The Minuteman Repeater Association

The Minuteman

Volume 42, Number 3 January 2013

Membership Meeting ~ Wednesday, January 16 ~ 7 PM

Technological Evolution in Disaster Communications

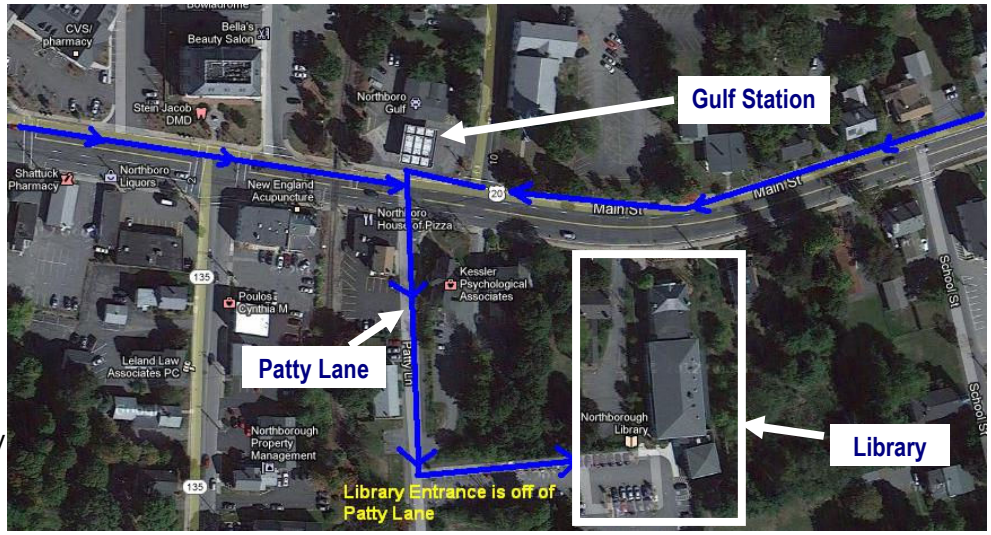
Tom Carrigan, NE1R, will discuss disaster communications from 1970 to present and the implications for Amateur Radio as an emergency communications resource.

Northborough Free Library, 34 Main Street, Northborough
Talk-in: 147.27

Directions to The Northborough Free Library

Directions from I-495:

- From I-495, take Exit 24B which is Rt. 20 West toward Northborough.
- Follow Rt. 20 West about 3.5 miles, into the center of Northborough..
- Opposite the Gulf Station on the right, turn left into Patty Lane.
- The Northborough Free Library parking lot will be on the left.



Also check: http://northboroughlibrary.org/northborough/hours.asp

LIBRARY PARKING

Rt. 20 construction has made it difficult to see the library parking sign on the corner of Main St. (Rt. 20) and Patty Lane. Patty Lane is right across from the Gulf station. Whether you're coming from out of town, or just not sure where to park, follow Patty Lane to the library parking lot.

The red brick building next to the library has a tempting driveway, being right next to the library, but it is private property. The property has recently been sold, so the building won't be vacant much longer. Please respect the owners' property, and use the library lot. Additional parking is available on the corner of Hudson and Pierce, or at Town Hall.

Table of Contents

About the Minuteman Repeater Association

The Minuteman Repeater Association (MMRA) is dedicated to Amateur Radio and public service. The MMRA maintains a large system of repeaters in Eastern Massachusetts.

The MMRA meets (usually) on the 3rd Wednesday of each month from September to June. Meeting times, locations, and talk-in frequency vary and are announced in this newsletter and on weekly nets. Meetings are open to all interested parties. Guest speakers and programs of general interest occur in September, November, January, March, and May. The intervening meetings are also open to all members and are for general business.

The Minuteman newsletter is Emailed one week before each general interest meeting. Members are encouraged to submit articles which can be sent to the editor at newsletter@mmra.org. The deadline for articles is the last Friday of the month preceding the meeting.

Each Tuesday evening at 8PM the MMRA links most of the repeaters for an open net. The topic is "Technical Information and Other Stuff". Join us!

Membership in the MMRA is open to all radio amateurs. Annual dues are $25 per individual or $35 per family. See our website for details.

Email to the club leadership should be sent to contact@mmra.org. The MMRA maintains a web site at: http://www.mmra.org/

An email distribution list for club members named "MMRA" is at: www.yahoogroups.com/

MMRA QRM Policy

MMRA members and all other operators are strongly encouraged to report repeater activity that does not abide by Part 97 rules or accepted amateur radio practice to the board of directors at contact@mmra.org or via other means.

The most effective way (and probably the only effective way) to deal with an individual causing QRM is to NOT engage that individual on the air. Please include the time and date of any incident. Measures are being taken to make audio recordings of repeater activity.

Repeater and Frequency Information

Up-to-date information about both MMRA repeaters and affiliate repeaters can be found at http://www.mmra.org/repeaters/index.html

Band	Location	Freq	PL	Call	Linking	
					To Hub 1	To Hub 2
MMRA Voice Repeaters						
10m	Marlboro	29.680	131.8	W1MRA	PTL	PTL
6m	Marlboro	53.810	71.9	W1BRI	PTL	PTL
2m	Boston	145.160	—	W1MRA	D-Star	
	Belmont	145.430	67.0	W1MRA	—	—
	Mendon	146.610	146.2	AE1C	FTL	PTL
	Quincy	146.670		W1BRI	PTL	PTL
	Burlington	146.715		KC1US	PTL	PTL
	Weston	146.790		N1BE	PTL	PTL
	Brookline	146.820		K5TEC	FTL	PTL
	Marlboro	147.270		W1MRA	PTL	PTL
1¼m	Hopkinton	223.940	103.5	K1KWP	PTL	FTL
	Quincy	224.400		N1KUG	PTL	FTL
	Weston	224.700		N1NOM	PTL	FTL
	Marlboro	224.880		W1MRA	PTL	FTL
70cm	Lowell	442.250	88.5	K1LVF	FTL	PTL: 446.775
	Weston *	442.700		W1MRA	**Network Hub 2 (PTL to Hub 1)**	
	Burlington	446.775		W1DYJ	FTL	PTL
	Southboro	449.575		W1BRI	PTL	PTL
	Marlboro *	449.925		W1MRA	**Network Hub 1**	
33cm	Boston *	927.0625	D244	K1RJZ	PTL	PTL
	Marlboro *	927.700		W1MRA	PTL	PTL
MMRA Other Systems						
Marlboro		144.390	none	W1MRA	APRS Digipeater	
???		145.630	146.2	W1MRA	Fox Box	

* Internet

HUB1— 449.925: **IRLP node 4133; Echolink**

HUB2 — 442.700: **IRLP node 4136; Connected to 220 Reflector 9124 on Tuesdays**

927.0625: **IRLP node 4977**

927.700: **IRLP node 4978**

Normally linked to the NEAR-900 Reflector, 9125. Linked to MMRA via IRLP for the TIAOS net. Normally linked together.

Notes: FTL = Full Time Linked (or default state)
PTL = Part Time Linked (on schedule or demand)
Note — a repeater can be linked to only one Hub at a time.

PL: PL is required to prevent interference. .

Off The Air

Reduced Power and/or Antenna Height

President's Corner ~ Selecting an HF Transceiver

Bob DeMattia — K1IW

I realize MMRA is primarily a VHF/UHF club, but many of us are also active, or would like to be active, on the HF bands as well. A question that comes up often is "what's the best HF transceiver"? As is almost always the answer – it depends!

I found thirty-four HF transceivers currently on the market. When I compiled my list, I excluded anything that wasn't ready to operate "out of the box". For example, one manufacturer in particular, FlexRadio systems, specializes in transceivers which you must control from a PC. Kenwood also offers a transceiver like this. There are also a few manufacturers that offer transceivers in kit form. These may very well be excellent products, but for the purpose of comparison, I wanted to keep my list restricted to main line traditional radio forms.

The first question you need to ask is – how am I going to use this radio? Casual use? DX? Contesting? Awards? The more serious you want to get about contesting, the more you are going to need better receiver sensitivity and selectivity. More expensive radios often include additional features to eliminate locally generated noise or to handle QRM. The second question might be "what is my budget"? In fact, this might be the first question. Almost everyone I know is on a budget. If you are the exception, then lucky you.

Estimated prices range from $520 to over $12000. There are actually some specialty companies that go higher, but I figure $12000 is more than enough. You will find that radios at the lower ends have simpler displays, poorer receiver performance, or may lack features such as a band scope that lets you see where the activity is on the band. Most transceivers include coverage up through 54 MHz, but there are exceptions. There are a handful of radios that also include the 2m and 440 bands. These transceivers may be in the same price class as others with VHF/UHF, but may sacrifice other features or HF performance.

Are you in the market? Use this list as a guide, but investigate further the ones that are in your price range. Keep in mind that some radios include an AC power supply. If they don't, you may need to add the cost of the supply to your purchase. Many radios include, or have available, at extra cost an automatic antenna tuner. Unless you are really lucky, you will probably need to have one of these if you want full access to all of the bands. To help you here, I included columns to indicate which radios have a built supply and/or tuner.

(Editors note: Reviews of most of these rigs can be found in ARRL's archives. Additional comparison specs can also be found on Sherwood Engineering's site: http://www.sherweng.com/table.html .)

Mfg	Model	b/c/m	price	TX power	6m	2m	440	AC pwr supply	auto tuner
Alinco	DX-SR8T	compact	520	100	NO				$350
Yaesu	FT-817ND	mobile	700	5	5	5	5		
Icom	IC-718	compact	740	100	NO				$350
Yaesu	FT-857D	mobile	800	100	100	50	20		
Yaesu	FT-450D	compact	900	100	100				
Yaesu	FT-897D	mobile	1000	100	100	50	20		
Elecraft	KX3	mobile	1000	10	10				$170
Kenwood	TS-480SAT	compact	1000	100	100				yes
Icom	IC-7200	mobile	1100	100	100				$350
Kenwood	TS-480HX	compact	1100	200	100				
Icom	IC-7000	mobile	1300	100	100	50	35		$500
Yaesu	FT-950	base	1500	100	100				yes
Kenwood	TS-2000	base	1600	100	100	100	50		yes
Kenwood	TS-590S	base	1600	100	100				yes
Icom	IC-7410	base	1800	100	100				$350
Elecraft	K3/10-F	base	1800	10	10				$300
Ten Tec	Eagle	base	1800	100	100				$250
Kenwood	TS-2000X	base	2000	100	100	100	50		yes
Elecraft	K3/100-F	base	2300	100	100				$350
Yaesu	FT-2000	base	2500	100	100			yes	
Yaesu	FT DX 3000	base	2700	100	100				yes
Ten Tec	Omni VII	base	2800	100	100				$300
Yaesu	FT-2000D	base	3200	200	200			yes	
Icom	IC-9100	base	3200	100	100	100	75		yes
Icom	IC-7600	base	3800	100	100				$350
Ten Tec	Orion II	base	4400	100	NO				$300
Yaesu	FT DX 5000	base	5200	200	200			yes	yes
Yaesu	FT DX 5000D	base	5400	200	200			yes	yes
Yaesu	FT-DX9000 Contest	base	5600	200	200			yes	yes
Yaesu	FT DX 5000MP	base	5800	200	200			yes	yes
Icom	IC-7700	base	7000	200	200			yes	yes
Yaesu	FT-DX9000D	base	10200	200	200			yes	yes
Yaesu	FT-DX9000MP	base	11400	400	400			yes	yes
Icom	IC-7800	base	12300	200	200			yes	yes

A New Antenna for Lowell

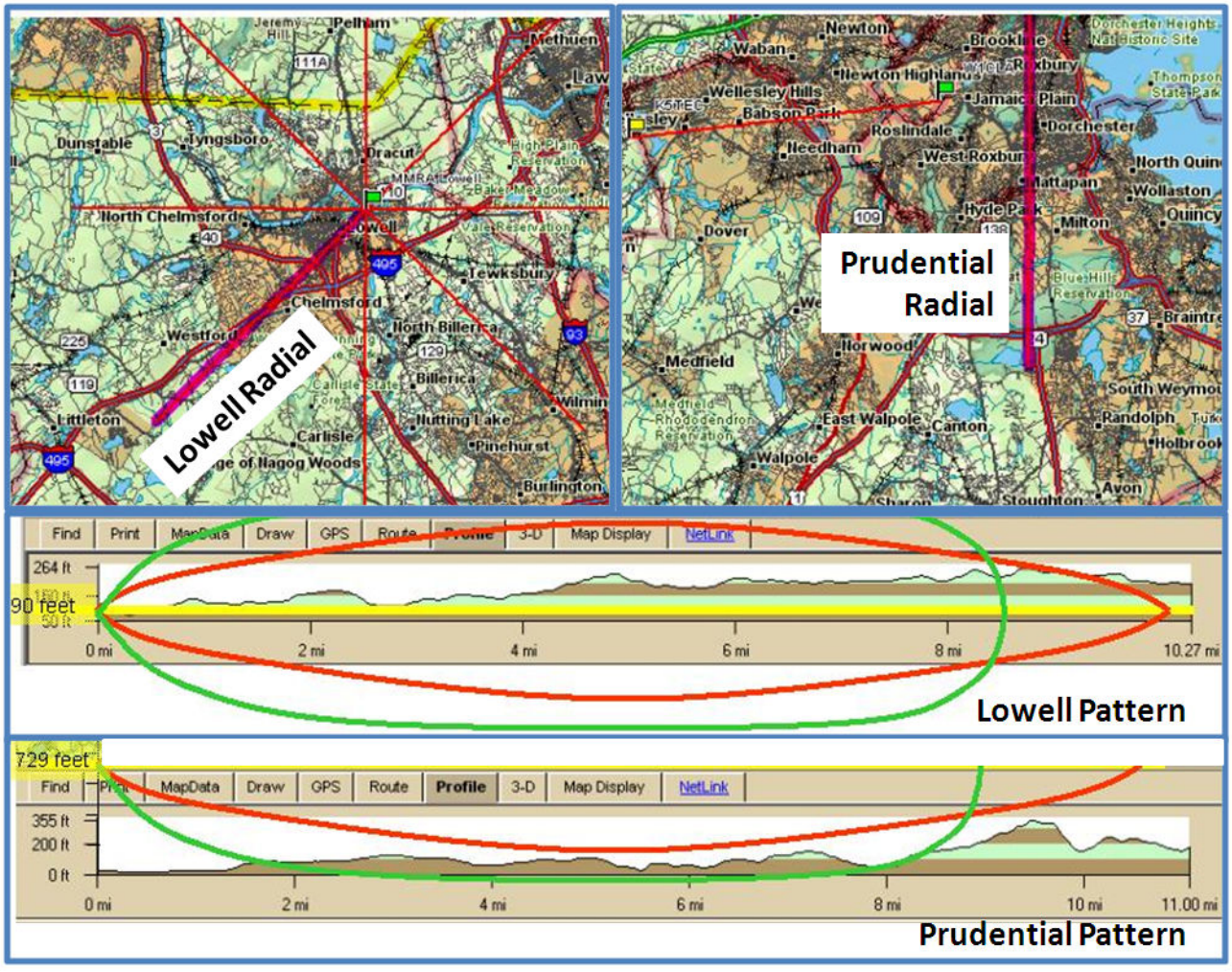
Bob DeMattia — K1IW

At the end of December, club members were asked to approve funds to replace the Lowell Repeater antenna which has failed. This measure passed by a vote of 72 to 3, with 2 abstentions. The new antenna will be a Decibel Products ANT450D6-9. This antenna will provide a gain of approximately 9dB. In order to do this, radiation outside the horizontal plane of the antenna is pushed into that plane.

Think of the pattern as donut shaped. The donut is laying on its side with the repeater in the center. As the gain increases, the donut gets flatter. More signal is pushed horizontally so locations above or below the horizontal plane of the antenna get less signal. There are situations in which a higher gain antenna can actually be detrimental. Lowell is not one of these cases.

The vertical beamwidth of a 6dB antenna is 34 degrees, for a 9dB antenna is 15 degrees. This makes the beamwidth a little over twice as large for the lower gain antenna. When everything is located in the same +/- 400 feet of the antenna, the narrower beamwidth will have no effect and the advantages of the 9dB antenna are clear. Below is a plot showing the 225 deg radial from the Lowell repeater. This radial is of particular interest because it follows I-495.

As the plot below documents, the higher gain antenna will provide superior coverage for *[continued]* the Lowell site. To show some contrast, I also superimposed the same pattern on our Prudential site (right). In this plot you can see how the Prudential site is so high up that the higher gain antenna is hurting locations that are too far outside the antenna's plane. Fortunately, we are using a 3dB gain antenna at the Prudential site and this is why.



Donations and Membership
Kevin K1KWP, Treasurer

The MMRA receives donations from members every year. Historically it seems that we do not publicize donations or even say thank you. At a recent business meeting we discussed this and decided to list the donators from the last two membership years.

Donations during Membership Year 2011-2012 (last year):

AB1IV	K1BC	KB1VQE	KD1CY	KD1TE	KG1H	N1DDU
N1KFV	N1YAZ	N1YDF	NV1W	WA1JIM		

Donations during Membership Year 2012-2013 (this year):

K5TEC	KB1LY	KD1TE	KT4OK	KX1M	N1DDU	N1NUS
N6QXA	W1CWJ	W1HBR	W1WRV	WA1JIM		

As of 4 January, 172 members have joined or renewed for this year. This is 11 members short of of the 183 from last year. 46 members from last year have not yet renewed. This indicates that 35 new members have joined this year. It was my hope to publish a list of the new members but for multiple reasons it was determined that our current database makes that query problematic. Stay tuned for list of new members in an upcoming newsletter.

Also as a result of recent discussion at a business meeting we decided to publish the list of all members who are renewed . If your callsign is not on one of these lists and you think that it should be please email/ notify the board.

Paid Members through 31 August 2013

AB1IV	AE1C	K1IW	K1IX	K1JWB	K1KWP	K1LCQ
K1LRS	K1LVF	K1NR	K1NZQ	K1PRO	K1ST	K1THR
K1UR	K9NPD	KA1AS	KA1CEW	KA1JMF	KA1NCF	KA1NXH
KA1U	KA2CNN	KB1DY	KB1EB	KB1HAZ	KB1ISZ	KB1IUM
KB1JFG	KB1JLA	KB1KCO	KB1LKR	KB1LY	KB1NTJ	KB1OEI
KB1SCG	KB1SMN	KB1SZZ	KB1TNN	KB1TOZ	KB1UMH	KB1URF
KB1VQE	KB1VXJ	KB1VXY	KB1WOD	KB1YMA	KB5JR	KC1SO
KD1BC	KD1LV	KG1H	KI1S	KI6MEV	KN1Q	KQ1Y
KT4OK	KX1M	N1BD	N1BE	N1COY	N1CPE	N1DAM
N1DDU	N1DFL	N1ELC	N1GWY	N1IZ	N1JKL	N1KFV
N1KUG	N1NVL	N1QD	N1QPR	N1UPY	N1YAZ	N1ZCE
N6QXA	N7FYO	NE1R	NH0CXM	NV1W	W1BP	W1BRI
W1CWJ	W1DDO	W1FDK	W1GFF	W1HAI	W1HIT	W1ICU
W1JMC	W1LSB	W1PMA	W1QEC	W1WH	W1WRV	W1WSN
W2NRL	WA1AOS	WA1MXO	WA1PZK	WB1AAT	WB1FIY	WG1L
WH6DSN	WN9T	WO1VES				

Paid Members through 31 August 2014

AA1VS	AB1II	AB1PH	K1ALL	K1HK	K1IJ	K1RJZ	
K1RWS	K1UCY	K1VEA	K1YSO	K3FG	K5TEC	KA1MN	
KB1JKJ	KB1JSW	KB1LOY	KB1MSR	KB1NCG	KB1NXL	KB1OQA	*[continued]*

MMRA December Business Meeting

Bob Evans ~ N1BE ~ Clerk

The MMRA Board met in the Northborough Public Library at 7:00 P.M. In attendance were W3EVE, W1JMC, N1BDA, N1YAZ, KG1H, K1KWP, N1NVK, KB1SCG and N1BE. MMRA President, K1IW was not present. Therefore Steve, N1BDA, MMRA Vice President presided during the meeting.

First on the agenda was a Treasurer's report from Kevin, K1KWP. We are still short $475 in dues compared to last year. This is 17 memberships. There has been some turnover of membership with 2 of last year's members becoming silent keys and 32 new members having joined. One of the largest operating expenses is utilities at MRW with projected annual costs of approximately $760 for electricity and $350 for internet connectivity. Funds allocated for MRW renovation are being reserved until the future time when that project can go forward.

The Board credited KB1OEI with the cost of his dues for the current year to provide some compensation for his expenses incurred while transporting the new MRW shelter from Maine.

The Board approved a frequency change for the 2-meter repeater at the Prudential. This repeater will operate on 145.430 MHz with a PL of 146.2 when in analog mode, with D-Star and digital modes also possible on 145.430 MHz. The current Prudential coordination for D-Star on 145.160 MHz will be will be relinquished.

The Board next considered what to do about the high SWR on the Lowell UHF repeater. We had unanswered questions concerning: cause of the high SWR (feed line or antenna), whether a replacement antenna would need a null towards Pave Paws, particularly since a higher gain antenna is being considered. Since we did not have enough information on which to base a decision, no action was taken.

We briefly discussed the AARC Flea Market on February 16 in Marlboro, MA. The MMRA will have a table at the market and board members should consider what items of MMRA property could be sold. We also need two or three members to man the table. Note that on the market day, MMRA repeaters will be made available for talk-in use by the AARC.

Finally a reminder to all that items for the newsletter need to be received by W1DYJ by December 28.

The meeting adjourned at 8:07 PM.

Donations and Membership ~ [continued]

Kevin K1KWP, Treasurer

KB1PRE	KB1SUA	KB1TTF	KB1UKU	KB1UXT	KC1US	KD1TE
KK1X	N1BDA	N1DDK	N1DM	N1KLK	N1KMM	N1LCY
N1LWK	N1NOM	N1NUS	N1NVK	N1OTY	N1TMK	N1ZCD
N1ZZN	N2IOF	N3EVL	NE1RD	W1DYJ	W1EZ	W1MPN
W1MVP	W1NGS	W1RJC	W1TGA	W3EVE	WA1CFX	WA1JIM
WA1NVC	WA1QGU	WE1L				

Paid Members through 31 August 2015

AB1IC	K1BOS	KA1RCI	KI6MEU
W1NOX	WA1WDQ		

Lifetime Members:

K1BC	KB1FZ	N1HBR	W4WR

Have you renewed your membership yet?

All 2012 memberships expired on August 31st! If you haven't renewed - it's time! Go to the Member's login link at www.mmra.org to renew online. If you prefer to renew by U.S. Mail, you can print out a membership application and mail it with a check to MMRA, PO Box 669, Stow, MA 01665.

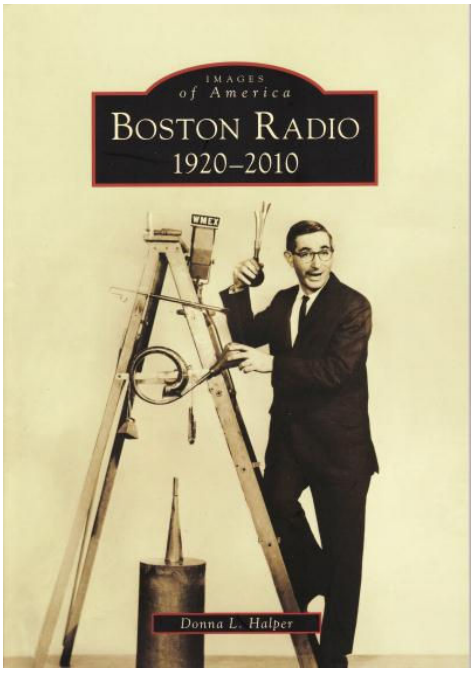
November Membership Meeting

What We Owe The Early Hams

How ham radio operators made friends, saved lives, and helped to create commercial radio.

Donna Halper

Our November guest speaker was Donna Halper. Donna told us many stories about what ham radio operators did over the past 100 years to help their communities and help build the commercial broadcast industry. Ms. Halper is a respected and experienced media historian, who makes regular appearances on WBZ's Jordan Rich Show. She is also heard on WBUR-FM and WGBH-FM and is frequently quoted in the Boston Globe and other newspapers. She is the author of five books, the most recent of which is "Boston Radio 1920-2010," a history of Boston radio in words and pictures. *[Editors note: I purchased this book from Donna that evening and really enjoyed it!]* You can read more about Donna at http://www.donnahalper.com/bio.html.



From Donna's Web Site

Boston's radio history begins with pioneering station 1XE/WGI, one of America's first radio stations, and includes the first station to receive a commercial license, WBZ; the first FM radio network, W1XOJ and W1XER; and one of the first news networks, the Yankee News Service. Nationally known bandleaders like Joe Rines and Jacques Renard were first heard on Boston radio, as was one of the first weathercasters, E. B. Rideout. The city has been home to a number of legendary announcers, such as Bob and Ray, Arnie Ginsburg, Dick Summer, Dale Dorman, and Charles Laquidara; talk show giants like Jerry Williams and David Brudnoy; and sports talkers like Eddie Andelman and Glenn Ordway. Many Boston radio personalities, such as Curt Gowdy, "Big Brother" Bob Emery, Don Kent, and Louise Morgan, found fame on television but first established themselves on Boston's airwaves. Since 1920, Boston radio has remained vibrant, proving that live and local stations are as important as ever.

2012—2013 Meetings

19 September — Membership Meeting
Bob Stone, N1KMA of Newfield Design
Holiday Inn, Boxborough, MA ~ 7:00 PM

17 October — Business Meeting
Stratus, Maynard ~ 7:00 PM

14 November ~ Membership Meeting
Donna Halper ~ A Short History of Broadcast Radio in Boston
Tatnuck Bookseller, Westborough ~ 7:00 PM

19 December ~ Business Meeting
Northborough Public Library ~ 7:00 PM

16 January ~ Membership Meeting
Technical Evolution in Disaster Communications & *Free Pizza Night*
Northborough Public Library ~ 7:00 PM

13 February ~ Business Meeting
Southborough House of Pizza ~ 7:00 PM

20 March ~ Membership Meeting
WRTC 2014 ~ Dave Pascoe KM3T & Doug Grant K1DG
Chelmsford Police Station ~ 7:00 PM

10 April ~ Business Meeting
Tech Projects Planning Meeting
Champion Center, Weston

22 May ~ Membership Meeting
Annual Meeting & Elections
Northborough Public Library ~ 7:00 PM

19 June ~ Business Meeting
Stratus, Maynard ~ 7:00 PM

17 July ~ Summer Get Together
Location TBA

21 August ~ Business Meeting
Location TBA

Next Business Meeting

13 February

Southborough House of Pizza

Don't Forget!

Every Tuesday @ 8 PM
Technical, Informational and Other Stuff Net

The MMRA's repeaters are linked Tuesday nights for the TIAOS Net. Join us! This is a good way to keep up with what is happening in the MMRA and ask your ham related questions.

If you would like to try your hand at Net Control contact me at W1DYJ@mmra.org – we have a script you can use.

Current Net Control Operators:

Week 1	WA1JIM	Jimmy Devaire
Week 2	W1DYJ	Larry Banks
Week 3	KQ1Y	Tim Wortley
Week 4	K1KWP	Kevin Paetzold
Week 5	W1DYJ	Larry Banks

To connect using the digital modes during the Net:

- Echolink node *NEW-ENG* (9123)
- IRLP node 4133

MMRA Leaders

Officers

President	Bob DeMattia	K1IW
Vice President	Steve Telsey	N1BDA
Secretary	John McGovern	W1JMC
Treasurer	Kevin Paetzold	K1KWP
Clerk	Bob Evans	N1BE
Technical Officer	Bryan Cerqua	W1BRI

Board of Directors

Director »2014	Clark Conti	N1NVK
Director »2014	Mike Neilsen	W1MPN
Director »2013	Steve Schwarm	W3EVE
Director »2013	Roger Coulson	WA1NVC

Repeater Trustees, Appointed

Boston 927.0625	Rick Zach	K1RJZ
Brookline 146.820	Bob Phinney	K5TEC
Burlington 146.715	Bruce Pigott	KC1US
Burlington 446.775	Larry Banks	W1DYJ
Hopkinton 223.940	Kevin Paetzold	K1KWP
Lowell 442.250	Vince De La Flor	K1LVF
Marlboro 53.810; Quincy 146.670; Southboro 449.575		
	Bryan Cerqua	W1BRI
Marlboro 144.390, 147.270, 224.880, 449.925, 927.700		
Belmont 145.430; Weston 442.700 — all as W1MRA		
	Bill Northup	N1QPR
Mendon 146.610	Jim Podsiadlo	AE1C
Weston 146.790	Bob Evans	N1BE
Weston 224.700	Eddie Mulhern	N1NOM

Appointed, non-Voting

Newsletter Editor	Larry Banks	W1DYJ
Emergency Coord.	Kevin Paetzold	K1KWP
Public Service Coord.	Bruce Pigott	KC1US
VEC Liaison	Bill Wade	K1IJ
Net Manager	Larry Banks	W1DYJ
Web Page Editor	Bob DeMattia	K1IW

Previous issues of the MMRA Newsletter are available at:

www.mmra.org → Newsletter Archive (on the left)

MMRA VE Sessions

3rd Saturday of each Month
9 AM at the Marlboro Public Library

Contact: Bill Wade, K1IJ 781-891-9079
Evenings 6 - 10 PM Weekends 8 AM to 10 PM.
Accredited by the ARRL VEC

Membership Meeting ~ Wednesday, January 16 ~ 7 PM

Technological Evolution in Disaster Communications

Northborough Public Library, 34 Main Street, Northborough

Calendar of Ham Radio Flea Markets

See this web site for more information: http://mit.edu/w1gsl/Public/ne-fleas

2 Feb	Windsor CT	Pierson LN
2 Feb	Augusta ME	AARA Clb Calumet
9 Feb	Springfield VT	CVFMA VFW
16 Feb	Marlboro MA	AARC MidSc
17 Feb	Westford MA	NEARC
23 Feb	S Burlington VT	HAM-CON HI
2 Mar	Feeding Hills MA	MtTARA
3 Mar	Hicksville NY	LIMARC
16 Mar	Dayville CT	ECARA
23 Mar	Laval PQ	CRAL-L
29,30 Mar	Lewiston ME	AARC Conv
7 Apr	Southington CT	SARA
7 Apr	Framingham MA	FARA
13,14 Ap	Wakefield MA	Photographica
14 Apr	Middletown NY	OCARA
20 Apr	Gales Ferry CT	RASON
21 Apr	Cambridge MA	FLEA at MIT
3,4 May	Deerfield NH	NEARFest XIII
19 May	Cambridge MA	FLEA at MIT
1 Jun	Hermon ME	PSARA
1 Jun	Windsor CT	VR+C Mus
15 Jun	Newington CT	NARL
16 Jun	Cambridge MA	FLEA at MIT
21 Jul	Cambridge MA	FLEA at MIT
18 Aug	Cambridge MA	FLEA at MIT
7 Sep	Ballston Spa NY	SCRACES
7 Sep	Windsor CT	VR+C
8 Sep	Newtown CT	CARA

THE MINUTEMAN REPEATER ASSOCIATION

MMRA
P.O. Box 669
Stow, MA. 01775-0669

Email: contact@mmra.org

WE'RE ON THE WEB
HTTP://WWW.MMRA.ORG/