be unacceptable practice. I have had questions about proper protocol on repeaters that were prompted by what may have been unecessarily harsh criticism.

When you overhear a newcomer doing

Continued on Page 2.....

Items of Interest.....

More On 220.....

The ARRL has begun working to improve our access to the 222-225 Mhz band. A petition has been started to eliminate restrictions for Novices on 220, and to reinstate a weak signal segment in the low end of the band. Also, the League continues to work for access to the 216-220 band on a shared basis.

ISM Equipment Interference....

The FCC has issued a Notice Of Inquiry concerning interference from industrial, medical and scientific equipment. This type of equipment uses RF energy for purposes other than communications; various types of RF heating devices, including domestic microwave ovens fit into this category. The purpose of the inquiry is to determine if FCC rules should be made to conform more with international standards for this type of equipment. Part 18 of the FCC Rules govern in this area; 11 frequency bands are allocated for ISM equipment. The Docket Number is ET 91-313; 15 questions are asked. This could have some interest for us; we should respond.

Scanners In New Jersey.....

Remember than New Jersey scanner law that made it a crime to have a scanner in your car? The New Jersey Senate has already passed an amendment that makes it an offense to "abet a crime" using a scanner; the NJ Assembly Committee on the Judiciary and the Law has favorable reported on the same amendment, and will be sending it to the floor of the Assembly. This is a good precedent; hopefully other states with similar restrictions will follow suit.

Continued on Page 2.....

The President's Corner... Continued

something that grates on you, stop and think before you chastise. Remember that we were all new once, and that the major difference between a new codeless Technician class licensee and yourself at the same point in your ham career is that you had passed a 5 word per minute code test. You may now know a lot more about the technology than the newcomer does...but how much more did you know when you had just passed your Technician/General theory test? Unless you were already somehow involved in communications at that point, probably not much.

Remember how hesitant and embarrassed you might have felt on occasion, and if you yourself got brought up short by someone, ask yourself: Did I feel a bit of resentment?

The last thing we need is to develop an "us and them" environment. If the hobby is to flourish, new hams should be made welcome; they will learn by listening and doing as did we all. Part of the MMRA's attempt to make the new people welcome is the Technical Net on the first Monday of each month. It will provide a time for people to get questions answered on technical and procedural matters. More importantly, it should help the new people and the rest of us to get acquainted.

We should all work to keep that sense of community that makes the amateur radio hobby cut so effectively across societal lines; our common interest in communications and the related technologies is the bond that we must work to maintain.

At the January meeting we will have Sharon Gartenberg as our guest speaker. She is going to talk about amateur radio in Russia...events of the recent past make this a fascinating subject. The future of Amateur Radio there should be bright; the hobby has already played a role in bringing freedom to Russia. So come to the meeting - it should be fun.

Due to circumstances beyond his control, Denley Karlson will be unable to work on setting up a series of training courses and exam schedules for the MMRA. We need someone to take his place; we do not want to drop the idea. So if you are interested in taking on the job or organizing an education and testing program for the MMRA, come to a board meeting or contact one of the officers or board members.

We are also looking for people to help organize a field day operation; if you are interested, let us know.

I'd like to wish our members a happy and prosperous New-Year; let's work to make it a good one for the MMRA.

Items of Interest.... Continued

Re Business Communications...

It looks like something is finally going to happen with respect to the FCC's rules about "Business Communications" on the Amateur Bands. Recent discussions between the ARRL and Private Radio Bureau Chief Ralph Haller, N4RH, would seem to indicate that two things will happen: first, Part 97.113 is going to get revised to make the FCC position much clearer. Second, it seems likely that we will be given greater lattitude in what we can do. There will still be strong prohibitions of communications for hire, communications in which a control operator has some commercial interest and communications for one's employer. The MMRA has a long history of support for public service events; often there has been controversy over what we can do to support some activity. The phrase in the rules that has always made it tough goes something like "communications in support of the normal course of operations..." What to do with that has been a key problem. What we can hope for is clarification on points like handling messages that assist the running of some event but are not directly related to public safety or health and welfare. If the FCC issues an NOI or NPRM, let's jump on it and let the Commission know what we think. With luck, it won't be too long before an opportunity like that comes up.

So Far we have 297 paid up renewals as of this printing....don't forget to send in your 1991-1992 dues! There still 112 of you who haven't gotten around to it. We hope for your continued support! *Renew Now!*

MMRA Test Equipment Raffle

We need Test Equipment...specifically, a good service monitor. So we are putting on a raffle to raise enough money to get one....If we are successful, an IFR 1200 with spectrum analyzer and sweep tracking signal generator is the most likely candidate. Not only will this give us a tool to do a better job of maintaining our repeaters, we will be able to hold VHF/UHF tranceiver clinics – when we did this a couple of years ago, it was very well attended, and a lot of people asked us when we plan to do it again. So here's the deal:

Grand Prize: $1000 Gift Certificate at HRO
Second Prize: Uniden 10 Meter Rig
Third Prizes: 4 Metz Mag Mount Antennas

Drawing: MMRA Membership Meeting, March 9, 1992

MMRA Officers, Trustees, Directors and their family members not eligible. Winners will be notified by Registered Mail.

Tickets: $1.00 Each, $10 for book of 11

Be sure you fill in the requested information on ticket stubs...it must be there for you to win a prize.

Additional Prizes: $50 Each to the MMRA member selling the winning ticket, and sells the most tickets.

January MMRA Meeting: Sharon Gartenberg, KC1YR, will give a talk on Ham Radio in Russia. Meeting starts at 7:30 PM at the Campion Center, Weston, MA. Raffle: Metz Mag Mount. You can pick up more raffle tickets to sell...see you there!

Flea Market - Sunday, March 22, 1992

The South Shore Amateur Radio Club of Braintree, MA will hold its annual indoor flea market at the Viking Club, 410 Quincy Av, Braintree, MA from 10:30 AM to 3:00 PM. 8 Foot tables: $12:00 if paid in advance by March 18, 1992. One Free Admission is included. Price is $14.00 at the door. No refunds after March 18. Send pre-payment to:

Thaire Bryant, KA1MJR, 81 Saning Rd, N. Weymouth, MA 02191
Make checks payable to: South Shore Amateur Radio Club

For Info, call: (617) 331-3673

Repeaters.... In which an attempt at explaining them is made.

A lot of us might not be very familiar with repeaters and how they work. Certainly the newcomers to ranks of Amateur Radio are not likely to know just what makes a repeater tick. So here's a simplified description of how repeaters work.

To have a relay system that repeats on one frequency what is being received on another frequency is the essence of repeater operation. That means that a transmitter and a receiver have to be working at the same time, and linked together so that when the receiver senses a signal on the frequency it is tuned to, the transmitter is turned on, and the audio from the receiver is fed into the transmitter. The transmitter sends on a frequency well away from that the receiver is tuned to.

To make this work, the receiver must provide some kind of indication that it is receiving a signal that is to be repeated. This is done by giving the receiver an output that has no voltage (or a low logic level) when the receiver is squelched, and some positive voltage when the squelch is opened by an incoming signal. That output voltage can be used to operate a relay that turns on the transmitter and connects the receiver audio output to the transmitter audio input. The common term used for that relay is "COR" - Carrier Operated Relay.

But because of FCC requirements you need more than just COR - you need to send an Identifier every 10 minutes; there must be a timer that will track an incoming signal and drop the transmitter if that signal lasts too long. Repeater users have gotten used to having a telephone interconnect capability - autopatch.

In the early days of repeaters, all this was difficult to implement. If you were at the last MMRA meeting you would have seen some slides of some of the original MMRA repeaters, with things like motor driven drum ID systems. Today this is all done with repeater controllers driven by microprocessors. The computer monitors the status of all repeater system components, decodes and executes commands from users and control operators. It controls the autopatch function, keeps track of time and performs functions that are time driven, like identifying and timeouts.

Advanced repeater controllers can even monitor system operation and give information via morse code or synthesized voice such as power levels, incoming signal frequency error and deviation, and various alarms.

The most basic connections are receiver COS (Carrier Operated Squelch) and transmitter COR. COS is the signal from the receiver that indicates to the microprocessor that a signal is present; COR is the output from the controller that turns on the transmitter. Receive audio is piped into the controller, and transmit audio is fed from the controller to the transmitter.

On some repeaters, because various sources of interference cause a simple COS based system to sense signal that would make the repeater activate falsely, CTCSS (Continuous Tone Coded Squelch System - also known as "PL" - Private Line) is used. If the incoming signal does not have a sub- audible tone in the range of 67 to 254.1 cycles, the microprocessor will not activate the transmitter. The tone to be used is programmable; repeater users must have transmitters that will superimpose the desired tone on the output carrier.

Our Marlboro and Weston 2 meter repeaters, as well as the Weston 220 machine have controllers that were conceived and designed by Bob Clements, K1BC. These controllers are based on the Z80 microprocessor; Bob wrote the program that executes on the processor, monitoring and controlling repeater functions. These controllers have been outstanding - we have not experienced a single failure in any of these controllers in the last 8 years.

Three of our controllers are S- COM Industries devices; two are 5-K models, one is a 7-K. The 5-K's are in use on the Quincy and Hopkinton 220 machines, the 7-K is on the Marlboro 440 machine, the hub node of the MMRA network. These controllers all offer the ability to actually create programs using DTMF over the air or telephone that combine various repeater control commands into a group that can be executed with one command - a "Macro." For example, one 4 digit DTMF command could be set up to make the repeater ID in voice, play an announcment in voice and send the time and date in morse. The controller can be programmed to execute a series of commands when a logic input level changes; some of those commands could turn on or off logic outputs that can be used to control external things - such as turning on or off an amplifier, tape recorder or the like.

The 7-K controller can control the operation of several repeaters or crosslink radios. At the 440 site, we have a commercial low band rig modified to operate on 6 meters; by DTMF

Continued on Page 5

Repeaters.... Continued.

commands, we can control the frequencies the 6 meter rig is tuned to. This setup is the means by which we link our network to World Net.

The transmitter that is part of the repeater package has a low level of output. and is often referred to as the "exciter." This is because the real workhorse is an amplifier that takes the exciter power output up to 100 - 200 watts. At Weston, we have two amplifiers, both homebuilt. One uses 2 4-CX250B tubes, the other amplifier uses a single 4-CX250B. At Marlboro, '61 has a similar 2 tube amp and a solid state amp that develops about 80 watts.

Another key aspect of operating a repeater is isolation. If you have a receiver and transmitter operating at the same time on two frequencies 600 KHz apart, the receiver is going to be overpowered by the presence of a strong signal saturating its front end RF amplifier stages. Some means of isolating the receiver RF input from the presence of a strong signal 600 Khz away must be provided. Antenna diversity is one way to do it; the receiver and transmitter use separate antennas, physically separated by enough distance to make the transmitter's signal weak enough at the receiver antenna so as not to desense it. This makes repeater siting a problem. So a way to make the receiver and transmitter use the same antenna was devised: the Duplexer.

You may have heard duplexers referred to as a set of "cans." That's exactly what they look like; in our repeater systems we use a set of 6 high Q cavity filters. For 2 meter operation, each is a cylinder about 22 inches deep and a little over 4 inches in diameter. These dimensions, along with the configuration of internal components result in a combination pass/notch filter that will give isolation for a 600 Khz spread of 35 Db.

Up at Weston, for example, 3 of the cans are between the receiver and antenna. These pass 146.22 and notch 146.82. The other three are on the transmitter output; they pass 146.82 and notch 146.22. The total isolation between transmitter and receiver is about 100 Db, even though they are both connected to the same antenna.

Properly tuned duplexers are a key element in good receive sensitivity - the most selective and sensitive receiver will go belly up if the cans are out of tune, allowing too much of the transmitter's RF output to get into the receiver front end. Keeping duplexers tuned is one of the things we need a good service monitor for. A spectrum analyzer with a sweep tracking signal generator is an absolute necessity for precise tuning of a set of cans.

To get the transmit signal out and the received signal in, the antenna and feedline systems must be well designed. Low loss feedline must be used; at Weston, the feedline run is over 200 feet. The losses inherent in coaxial cable demands that a type of cable called "hardline" be used. The stuff is 1/2 inch in diameter, has a solid aluminum shield and a thick, pure copper solid center conductor. At the Marlboro 440 site, we use hardline that is 7/8 inch thick; at the higher frequency, 1/2 inch hardline over a long run has too much loss.

In most cases, our antennas are Super Station Masters. These are coaxial colinear arrays...in simple terms, one of these antennas has 6 or 8 half wave elements stacked vertically, separated by phasing stubs that result in each of the elements getting the signal in phase. This results in the radiation from all the elements re-inforcing each other, producing 6 or more decibals of gain over a single dipole. One of these antennas is 22 feet high; the elements are inside a fiberglass sheath. One of these antennas costs about $600. The feedline can cost as much as $7.00 per foot for 7/8 inch hardline.

Because we have over the years built our own repeaters, controllers and been good scroungers for hardline at low cost - even free - we haven't had to pay what would be necessary to buy it all ready made and new. To put up a repeater system like that at Weston, with three repeaters (2 backups), 2 tube type amplifiers, duplexers, feedline and antenna would cost over $20,000... for just one repeater. We have eight systems; if you figure an average of $15,000 per commercial equivalent system, it comes to a total of $120,000.

If you have never seen a repeater system, come to a membership meeting; usually before the meeting some of us are at the Weston repeater site in the basement of the Campion Center. You are welcome to come down and get a cooks tour and get any questions you might have answered. In addition, you can check into the monthly Technical Forum Net, on the first Monday of each month at 8 PM or shortly thereafter. There will be people on the net who can amplify on what you have read here.

The Minuteman

The Official Newsletter of the Minuteman Repeate Association

Ham Radio Outlet

HRO Announces "Yaesu Day" - January 18, 1992
At the Salem, New Hampshire Store

Yaesu is Proud to Announce the FT – 890

The world's smallest premium high–performance mobile includes Yaesu's exclusive DDS, IF Notch, IF Shift built in iambic keyer, general coverage receiver and built in high speed antenna tuner with memories. Outstanding receiver front–end with IPO (Intercept Point Optimization), selectable AGC and all–mode squelch, DFCS (Duct Flow Cooling System) for 100% duty cycle at 100 watts for up to 30 minutes! A great field day or DXpedition rig!

This exciting new radio will be available in January, 1992.

Ask about the new FT–815 VHF or UHF handheld....you may find hard to believe what people have to say about the effectiveness of the Sliding Preselector in this HT... it's nearly intermod proof!

MMRA Raffle Tickets available at HRO in Salem....
Take a shot at a $1000 Gift Certificate at HRO!

Mail/Return Address:
MMRA, P.O. Box 2282
Lexington, MA 02173