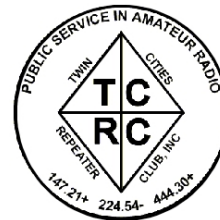


# The Repeater



The Official Publication of the Twin Cities Repeater Club, Inc.

## Mission Statement of the Twin Cities Repeater Club, as Adopted on September 20, 1993

The purpose of the TCRC is to facilitate the local communication needs of its members by owning and operating a state of the art wide area coverage two meter repeater system. The club will further involve itself in secondary activities intended to (1) Promote the exchange of ideas and information related to amateur radio, (2) strengthen the fellowship and camaraderie among the members, (3) serve the local amateur radio community, and (4) increase local public safety.

## TCRC Becomes First Metro Area Repeater Organization with Four Repeaters on Four Bands!

The TCRC now has the distinction of being the only Quad-Band Repeater Organization in the Twin Cities Metro area, with the installation of our new 6 Meter repeater system. More details can be found in Phil's article inside this issue, on pages 3 and 4.

Here's a quick summary of the four TCRC repeaters that are now on the air.

Amateur Band	Output Frequency (Listen Here)	Input Frequency (Transmit Here)	You Send a PL Tone of:	Phone Patch?
6 Meters	53.370 MHz	52.370 MHz	100 Hz	No
2 Meters	147.210 MHz	147.810 MHz	Not Required	Yes
135 cm	224.540 MHz	222.940 MHz	100 Hz	No
70 cm	444.300 MHz	449.300 MHz	114.8 Hz	Yes



## Annual Membership Meeting

Tuesday, December 9<sup>th</sup> is the final quarterly membership meeting of 2003 for the Twin Cities Repeater Club. As usual, it will be held in Burnsville City Hall, with folks gathering at about 7:00 PM and the official meeting start at about 7:30 PM.

Our guest speaker will be Russ Lalim from the Burnsville Fire Department, who is currently the full time Community Emergency Response Team (CERT) Coordinator, will give a presentation of the CERT program at 7:30 pm on 9 Dec 2003. All TCRC members are encouraged to show up for this presentation. This is an opportunity for all members, regardless of where you live, to acquire training that the City of Burnsville believes will be of benefit to the community. CERT training is part of the ongoing efforts of the TCRC to help cement a positive relationship with city officials.

After Russ' presentation, you will have an opportunity to give feedback to, or ask questions of, the current members of the Board of Directors. And since this is the annual meeting, you will also have the opportunity to vote a new (or old) slate of officers into place for the year 2004. This is also the meeting at which we select the recipient of the Arnie Pung Award for Outstanding Service to the Amateur Radio Community and the TCRC Membership.

Please join us for this meeting.

## Winter 2003 Volume 26, Number 4

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**Remember!**  
TCRC Annual  
Membership Meeting  
Officer Elections  
Arnie Pung Award Selection

Tuesday, December 9<sup>th</sup>  
Burnsville City Hall 7:00 PM  
Talk-in available during the TCRC  
Info Exchange Net, 147.21 MHz

**Please Join Us!**

The Repeater is published quarterly by the Twin Cities Repeater Club, Inc. (the TCRC). The TCRC is organized as a nonprofit corporation in the State of Minnesota, with Articles of Incorporation and Bylaws. The club elects officers annually. These officers are simultaneously elected for a two-year term on the Board of Directors. The Repeater Trustee is a permanent member of the Board of Directors. Unlike the other Officers and Board Members, the Trustee may select a proxy to serve in his place at meetings of the Board. Membership in the TCRC is \$25 per year. The TCRC is an official ARRL affiliated society.

**TCRC Officers:**

**President:** Shanon Haralson, KCØEIG  
**Vice President:** Phil Lefever, KBØNES  
**Secretary:** Jim Rice, NØOA  
**Treasurer:** Pat Cain, KØPC

**Board Members:**

All of the above Officers, plus...  
 Ivan Frantz, WØBU, **Repeater Trustee**  
*Ivan has currently appointed Mogens Dantoft, OZ9MD, as his proxy for Board Meetings.*  
 Ian Boje, KCØITQ, **Past Vice-President**  
 Janet Dibble, KBØZFB  
 Kevin Uhlir, NØBEL  
 John Toscano, WØJT

**Technical Committee (a/k/a Tech Team):**

Kevin Uhlir, NØBEL, **Chair**  
 Phil Lefever, KBØNES, **Vice Chair**  
 Shanon Haralson, KCØEIG, **Tech Team Manager**  
 Doug LaBore, NØBIS  
 Mike Ferguson, NØDGG  
 Rich Kenney, WØRFK  
 Steve Filek, NØOWL  
 Kelvin Olson, NØMQL  
 John Toscano, WØJT  
 John Phelps, KFØZM  
 Tyler Williams, KØZDA  
 Ed Walsh, KØCKK

**Field Day Committee:**

Phil Lefever, KBØNES, **Chair**  
 Kevin Uhlir, NØBEL, **Site Setup Manager**  
 Monica Filek, KBØUWZ, **FOOD Station Manager**

**Information Services Committee:**

Ian Boje, KCØITQ, **Chair and Head Webmaster**  
 Phil Lefever, KBØNES, **Assistant Webmaster**  
 John Toscano, WØJT, **Assistant Webmaster**

**Membership Committee:**

**Mark Neuman, KCØITP, Co-Chair**  
*(vacant), Co-Chair*  
 Steve Kickert, WØGXO, **Member Meeting Guest Speaker Coordinator**

**Newsletter Committee:**

John Toscano, WØJT, **Editor**

**Net Control Operators:**

Kevin Plummer, KBØUEU, **Chair**, 1<sup>st</sup> Tuesday  
 Ian Boje, KCØITQ, 2<sup>nd</sup> Tuesday  
 Thomas Gagnon, KBØDCO, 3<sup>rd</sup> Tuesday  
 Phil Lefever, KBØNES, 4<sup>th</sup> Tuesday  
 John Toscano, WØJT, 5<sup>th</sup> Tuesday

**Metro Skywarn Liaison:**

Jeff Goodnuff, WØKF

**Minnesota Repeater Council Liaison:**

Jeff Goodnuff, WØKF

# Welcome, New Members!

The Twin Cities Repeater Club would like to welcome the following fine folks who have joined our organization since the last newsletter. Listen for them on the air, and give them a friendly TCRC Hello!

Callsign	Name	Residence
KCØNPA	Richard Bopp	Plymouth, MN
KØLEJ	Larry Jenkins	Savage, MN



## President's Report

It's that time again. Winter is here, and it's time for elections for the TCRC. I encourage you to please come down to Burnsville City Hall on December 9<sup>th</sup> for the 2004 elections.

This is my second year as the TCRC club president. I have enjoyed working with all the board members and club members. The TCRC is one of the best ham clubs I have ever had the pleasure to work with. I want to thank all of the members for their great work and support.

I also want to thank the Tech Team for getting the 6-meter repeater on the air. It works great. It has great coverage of the Twin Cities, and it should be a lot of fun this summer when the 6 Meter band is open. If you have a rig that works on 6 meters, dial it up and give it a try.

I don't think I will be running for club president in 2004. I have enjoyed doing it the last two years, but I own a business and it's hard to find the time. I will be still very active in helping the club with events and Field Day.

Please make it down to elections on December 9<sup>th</sup> at 7 PM, at Burnsville City Hall. I will look forward to seeing you there.

**Shanon Haralson**  
**KCØEIG**



## Your Newsletter Editor's \$0.02

Article submissions were down from last quarter's record high, but as always, I appreciate whatever you can share with me to share with the rest of the club. I also note that new member enrollments are at an all-time low. I'd encourage you all to find a ham and invite him or her to join us! It is the membership of this organization that is its lifeblood. And by the way, the best way to volunteer for the Twin Cities Repeater Club is to run for elected office at the upcoming Annual Meeting!

73 de WØJT

# The Long Road to 6 Meters

## The story of the 53.37/52.37 WØBU repeater

by Phil Lefever, KBØNES

About four years ago, somebody (it may have been me, but I don't want to take the credit/blame for it) brought up the idea of the club putting a 6 Meter repeater on the air. This was about the time that 6 Meter capability was becoming a major selling point on many new radios, meaning there would be a larger potential group of users. Also, building a 6 Meter system was fairly simple, due to the common availability of surplus, inexpensive low band VHF equipment. The entire system could easily be constructed for well under \$1000!

After doing more research, we found that the best way to get on 6 Meters was to build a "split site" repeater. This means that the receiver and the transmitter are located at different locations, to provide the needed isolation between the two radios. On most higher frequency repeaters, cavity duplexers are used to provide enough isolation that the transmitter and receiver can actually *share* a single antenna! The hitch with a repeater at 50 MHz is that the duplexer is about 5 feet tall and very expensive. Split site is the way to go, but where would we put the transmitter?

The plan started to move forward, and the used General Electric radios were purchased. (You can find *anything* on Ebay!) Next, we needed to get a frequency pair allocated to us. The coordination of our frequencies dragged on for quite a long time. Finally, with the help of Jeff, WØKF, the Minnesota Repeater Council granted us the pair of 53.37/52.37 MHz, some time early in 2002. We were also granted a link frequency for the receiver site to send the audio over to the transmit site. Now, we could order the crystals needed to move the GE radios to our new frequencies.

Now the next issue was finding a second site at which we could locate the transmitter. The obvious choice for us was another city-owned water tank, 1.6 miles to the East of our current main site. The distance should provide an adequate amount of isolation, and the other site should provide excellent transmitter coverage. The TCRC has always had an excellent relationship with the City of Burnsville. We had a meeting with the Linda from the City, and she started processing our request. Other things that had to be taken care of were a frequency study done with our proposed transmit frequency at the new site, to assure that we won't mix with another transmitter there and cause problems. Also we had to get the City to draw up a lease. This required my attending and speaking at a City Council meeting on behalf of the TCRC. Several revisions later, we were finally granted a lease for the new site! Another issue that had to be worked around was our access to the top of the water tanks, which was greatly restricted after the 9/11 terrorist attacks. More hoops for us to jump through, but eventually, we got it all worked out.

The next step involved modifying the GE radios to do what we needed them to do. This involved moving them to our frequencies and tuning. Then the radios were split and the receivers were swapped, so that one radio would listen on 6

Meters and transmit on the link frequency, while the other radio would receive the link and retransmit on 6 Meters. Also, a controller had to be added to provide the ID's, the timing, and courtesy tone, etc. We also installed PL tone boards to protect the 6 Meter input and the link input from accidental interference. Be sure to remember that the repeater requires a 100Hz PL tone for access!

During a Spring 2003 tower climb at the main site, the 6 Meter receive antenna was installed. Both the antennas are basic a ½ wavelength vertical antenna that are about 10 feet tall. We had a leftover run of hardline on the tank from a prior upgrade we did to the 220MHz repeater, so the feedline was already in place. For the transmit site, we were fortunate to find that a paging company was vacating the tank, and was willing to donate an old run of 7/8" hardline that was already on the tank. In fact, they were more than happy to donate it to us, because it saved them the expense of removing it! It was a very lucky break for us, as installing 250 feet of cable on that tank would be a major hassle! The transmit antenna was installed on the new water tank in the middle of October. Also, two link antennas were installed near the ground, one at each site.

With the radios all ready to go and the antennas all up in the air, all that was left was to plug things in. The system worked well from the second it was turned on! We did develop a minor problem in the transmitter after a few days of activity. It required just a minor amount of tuning to straighten things out. The transmitter is feeding the antenna with a solid 65 watts or so.

It was sure a long road with many forks to slow our progress, but it is great to finally have the repeater on the air for our members and other users in the Twin Cities. There have been precious few 6 Meter repeaters here in the Cities in the past, and virtually none of them are kept in a working state. Hopefully, with all the new 6 Meter-capable radios out there, we will get a decent amount of usage. So far, we have been getting excellent coverage and audio reports on the new system. In some ways, the repeater is a bit of an alligator (big mouth, small ears) but this is mostly due to the fact that most users are using small compromise antennas. Users with HT's will have the most trouble getting a solid signal into the repeater. Also you'll find the long wavelength of 6 Meters makes it a lot harder to get the signal out of a vehicle if you are trying to use your HT in a car. An external antenna is a MUST. With a good 6 Meter mobile antenna and 25 watts of power or more, coverage is very similar to the 147.21 repeater. Give it a try if you have the equipment for 6 Meters!

While "repeater DX'ing" is usually more of a nuisance than a treat, we are fully expecting that from time to time, 6 Meter band openings will cause our newest repeater to have much wider coverage than our users are accustomed to having. That's why the repeater ID gives our location, so that in the event of a band opening event, remote operators will know what system they are getting into ("Burnsville, Minnesota, Grid Echo November 34").

There are some pictures of the system are on the next page.

73, Phil (KBØNES)

Here is a shot from the top of the water tank, showing our new 6 Meter antenna (in the center of the photo).



Here is a photo from the inside the remote (transmitter) site, showing the 6 Meter transmitter with link receiver (top box), and the Astron power supply that provides it with 13.8 volts DC. The 6 Meter signals you transmit on 52.37 MHz are received on the other half of this system, at the TCRC's Main Site, and sent to this box on a link frequency. When this box hears the signal on the link frequency, it re-transmits it on 53.37 MHz.



## Those Repeaters in the Sky The Amateur Satellite Service

by John P. Toscano, WØJT

Most of our readers are familiar with the idea of how a repeater works to extend the range of a less-powerful radio. Most of you have 5-watt handheld radios that, unassisted, are seldom capable of communicating over a distance of 25 miles, but you take it for granted that you can grab such a radio in Wisconsin, and talk, through the WØBU repeater, to a similarly-equipped station in the western end of the Twin Cities metropolitan area. The fundamental reason that this is possible is that there is a repeater between them, with a highly-placed gain antenna, a sensitive receiver, and a powerful transmitter, which work together to relay the weak signal from your handheld (or mobile radio) over a much greater distance than it can do without such help.

The ultimate in amateur radio repeaters is one that circles the Earth many thousands of kilometers high – an Amateur Radio Satellite. Like a terrestrial repeater, it has a very well-placed antenna, high enough up to overcome nearly any obstruction to a line-of-sight view to your radio, and a very sensitive receiver that listens on one frequency, and re-transmits your signal on another frequency. Unlike a terrestrial repeater, however, it has a low-power transmitter, because of the difficulty in generating lots of electrical power in space, and because high power is not really needed. Also, unlike a terrestrial repeater, the transmit and receive frequencies are on completely different Amateur Radio bands. This is because the duplexers that are used on terrestrial repeaters to provide isolation between the input and the output of the repeater are far too large, bulky, and heavy for use in satellites. The transmit/receive isolation is mainly provided by having the two radios operate on different bands.

The year 2003 was not kind to the Amateur Radio Service. Many of our “old reliable” satellites have died, or are in the process of failing. AO-27 is not currently operational, but the controllers still have hope of restoring it to operation. UO-14 has been taken out of service after many years of faithful operation, due to electronic failures. SO-35 is also deceased, so the three most popular FM satellites are gone now. Among the “linear transponder” satellites that support SSB and CW operations, FO-20 and FO-29 are “semi-operational”, AO-10 has not been heard from anytime in 2003, AO-7 continues its sporadic sunlight-only operation after its miraculous “return from the dead” last year, and AO-40 is operating like gangbusters (but the transponder has been turned off for a few weeks due to poor sun angle on the solar cells, and the need to conserve power). Most AO-40 activity uses uplinks on the 435 MHz U band or the 1269 MHz L band, and downlinks on the 2400 MHz S band (with the rare 24 GHz K band downlink user).

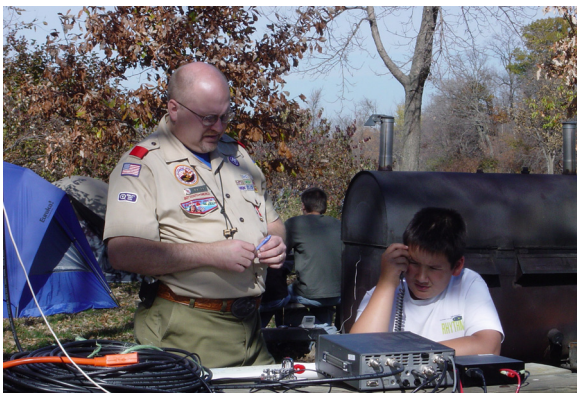
Amsat-NA is preparing to launch a new low Earth orbit FM satellite, (“ECHO”), in March of 2004. Progress on their high Earth orbit, linear transponder bird, “Eagle”, has been quite slow. Meanwhile, the German branch of Amsat, Amsat-DL, is working on “Phase 3E”, another high-Earth orbit linear transponder bird, but there is no information available yet on a projected launch date, probably several years away at least.



## Jamboree on the Air (JOTA) 2003

by Mark Neuman, KCØITP

JOTA, or Jamboree On The Air, was October 18 this year, and Boy Scout Troop 445 participated again this year. JOTA is a worldwide event where Scouts of every type around the world have a chance to use Amateur radio to contact one another. This year Troop 445 combined the JOTA radio event with a campout, annual pig roast, Eagle Court of Honor, and a visit of interested Cub Scouts. In order to make this year's JOTA more accessible, we camped at a group campsite at Cleary Lake Regional Park. The campsite was on a point on Cleary Lake, and was beautiful; it also had power – what more could you ask for? With all of this going on, when do we get a chance to be on the radio? Well, radios were going most of the day, with one operator or another attempting to make contacts and get the Scouts to talk. Scouts, and youth in general, can be quite mike shy, so getting something other than a “yep” or “nope” can be a challenge. The fact that I managed to get a one-word response to an essay question tells of their abilities to sum it all up into a very short answer. With the solar cycle on the downturn, and the sunspot number at 25 on JOTA weekend, conditions were more difficult than in past years. I made a few contacts on 15 and 17 Meters, and nothing on 12 or 10 Meters, meaning all of the activity was on 20 Meters. With everyone on 20, it was like a contest trying to get attention and not get stepped on. This was difficult to explain to a young Scout, therefore I did not try too hard to grab a contact that would lead to frustration to the Scout I was working with. I wanted to make this an interesting and somewhat easy first contact for these young Scouts. In all I had a blast, and look forward to next years JOTA experience.



## Association of Emergency Radio Organizations (AERO) Meeting 11/20/03, Bloomington Emergency Operations Center

The meeting was attended by the following:

Name	Callsign	Representing
Dan Peitzo	NØPIY	American Red Cross
Doug Reed	NØNAS	Ramsey County
Paul Oby	KCØESE	REACT
Ed Jacobson	WBØVHF	Bloomington
Thomas Gagnon	KBØDCO	McLeod County
Larry Larson	NØSUO	Bloomington

The meeting was called to order at 1945. A videotape of a portion of the AERO class held in Stillwater this fall is available on VHS or DVD. It runs about 90 minutes, and those interested can contact Dan, NØPIY.

It was decided to hold an AERO class in February 2004. The tentative date is February 21, 2004, from 0800 to 1600. The likely location will be in Anoka.

A discussion was held pertaining to the list of frequencies on the yellow handout sheet. It's noted that the Stillwater repeater is now located on 147.060 with a PL of 114.8 Hz. Change 14N on the yellow sheet to this frequency. A second change is recommended, 7G to be changed from 146.575 simplex to 146.595 simplex, to fit the offsets in the band plan. 147.090 should include a PL tone of 100 Hz (11K on the list).

It was mentioned that we have around 42 repeaters active in the Metro area. This sounds like a lot, but in case of a large Metro emergency, having a number scattered around the Metro would be very necessary. Several attendees mentioned that they were grateful so many Hams spend the time and money to keep them on the air. It's recommended that in case of an emergency, club-affiliated Hams should go to their repeater to check in. All others should check in on the two Skywarn repeaters (147.010 and 146.850) for further instructions.

The AERO member list is being continuously updated, a difficult task at best.

The next AERO meeting will be held on January 15, 2004, at 1930, in the Ramsey County EOC, which is located at Interstate 494 and Rice Street.

The official AERO web site is:

<http://lists.twinslan.org/twinslan/listinfo/aero>

An interesting document, the “2002 Basic Level Radio Operator Training Guide”, can be found on the web at:

[http://www.frontiernet.net/~narikawa/AERO\\_02\\_Manual.doc](http://www.frontiernet.net/~narikawa/AERO_02_Manual.doc)

Meeting minutes provided by AERO Secretary Larry Larson, NØSUO, with additional editing by your editor (naturally!)



**Twin Cities Repeater Club, Inc.**  
**P.O. Box 11534**  
**St. Paul, MN 55111-0534**

**Place  
Stamp  
Here**

Your Membership  
Dues are Up-To-  
Date. Thank you  
for your Support of  
the TCRC!

Your Membership  
Dues Have Expired.  
Please Consider  
Renewing your  
Membership Today!

## Join the Twin Cities Repeater Club!

**P.O. Box 11534, St. Paul, MN 55111-0534**

<http://www.tcrc.org>

Fill out this Membership Application Form, and mail it with your check for \$25.00 payable to the Twin Cities Repeater Club, to the mailing address listed above. You can also fill out this form electronically at the web address listed above, and either send us a check, or pay online using the PayPal system.

Name \_\_\_\_\_ Callsign \_\_\_\_\_ License Class \_\_\_\_\_

Address \_\_\_\_\_ City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Home Phone \_\_\_\_\_ Work Phone \_\_\_\_\_ Computer Phone \_\_\_\_\_

Ok to list your address in club publications?      \_\_\_ No    \_\_\_ Yes

Ok to list your phone in club publications?      \_\_\_ No    \_\_\_ Yes

Are you available for Emergency Service?      \_\_\_ No    \_\_\_ Yes

Are you a member of the ARRL?                    \_\_\_ No    \_\_\_ Yes

Are you a member of Metro Skywarn?            \_\_\_ No    \_\_\_ Yes, spotter ID: \_\_\_\_\_

Are you a member of ARES?                        \_\_\_ No    \_\_\_ Yes

Would you like an autodial speed dial number?   \_\_\_ No    \_\_\_ Yes, to phone # \_\_\_\_\_

Would you like a club ID badge?                 \_\_\_ No    \_\_\_ Yes (free to new members, otherwise \$5.00)

What is your internet e-mail adress, if any?    \_\_\_ None

Would you like an e-mail alias set up, so that mail sent to **yourcallsign@tcrc.org** gets redirected to the e-mail address you listed above? This can be handy on the air!            \_\_\_ No    \_\_\_ Yes

Do you want a copy of the TCRC Handbook?    \_\_\_ No    \_\_\_ Yes (add \$9.50, which includes postage)

Do you want a TCRC binder to hold it?         \_\_\_ No    \_\_\_ Yes (Add \$5.50 to the above)

This is \_\_\_ New Application    \_\_\_ Renewal    \_\_\_ Other Change    \_\_\_ Callsign update, old call was \_\_\_\_\_