NVARC
Nashoba Valley
Amateur Radio Club

# SIGNAL

SPECIAL SERVICE CLUB

June 1997 Volume 6 Number 6

## June 1997 Presidents Letter

Have you caught ***Field Day*** fever yet? You don't have much time before this most interesting non-contest, contest. As Bruce has told us in past meetings, this event is the one event that every non-contester should have a look at. It is an opportunity to get out, under the summer skies, breath in the exhaust from the generators and have some simple fun with radio. Our club is putting together a station for the event. They can use any help, be it for the whole event, or simply a few hours, every bit works towards maximizing the fun. Get out there and have fun, pretending that the phones and power infrastructure has stopped working.

I will be up at Mount Washington, helping with the MT Washington Hill Climb, an auto race up the mountain, where 40 plus hams provide emergency communications to keep the event safe. When we are not "On the mountain", we will be at our camp site, playing radio, and making some "Q's" for the field day. I look forward to working the N1NC station during the weekend.

Get out and involved. It's a lot of fun. See you at the meeting on Thursday.

Erik Piip KA1RV

## Club Call N1NC

# N1NC

## Last Months Meeting

Jim Western AA1PO reported on the "Adopt a Highway" program. We have been given the stretch of Rt. 119 from Shirley St. in Pepperell to the entrance of the Groton Schools near the center of Groton. The Adopt a Highway signs are up denoting our piece of road. Jim went over the rules and safety issues and had the equipment provided by the state. We have to clean the roadside once a month from May to October.

Mike Tyo KA1BK spoke to the group about supporting a road race at Devens. He got several volunteers for the race.

Bruce K1BG was the main speaker and spoke about Field Day and Field Days Past and generated discussion about what we wanted to achieve this year on field day. Bruce had slide taken at field days over the past 25 years.

In a related matter, Craig N1ABY showed and explained the power switching unit he and Stan KD1LE had been working on since last field day. This unit will allow switching between generators with minimal power interruption. With the computers on a UPS, switching from one generator to the other should not shut down our operation. Being able to switch over easily eliminates unplugging from the generator to be shutdown and plugging into the "new" generator. This should eliminate any reason to refuel or do maintenance on a hot machine.

Stan

## This Month's Meeting

At this months meeting William K1WD will be presenting "Getting Knotted" which should have particular application with Field Day coming up quickly. William says everyone will go home with a "keepsake".

## Field Day

Well, It's June and Field Day is just around the corner. Our annual club gathering and test of emergency preparedness will take place on Saturday and Sunday, June 28 and 29. Our location this year will be the same as last

year, behind the Groton-Dunstable Middle School in Groton.

Set-up will begin on Saturday morning, right after breakfast. Join us at the Restaurant/Pizza place in the Donlons plaza in Pepperell center around 8AM, we will go to the site around 9AM). Field day itself starts at 2PM and will run for a continuous 24 hour period. Our setup will consist of setting up tents, stations, and antennas (we could use some screened canopies if you have one available).

While our high frequency stations are coming together nicely, we are still in need of help and expertise with the "special teams". A novice/tech plus station, VHF station, packet station, and satellite station are all needed and could give us some valuable bonus points. Do you operate these modes at home? Bring a rig and antenna! A simple 2 meter multi mode and small yagi could bring us a lot of points. Share your experience with those of us who have no experience with these bands or modes.

We'll discuss field day as part of our meeting this week, and we will have a special meeting on Thursday, June 26th (the Thursday before field day) to discuss our last minute plans and issues. We invite you to attend these meetings, but if you can't, please participate with us anyway!

Everyone who participated in last year's field day is looking forward to this year, and we invite you to join in. Our callsign will be N1NC, the clubs new call. Work us from home, but better yet, work other stations from our field day station. I'll look forward to seeing you there, or on the air!

Bruce, K1BG

## From The ARRL Newsletter

WISCONSIN HAMS ASKED TO PREPARE FOR POWER BLACKOUTS

Hams groups in Wisconsin have been asked to prepare to help out in the event of possible power outages this spring and summer--some of which may be unannounced--because a significant portion of the region's power-generating capacity is out of commission. The Wisconsin Public Service Commission briefed state agencies in late April on the possibility of power blackouts--including local outages and "rolling blackouts" that could adversely affect telephone service as well as police and other public safety agencies. The Wisconsin Reliability Assessment Group--a cooperative of the region's electric utilities--says that about one-third of the region's nuclear-powered generating capacity is "temporarily or permanently out of service." This includes several nuclear units in Illinois, a source of backup power for Wisconsin. The nuclear plants are scheduled to be back on line this summer. In addition, 12 of the state's fossil-fuel plants were scheduled to be down for maintenance during April and May. The greatest threat is from higher-than-normal power demand during hot weather--when air conditioner usage surges--although lightning damage from storms also could play a role, the Commission said.

Alan Wohlford, Warning and Communications Officer, Wisconsin Emergency Management, issued the warning and asked Amateur Radio clubs and ARES and RACES groups--but not individual hams--to meet with local emergency management and public safety officials to coordinate any assistance that might be needed if normal communication are disrupted. In the event of power and/or telephone outages, all hams were being asked to be alert for emergency traffic, and mobile operators were being asked to placard their vehicles to identify themselves as hams who can provide emergency communication.

A statewide power outage may require the activation of the Badger Emergency Net (BEN) on 3985 kHz. For more information, contact the Wisconsin Emergency Management ham station: Tel 608-242-3323; e-mail wc9aag@SKYWARN.cs.wisc.edu.

## Musings on VSWR and Stuff

"My VSWR is 1.5:1, so my signal in Crudistan is better than your 2:1" Well, everything else being equal, the first signal is stronger by about 10% minus 4% or 6%. That is less than 0.3 dB. This difference probably won't get you out of the pile. Where did I get the numbers for this comparison? Let's go through some simple explanations on this whole power transmitted/VSWR and other confusing stuff.

What is VSWR, how does it affect our performance, what can we learn from its value, and why is it so often misused and misquoted? Let's start with the meaning of VSWR.

Most hams use the term "SWR", which is actually a contraction of the more complete term of VSWR. VSWR means "voltage standing wave ratio". It actually applies to both the voltage and the current standing waves on the transmission line. Either is a measure of the mismatched load, but the voltage standing wave is more easily measured by some sort of probe than the current. The standard directional coupler measures both terms and derives forward and reflected power.

We transmit energy down a transmission line toward what we refer to as a load. The load is a complex impedance into which we intend to dump all of this energy. Complex impedance just means that there is probably a resistance and some capacitor or inductor in combination. Only resistance can dissipate power, so whatever capacitor or inductor is a component of the load only contributes to modifying the load VSWR. You notice I didn't say raises the VSWR, because sometimes it lowers it. It just changes it. So here comes our energy hauling down the transmission line towards the load. When it reaches the load it dumps some of its power. It only dumps it all if the load is an exact match to the impedance of the transmission line. Fifty ohms comes to mind but it must be whatever value we choose as a transmission line. We know that the capacitor and inductor can't dissipate any power so this energy is reflected back up the transmission line. How about the resistor? Depending upon its value it will dissipate power but also reflect what it doesn't use back up the line. In order for all the energy to be dissipated by the load, the resistance must have the same value as the impedance of the transmission line and there can be no capacitance or inductance component in the load. There may be inductors and/or capacitors but their effect must be to cancel all reactance, leaving only the resistance value. As an example in a real situation, a given antenna may have a radiation resistance of 72 ohms but also have a capacitive reactance of 10 ohms. An inductor with an inductive reactance of 10 ohms may cancel the capacitive reactance yielding a final load of a 72 ohm radiation resistance. This is obviously a perfect match for an RG-59 co-ax cable. All of our energy will be radiated because the load is the radiation resistance of the antenna which is a true resistance.

OK, so some of our power is bounced back up the transmission line. How much? Well, we have two distinct signals on our transmission line. One leaving our transmitter which we call the incident wave (I prefer the term forward wave), and the other one bouncing back called the reflected wave (I like that term). As the two waves pass in opposite directions they add on parts of the transmission line and subtract on other parts. The mins and max's are one quarter wave apart but that is not important at this time. The location on the transmission line is governed by the phase angle of the reflection coefficient, which is in turn governed by the complex impedance of the load. A load with a capacitive reactance will have a different reflection angle than one with an inductive reactive . The location of these nulls and max's of the standing wave is essential information in determining the actual impedance of the load, information required to design a matching network at the antenna terminals. Later information will describe how the Smith chart uses this information for a complete analysis of the system. The VSWR of the system tells you how much of a mismatch exists, whereas the location of the standing wave tells you the exact value of the complex impedance of the mismatch.

The ratio of the maximum signal to the minimum signal is called the standing wave or VSWR (voltage standing wave ratio). This ratio has the same value as the ratio of the complex load impedance to the impedance of the transmission line, although it doesn't have to be a transmission line. Any source of power at a given impedance will be mismatched by a load with a different impedance. It doesn't have to be an antenna, it could be the VFO driving a buffer. Energy will be reflected if the match is not proper.

So we can calculate or measure the VSWR but what does it do for or to us? Any energy that doesn't get used and is reflected is inefficient. Let's see how inefficient. A term called "Reflection Coefficient" is a measure of the voltage or current (like amps) value of the reflected wave. The reflection coefficient is found from the value of VSWR as follows. The reflection coefficient is the ratio of the VSWR-1 to the VSWR+1. It's that simple. Say our VSWR is 2 to 1. The VSWR-1 is 1 and the

VSWR+1 is three, so our reflection coefficient is 1 divided by 3 or .333. We know that power is a product of the voltage or current squared, as $P=I^2R$ and $P=E^2/R$. In each expression the voltage or current is squared to find the power term. To convert our voltage reflection coefficient to one of power we simply square it. .333 squared is about .1 or ten percent. What we've found is that with a VSWR of 2 to 1 we reflect about ten percent of our power back up the line toward the source or transmitter. We're assuming here that the transmitter has an output impedance match equal to the impedance of the transmission line so that any energy reflected back is absorbed in the transmitter. In many cases, this is not the case and the energy reflected back to the source sees an additional mismatch and is reflected once again in the forward direction. If the source has a 2 to 1 mismatch, ten percent of the reflected power will be re-reflected toward the load. But ten percent of ten percent is one percent and hardly a concern.

So what we have discovered is that if we have a 2 to 1 mismatch we lose 10% of our power or about 1 dB. Using the same methods we find that a 3 to 1 costs us 25% of our power or 1.25 dB. A 4:1 is 36% power loss or about 2 dB.

Pursuing the 3 to 1 mismatch, and losing 25% of my power means that I'm putting 75% of my power into the antenna. That's a difference of about one sixth of one S-Meter unit. See if you can read one sixth of an S-Meter unit change on your receiver.

There is additional real loss associated with higher VSWR's. Our cable or transmission line has some real loss associated with it. It will dissipate energy in the form of heat when we pass power through it. It will also dissipate energy as the reflected power passes through in the other direction. So simply put, the loss due to heating of the transmission line goes up exactly by the amount that is reflected by our mismatch. If 4% of our power is reflected, the loss in the transmission line will increase by 4%. The forward and reflected waves are independent and create heat as if the other wave didn't exist.

How about things like voltage breakdown in connectors or hot spots caused by high VSWR's. Well, let's see how high the voltage or current can go. If we terminate our line in a perfect mismatch, all of the energy in the forward wave will be reflected. As the voltage and current value of the reflected wave is the same as that of the forward wave, the maximum levels can only be twice those of a perfectly matched line (no reflected wave). If we have a 50 ohm cable or connector rated at a breakdown voltage of 100 volts and we are running 200 watts we are at the limit of our system. Suppose we trip over the co-ax going for the phone and disconnect it from the antenna. The voltage on parts of the line now goes to 200 volts. It may be that the line is not the limiting factor in breakdown. It may be the final amplifier in our rig, most likely the final tank circuit. Arcing in tank circuits is a proven test for a serious mismatch. God bless the circuit breaker. The maximum value possible for either voltage or current as a result of a mismatch is the level of matched voltage multiplied by 1 plus the reflection coefficient. Where our reflection coefficient was .333 in the 2 to 1 mismatch, the maximum possible voltage or current on the line is the value of the voltage or current in the forward wave multiplied by 1.333 which represents the maximum value possible by adding the forward and reflected voltage or current.

Attached is a sheet that describes all of the mathematical relationships we've covered along with a couple of cheat sheets to spare you the effort of figuring them out. The concept of forward and reflected energy is basic, simple, and essential to understanding power transfer. It makes a lot of sense once you get the hang of it.

Go back to the first paragraph and see if you agree with the example using the chart attached, or use the formulas listed to confirm what the chart says. The chart is on the last page.

Useful Formulae

The voltage reflection coefficient is $\frac{VSWR-1}{VSWR+1}$ commonly called "K"/column

The power reflection coefficient is the square of "K". Column 3 is power reflected. The percentage value is the power reflection coefficient times 100. Return loss in column 4 just expresses this value in dB.

The power transmitted is what's left after whatever power is reflected, and the transmis-

sion loss expresses what we have lost is dB. This is column 5 and 6.

Using a ruler and going straight across the chart from the VSWR gives a quick value of these parameters.

Earl WR1Y

## Upcoming Public Service Events

Jul 12 Eastern MA Diabetes NE Classic bike Faith N1RUN 800-229-2559 FLinsky@ada.noli.com
Jul 13 Southern ME Diabetes NE Classic bike Faith N1RUN 508-879-1776
Jul 14 Lakes Rgn NH Diabetes NE Classic bike Faith N1RUN 508-879-1776
Jul 15 Barre Rgn VT Diabetes NE Classic bike Faith N1RUN 508-879-1776
Jul 16 Woodstock VT Diabetes NE Classic bike Faith N1RUN 508-879-1776
Jul 17 Walpole NH Diabetes NE Classic bike Faith N1RUN 508-879-1776
Jul 18 Central MA Diabetes NE Classic bike Faith N1RUN 800-229-2559

## Sister Alverna Retires From Handi-Ham System

ARRL Humanitarian Award winner Sister Alverna O'Laughlin, WA0SGJ--a mainstay of the Courage HANDI-HAM System--retired on April 28. "Sister" (as she's known) worked at Courage Center for 16 years, serving as educational services coordinator in the HANDI-HAM Program. However, her association with the HANDI-HAM System goes back much further than that. She was one of the original member-volunteers when the late Ned Carman, W0ZSW, founded the program in 1967. Sister was first licensed in 1967 as WN0SGJ, and now holds an Advanced Class license. She received the Humanitarian Award from ARRL for her good work with persons who have severe physical disabilities and sensory impairments.

Through the 30 years that WA0SGJ has been in HANDI-HAMS, she has helped thousands of newcomers along the path to their licenses, all the while remaining a very active amateur. Sister has a special love for county hunting, and has worked all counties (she's now a "wild card" for county hunters with similar aspirations, and her call is much sought after as she works HF mobile on her auto trips across North America).

Last Spring, Sister Alverna was in a car accident while on her way to the Midwest Division Convention, and sustained serious injuries to her leg and ankle. She has spent the past year recovering, but has maintained a part-time schedule at HANDI-HAMS. Her retirement will allow her to concentrate on getting well again, and she hopes to be walking this summer!

Retirement will not keep WA0SGJ off the air! Plans are being made to install her HF and VHF rigs at her new QTH in Rochester, Minnesota, soon after she moves there from the Twin Cities. Friends and well-wishers may contact Sister at wa0sgj@juno.com. There's a picture of Sister on the Courage HANDI-HAM home page, http://www.mtn.org/handiham/.--Patrick Tice, WA0TDA, Manager, Courage HANDI-HAM System

## Board Meeting Minutes

The Board meeting minutes were not available at the time of printing.

## NVARC QSL BUREAU

Bring your cards and a QST label to the meeting or to breakfast and the club will take care of the shipping and bureau fee. We sent out two pounds of cards this month. Stan

## WX Stuff From NWS

The national weather service relies on its network of trained Weather Spotters to report severe weather. This is part of a nationwide program called SKYWARN. Real-time reports from these SKYWARN spotters can be integrated with what is seen on Doppler radar to help the national weather service issue the most accurate severe weather warnings possible.

Every spring and summer. several training sessions are held. They are open to the public free of charge. The session is a two and one-half to 3 hour slide and video presentation which shows the cloud features associated with severe thunderstorms and tornadoes. Examples from New England are stressed. including damage photos from the 1953 Worcester tornado, the 1979 Windsor Locks tornado, the 1986 Providence/Cranston tornado, the 1995 Great Barrington tornado, and the 1996 downburst in and near Brockton. The training also stresses what types of phenomena should be reported. Upon completion of the training identification cards are handed out along with a special phone number for reporting directly to the national weather service.

About downburst winds from severe thunderstorms.

A downburst is a strong downrush of air from a thunderstorm. It is also referred to as strong straight line winds. Downburst wind speeds can be phenomenal...with 158 mph measured from a downburst at Andrews Air Force Base in Maryland in 1986. As viewed from the air downbursts have a damage pattern that gets wider along its path, as opposed to that of a tornado which exhibits a pattern that converges toward one central track. A small downburst with a damage swath less than 2.5 miles across is called a microburst. These are extremely dangerous to aviation. A large downburst is called a macroburst. Strong downbursts will definitely cause roaring sounds and people often refer to a sound like a freight train...terms typically associated with tornadoes. Although downbursts are not tornadoes, they can cause damage equivalent to that of a small to medium tornado. After all, wind is wind.

A major downburst occurred late in the afternoon on may 21 1996 in Plymouth County in Eastern Massachusetts. Earlier in the day downbursts swept across southern portions of Hartford, Tolland. and Windham counties in Connecticut with gusts to 70 mph reported and trees knocked down. But the storm that moved across Plymouth County had a measured gust to 104 mph in Whitman and caused 60 injuries in the city of Brockton and a total of about 4 million dollars in damage. Thousands of trees and tree limbs were blown down from northwest to southeast across a wide area, some striking homes and automobiles. Several thousand electric customers remained without power for several days. A number of Cemeteries were severely damaged when large trees were uprooted. Golf ball size hail accompanied this storm. When unusually large hail is present you should always take immediate precautions Because the storm could be capable of producing a downburst or even a tornado.

Lightning safety rules

All thunderstorms produce lightning by definition. If you can hear thunder you are close enough to the storm to be struck. Move inside. It doesn't have to be raining yet since lightning can strike 10 to 15 miles away from the rain portion of the storm. These lightning strokes come out of the upper portions of the thunderstorm cloud which extends 5 to 10 miles into the Atmosphere.

In general, lightning will travel the easiest route from the cloud to ground which means that it often strikes the tallest object. Therefore a simple rule is to not make yourself the tallest object or stand near the tallest object in your immediate surrounding. For instance, do not stand in an open field, on a beach, or on a hilltop. Do not stand under an isolated or large tree or near a pole. and do not stay out on a boat. If you are in a forest you should seek shelter in a low area under a thick growth of small trees. If you are in a group of people spread out keeping several yards apart from each other. Stay away from metal objects such as; fences, poles, equipment, pipes, etc. Get rid of metal objects on your body such as; coins, money clips, hair pins, jewelry, etc. Stay away from water. Inside stay away from electrical appliances televisions and telephones. Only use the phone in an emergency.

If you feel your hair stand on end you are in immediate danger of being struck. Unless you can instantly jump inside a shelter drop to a crouching position bending forward and keeping your feet close together with your hands on your knees. The object is to be as low to the ground as possible. but with as little of your body surface touching the ground.

Persons struck by lightning carry no electrical charge and can be handled safely. Lightning often has a paralyzing effect that is temporary. Even though a person appears dead, he or she may be resuscitated. If a victim

is not breathing immediately start mouth to mouth resuscitation every 5 seconds for adults and children. If a person is not breathing and there is no pulse cardiopulmonary resuscitation, or CPR must be administered. This is a combination of mouth to mouth resuscitation and external cardiac compression and should only be undertaken by persons with proper training.

Here are some fallacies and facts.

Fallacy...lightning never strikes twice in the same place.

Fact...there are numerous documented cases of multiple lightning strikes in the same place.

Fallacy...the rubber soles of your shoes or the rubber tires on a car will protect you from being injured by lightning.

Fact...rubber soled shoes and rubber tires provide no protection from lightning. However the steel frame of a hard topped vehicle will protect you if you are not touching metal. If your car is struck by lightning you may suffer injuries and your car may be damaged but you are enormously safer than if you are outside.

Fallacy...you can tell the distance to lightning by counting 1 second per mile after the thunder. Fact...it takes sound 5 seconds to travel 1 mile. So count 5 seconds for one mile, 10 seconds for 2 miles, etc.

## $The Treasurer's Report $

Income for May was $15.00 in dues. Expenses were $22.38 for newsletter postage, QSL Bureau and colored paper for new club brochures. Current balances are:

General fund $454.38
Education fund $448.34

And don't forget to renew your ARRL memberships, too! If you do it through the club you save a stamp and the club gets part of the money from the League.

73, Ralph KD1SM

## CW Practice Nets

the NVARC slow speed net meets Tuesday and Thursday at 7:30 p.m. on 28.123 MHz. Except the third Thursday of the month. That being the club meeting night.

There is now a CW practice session running on the Nashua repeater (147.045) Wednesdays at 8:00 PM. It will be ARRL style and the text will be taken from the Nashua Area Radio Club (NARC) newsletter. You don't need the newsletter to be able to take advantage of the broadcast.

NVARC

**Nashoba Valley Amateur Radio Club**

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Meetings are held on the 3rd Thursday of the month - 7:30 p.m. - Pepperell Community Ctr.
Talk-in 146.490 simplex
442.90 + 100Hz Repeater
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You can leave items on PEPMBX or
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