Ottawa Amateur Radio Club
Groundwave
P.O. Box 8873, Ottawa, Ontario, Canada, K1G 3J2

*Check out our Web Page: **www.oarc.net***

February 2008

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Canadian Ski Marathon is February 9 and 10. If you want to participate contact Richard Hagemeyer, VE3UNW, or go online to radio.admin2.ca.

Don't forget that Homebrew Night is coming up in April. If you have not already got your show and tell project ready, you'd better get started soon. Great glory to the winner.

February's speaker will be Peter Gamble, VE3BQP. His topic is "Building Robust Repeaters for Amateur Radio Emergency Communications".

See you at the meeting.

Ian Jeffrey, VE3IGJ
Editor

One of the contestants in the Annual Trivia Night in December—Bryan Campbell, VE3ZRK.

FEBRUARY MEETING 7:30 pm, Wednesday, February 13th in the Honeywell Room at Ottawa City Hall

In This Issue....

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Articles may be submitted for use in this publication provided that they portray events or activities that promote Amateur Radio. Letters and comments are also welcome. Submissions may be made by mail addressed to the Editor care of the OARC, or by e-mail to "ve3igj@rac.ca". Deadline for submissions occurs three days after the regular monthly meeting of the OARC.

Please support your local radio organisations. They support you!

Club Information

The Ottawa Amateur Radio Club Inc. is an association of Radio Amateurs devoted to the promotion of interest in Amateur Radio communications in the National Capital Area and to the advancement and achievement of club members.

Regular Meetings of the OARC Inc. are held on the second Wednesday of each month (except July and August) in the Honeywell Room (2nd floor of the Old Teacher's College) of Ottawa City Hall (formerly Regional Municipality of Ottawa Carleton Headquarters) on Lisgar Street. Meetings commence at approximately 19:30 hours. Further details about each meeting is elsewhere in this publication.

Executive Meetings of the OARC Inc. are normally held on the first Wednesday of each month at 19:30 hours. Contact the President to confirm the date, time and place of the next meeting.

The CAPITAL CITY FM Net meets every Monday (except some holidays)at 20:00 hours on the club repeater **VE2CRA** to pass traffic and to make announcements of interest to Amateurs in the National Capital Region.

The SWAP Net is a service provided and conducted by Ed Seib, VA3ES. This feature appears on theCapital City FM Net. To list items and make inquiries, got to http://www.ncswapnet.ca. You may reach Ed at 613-738 8924 or e-mail him at va3es@rac.ca.

The POT-HOLE Net is a SSB/HF net sponsored by the Ottawa Valley Mobile Radio Club and is conducted every Sunday at 10:00 hours on **3.760 MHz**. All amateurs are welcome to check in.

The POT-LID CW Net is an informal slow-speed **CW** net sponsored and conducted by Ed Morgan, VE3GX, and meets every Sunday, except during July and August, at 11:00 hours on **3.620** MHz, to promote interest in CW and CW procedures.

The QCWA CHAPTER 70 Net meets every Monday evening at 19:30 hours on repeater VE3TEL **147.030(-).** You do not have to be a QCWA member to participate.

The Ottawa Valley VHF/UHF SSB Net is sponsored by the West Carleton ARC. Look for it every Tuesday night (except the first Tuesday of the month) around 21:00 on **144.250,** (roll calls after net on 50.150, 432.150, 222.150, and 1296.100.) Horizontal polarization is preferred.

VE3TEN

Tuning in the beacon so that it makes sense requires you tune to **28.175** on **cw** and read the tone that is there . The spaces between the elements are the higher tone. If that doesn't work, tune to **28.175.28** on **lower sideband** for better results.

Voice (VHF) 146.94/146.34 100Hz CTCSS required
(UHF) 443.300/448.300

VE3TVA Amateur Fast Scan Television Repeater
Video/audio beacon & input 439.25 MHz (audio sub. 443.75)
Video/Audio output 914 MHz (FM)

IRLP Node 2040 146.94/146.34 (VE2CRA/VE3RC)
(Code 411 for info) (Code 204 for activity)
(Code 88 for time)
For further information please contact the Repeater Chair.

Note: The IRLP link is not connected to ECHOLINK. Please do not try to connect using the alpha keys on your keypad. It just confuses the operator.
Note: The IRLP link is disabled during the Capital City Net each Monday. It is disabled from 2000 to 2145 Mondays except for May to August when the link is disabled from 2000 to 2020.

January Minutes

The president called the meeting to order at 19:30. There were 33 in attendance including 6 guests: Doug Yuill, VE3OCU, Marcus Leech, VE3MDL, and his family Lara, Claudia, Ursula, and Aldus.

The membership chair reported there were 69 paid up members. Membership badges were handed out to those present.

Greg Danylchenko reported o the club operation for the RAC Winter Contest.

Richard Hagemeyer, VE3UNW, announced the upcoming Canadian Ski Marathon, February 9, 10 and asked for volunteers for communications.

George Roach, VE3BNO, is looking for two volunteers with time on their hands to work at home to fill out QSL cards for the RAC station VA3RAC.

Dave Green, VE3TLY, reported on the status of the club project. Kits have been ordered and possible projects were suggested.

Homebrew Night in April was mentioned. Everyone should get their projects ready to present.

Joe Parkinson, VE3JG, presented his DDS VFO synthesizer for Show and Tell. This is based on a PIX processor kit from NORCAL.

The evening's speaker, Marcus Leech, VE3MDL, gave a presentation entitled "An Introduction to Radio Astronomy". The talk also included some of Marcus' experiences with his amateur radio astronomy work.

On a related matter, Marcus is looking for volunteers to help refurbish the radio telescope located at the Communications Research Centre at Shirley's Bay.

The 50/50 draw of $18.50 was won by Diane Bruce, VA3DB. The meeting was adjourned at 21:50.

Dates to Remember

2008	
Feb. 9,10	Canada Ski Marathon
Apr. 9	Homebrew Night
Jun. 11	OARC AGM and Elections
Jun. 28,29	Field Day
Jul. 1	RAC Canada Day Contest
Aug. 30	Hamfest
Sep. 30	Membership Renewal Deadline
Nov. 3	Joe Norton Award Subm. Due
Dec. 27	RAC Winter Contest

RAC Bulletin

John Scott, VE1JS, of Sandy Cove, Nova Scotia is RAC's representative on ARRL's DX Advisory Committee. The committee is currently dealing with questions concerning remotely-operated stations, and whether such operations should count for the DXCC Award. John requires your opinion on the following questions:

(1) Should QSOs made with these remote stations count for DXCC?

(2) Is it necessary to require that operations from remote countries only use the receiver located at the remote location? What if the operator listens to a local receiver, or any other receiver, as well as the one located at the remote transmitting site?

Please contact John at scotts@sandycove-ns.ca for more details of the discussion, or to offer your opinion.

mk's Words

This will be a bit short, since I'm running into deadline. Please excuse the spleing misteaks.

Those of you who were at the last meeting know I missed it due to a cold. Who would have thought that knocking just a day or two out of the schedule of a retired guy would back things up so much.

Anyway, old news: Much fun was had during the Canada Winter Contest. I'm sure Greg brought you all up to date, but it is worth repeating how much fun it is to have a quick yack with hams from all over the place. There is still something about a Canadian contest that attracts people from Europe and the USA in a way that is nice to see. It is especially nice to work the rest of Canada, with enough time to say a quick hello even during a contest. I worked about 50 stations in less than three hours of operating late Friday evening and early Saturday morning. Another thing about contests like this is that they don't have to interfere with the social stuff that goes on during the holidays, as long as you are willing to make a small hole in your sleep schedule. (During the holidays, there isn't much of a schedule anyway.) The point is that you don't have to work the full 24 hours. Even one hour will let you get your share of the fun.

I was scheduled to work on both 80 and 40m CW, but for some reason the band sounded dead on 80. To fix that for next year, I'm trying to put up the 80m dipole that I usually drag out to field day in June. The first step was to launch a tennis ball with fishing line attached to it over the trees in the back yard. With a stiff tail wind and a roof top vantage point it shouldn't be too hard, but I'm no pitcher. Anyway, it cleared the first tree and I'm still trying to work the line over various branches with the aid of the pole I use for a portable mast. Just a few more branches and I'll have enough line to put out the first half of the dipole. Worst case, the second half will have to hang down the side of the house, or go through the attic. One way or another I'll be ready to tackle the Canada winter contest again next December.

Way before that, on Jan 19 we have the next EMRG meeting. Another 160m CW contest is coming up on the 27-28th, and there is the world famous Canadian Ski Marathon coming up way too fast. Something tells me it could be a while before I get to try out the 80m dipole.

Doesn't 2008 sound like the future to you? I mean with atomic robots and flying cars? That 5 year old kid I was in the '60s is getting tired of waiting for that stuff.

73.. Keep looking for a jet pack.

mk

Humour

An atom sees one of his mates looking a bit glum. “What's wrong?” he asks.

“I'm really pissed off”, replies the other atom. “I've lost my electron.”

“Are you sure?” his mate asks.

“I'm positive!”

- Bryan Campbell

Laws of the Natural Universe

Wilson's Law

As soon as you find a product that you really like, they will stop making it.

Brainteaser

This month's puzzle:

			20	21
	6	5	4	
23	7	1	3	?
	9	8	2	
25	24			22

In the diagram above, the numbers from 1 to 25 are to be arranged in the 5 x 5 grid so that each number, except 1 and 2, is the sum of two of its neighbours. (Numbers in the grid are neighbours if their cells touch along a side or at a corner. For example, the "1" has eight neighbours.) Some of the numbers have already been filled in. What number must replace the "?" when the grid is complete? Send your answers to editor@oarc.net.

Last month's puzzle:

In the long division shown below each X is a digit between 0 and 9 (not necessarily the same digit, of course!). Determine the quotient X9X.

```
      X 9 X
X3 | 1 X 2 X 7
     1 X 1
       X 1 X
       2 X X
         1 1 7
         X X X
             2
```

Answer: 795. Congratulations to Bryan Campbell. He was the only one old enough to remember how to do long hand division!

Badges Ready For Pickup

The following name badges are ready for pickup at any upcoming meeting. A few of these date from last January's production run. Most have just been produced this January. See Al MacPhee, our membership director.

VA3PUR	Patricia
VA3RKM	Bob
VE3CT	Croft
VE3EV	Cary
VE3FN	Ray
VE3PJ	Peter
VE3ADM	Roy
VE3DFH	Deborah
VE3EDR	Brice
VE3EPB	Peter
VE3EUR	Pat
VE3GGQ	Edward
VE3GJE	Graham
VE3HEW	Bill
VE3HLB	Mike
VE3NSI	Brian
VE3TIC	Chris
WY4LMB	Leo

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able. In such a situation, the system designer may have to look more closely at the loss characteristics of the transmission line.

The conclusion that can be drawn from this is that the threshold SWR, as seen by the transceiver, is about 2:1. An SWR above 2:1 will result in a power loss that will be noticeable at the receiving end. An SWR of less than 2:1 will not create a noticeable drop in power. In terms of perfection, tuning your antenna system for an SWR of less than 1.5:1 will result in full output power from your transceiver and negligible reflection losses at the antenna. Spending a lot of time trying to reduce your SWR from 1.5:1 to a perfect match of 1:1 is generally not time well spent. From a practical stand point, an SWR of 1.5:1 is indistinguishable from a perfect match of 1:1.

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Understanding Standing Wave Ratios
Ken Larson, KJ6RZ

We worry a lot about Standing Wave Ratio (SWR) in amateur radio since SWR is one indication of how well our antenna system is working. Most HF transceivers and antenna tuners have built in SWR meters.

SWR is a measure of a transceiver's output power (P_f) verses the portion of that power reflected by the antenna system (P_r). If the antenna system is working well, most of the forward power will be radiated by the antenna with very little power reflected back to the transceiver. That is, the reflected power will be much less than the forward power ($P_r << P_f$). The difference between the forward power and the reflected power is the actual or true power (P_t) radiated by the antenna ($P_t = P_f – P_r$), assuming that losses in the transmission line are negligible.

If the output impedance of the transceiver, the characteristic impedance of the transmission line, and the impedance of the antenna itself are all equal (if we have a perfectly matched system), then the SWR will be 1:1. This is the best or ideal case in that all of the transceiver's output power P_f will be radiated by the antenna ($P_r = 0$). In practice, this case is rarely achieved. Normally the antenna system will reflect some power back to the transceiver. Typically then, the first number in the SWR ratio will be greater than 1. If SWR is represented as S:1, then S > 1 in most cases. From a practical point of view, SWR numbers in the range from 1:1 to 1.5:1 (1 < S < 1.5) are very good, meaning that the antenna is radiating most of the power sent to it.

The term Standing Wave Ratio, SWR, relates to the variation in the voltage (or current) along the length of the transmission line from the transceiver to the antenna. If the antenna is perfectly matched to the transmission line, there will be no variation in the voltage. The voltage measured at each point along the transmission line will be the same. However, if the antenna impedance is different from that of the transmission line, then some of the forward power will be reflected by the antenna and travel back toward the transceiver. The forward power traveling in one direction along the transmission line and the reflected power traveling in the opposite direction creates an interference pattern along the length of the transmission line. Because of this interference pattern, the voltage measured at various locations along the transmission line will no longer be the same. At some point the measured voltage will be V_m. A short distance from that point the voltage will be less than V_m. A little further on the voltage will be even less. As we continue to move away from that point toward the antenna, the voltage will reach a minimum value and then start increasing again. If we measure the voltage along the entire length of the transmission line, we find that the voltage varies sinusoidally. Furthermore, this sinusoidal voltage waveform is stationary, it does not move, it appears frozen in place along the length of the transmission line. Thus the name standing wave. The ratio of the highest voltage (V_h) to the lowest voltage (V_l) along the transmission line is called the standing wave ratio (SWR). Thus SWR = $V_h : V_l$. If the impedance of the antenna and the transmission line are the same, there is no reflected power, there is no standing wave, and the voltage everywhere along the transmission line is the same. That is $V_h = V_l$, and SWR = $V_h : V_l = V_l : V_l$ = 1:1, a perfect match. If the impedance of the antenna and the transmission line are not the same, some of the forward power will be reflected by the antenna, a sinusoidal voltage interference pattern will develop along the transmission line, and V_h will not equal V_l . In this situation $V_h = SV_l$, where S is some number greater than 1. Thus in this case the SWR = $V_h : V_l = SV_l : V_l = S : 1$.

The output impedance of commercially available amateur radio transceivers is 50 ohms. The characteristic impedance of the various types of coax cable transmission lines used in amateur radio is also approximately 50 ohms. However, the impedance of the antenna is rarely 50 ohms. The radiation resistance of a quarter wavelength vertical antenna with a very good ground plane is about 35 ohms.

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The radiation resistance of a half wavelength center fed dipole is about 70 ohms. In each case, this is the approximate impedance of the antenna at its resonant frequency. In both cases the antenna impedance is pure resistive (the antenna appears to be a resistor). Above its resonant frequency, the antenna's impedance is inductive (the antenna appears to be an inductor in series with a resistor). Below the resonant frequency, the antenna impedance is capacitive (the antenna looks like a capacitor in series with a resistor). The impedance of the antenna is not equal to 50 ohms in any of these situations. As a result, part of the transmitted power will be reflected by the antenna back to the transceiver.

In terms of SWR ratios, the reflected power $P_r = [(S-1)/(S+1)]^2 P_f$ and the power radiated by the antenna (P_t) is given by $P_t = [1 – [(S-1)/(S+1)]^2]P_f$. As an example, suppose that the power output of a transceiver is P_f = 100 watts and the antenna system is perfectly matched with an SWR of 1:1 (S = 1), then

$P_t = [1 – [(S-1)/(S+1)]^2]P_f = [1 – 0] P_f = P_f = 100$ watts.

That is, all of the transceiver's output power is actually radiated by the antenna. As a second example, suppose that the SWR of the antenna is 3:1 (S = 3). In this case

$P_t = [1 – [(S-1)/(S+1)]^2]P_f = [1 – [(3-1)/(3+1)]^2] 100 = [1 – [1/2]^2] 100 = 75$ watts.

In this example only 75 watts of the transceiver's output is actually radiated by the antenna. The remaining 25 watts is reflected by the antenna back to the transceiver. Expressing the true power P_t actually radiated by the antenna relative to the transceiver's output power P_f as a db power gain (or loss if a negative number) we have

$db = 10 \log (P_t / P_f) = 10 \log [1 – [(S-1)/(S+1)]^2]$.

If the antenna system SWR = 3:1 then the gain = 10 log [0.75] = -1.25 db. Since the gain is negative, the antenna system will actually produce a loss which is what would be expected. What is interesting is that an SWR of 3:1 is considered to be a high undesirable SWR, and yet it results in a loss of only 1.25 db, hardly noticeable to anyone receiving the transmission. Remember that a 3 db gain or lost in power is required at the transmitter before a person receiving the signal will notice any change in received signal strength. However, there is more to the SWR story.

Power reflected by the antenna will travel back through the transmission line and arrive at the output of the transceiver. Modern day semiconductor transceivers do not handle this reflected power well. If the reflected power is sufficiently high, it can severely damage the transceiver's power output transistors. To avoid damage, manufacturers design protective circuits into the power output stage. The protective circuit reduces the transceiver's output until the magnitude of the reflected power is below that which would cause damage to the transceiver. In terms of SWR ratios, transceiver's typically operate at their full nominal output power P_n, for example 100 watts, at SWR values of less than 1.5: 1 (S < 1.5). For SWR values greater than 1.5:1, the transceiver's protective circuitry kicks in, typically limiting the transceiver's forward output power P_f to approximately $P_f = [1/(S-0.5)^2] P_n$, where S > 1.5. If the antenna system SWR is 3:1 and the transceiver's nominal output power P_n = 100 watts, the output power of the transceiver will be limited to $P_f = [1/(S-0.5)^2] P_n = [1/(3-0.5)^2]100 = 16$ watts! In terms of db change, the protective circuitry drops the transceiver's power output by

Power reduction $= 10 \log [P_f / P_n] = 10 \log [1/(S-0.5)^2]$ for S > 1.5.

For an SWR of 3:1, the power reduction = 8 db. This power reduction will clearly be noticeable at the receiving end.

The total loss in power due to a high SWR is the sum of the db power reduction imposed by the

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transceiver's protective circuitry and the loss resulting from reflection at the antenna. Thus:

Total SWR loss = $10 \log [1/(S-0.5)^2] + 10 \log [1 - [(S-1)/(S+1)]^2]$, for S > 1.5.

The interesting observation from this equation, and the above discussion, is that the power reduction imposed by the transceiver's protective circuitry is considerably greater than the loss at the antenna due to mismatch reflection. At an SWR of 3:1, the total SWR loss is 9.25 db, a considerable loss. However, the total SWR loss at an SWR of 2:1 is approximately 4db, which is just barely perceptible at the receiving end. For an SWR less than 1.5:1, power loss is negligible since the transceiver operates at full output power and the mismatch reflection loss at the antenna is less than 0.18 db.

So far the discussion has assumed that the transmission line loss is negligible. But suppose this is not the case. Suppose that there is 3 or 4 db of loss in the transmission line, as might be experienced at UHF frequencies. How will this loss affect SWR readings? A transmission line with loss will cause the SWR measured at the transceiver to be better than the actual SWR at the antenna. It is easy to see why this is the case. The transceiver determines the SWR it sees by comparing the amount of power that it transmits to the antenna verses the reflected power that it receives back from the antenna. However, some of the power that it transmits is consumed by the lossy transmission line, so the power actually reaching the antenna is less than that output by the transceiver. Part of the power arriving at the antenna is then reflected by the antenna. However, since the power arriving at the antenna is lower, because of the lossy line, the amount reflected is also lower. The reflected power is then attenuated by the lossy transmission line as it travels back to the transceiver. The result is the amount of reflected power actually arriving back at the transceiver may be quite small, indicating to the transceiver that the SWR is better than it really is. Working through the numbers illustrates this point. Suppose that the forward output power of the transceiver P_f = 100 watts, the actual SWR at the antenna is 3:1 (S = 3), and the loss of the transmission line L = 4 db. What is the SWR of the antenna system seen by the transceiver? The actual power arriving at the antenna $P_A = \log^{-1} [-L/10] P_f$ = 40 watts. The amount of power reflected by the antenna is $P_{rA} = [(S-1)/(S+1)]^2 P_A$ = 14.4 watts. This reflected power travels back to the transceiver being attenuated by the lossy transmission line as it goes. The amount of reflected power that arrives back at the transceiver is $P_{rT} = \log^{-1} [-L/10] P_{rA}$ = 5.7 watts. The SWR equation seen by the transceiver is $P_{rT} = [(S-1)/(S+1)]^2 P_f$. Rearranging this equation and solving for S yields a value of S = 1.6. So while the actual SWR at the antenna is 3 : 1, the SWR seen by the transceiver is only 1.6 : 1. The antenna system looks a lot better to the transceiver than it actually is. In the chapter on transmission lines (Chapter 24) of the 15th Edition of The ARRL Antenna Book (1988), there is a nice chart (Fig. 18) that allow you to figure out all of this graphically. I assume that this chart has been retained in more recent versions of the antenna book..

This example raises an interesting situation. When perfect no loss transmission line was used, the transceiver saw the real antenna SWR of 3 : 1. As a result of this high SWR, the transceiver's protective circuitry kicked in limiting the transceiver's output to 16 watts. Since the transmission line was lossless, 16 watts was delivered to the antenna. In the above example, the antenna SWR is still 3 : 1, but the transceiver sees the SWR as only 1.6 : 1. The transceiver thinks the antenna system is great, its protection circuitry does not kick in, and it pumps a full 100 watts into the transmission line. Of that 100 watts, 40 watts actually reaches the antenna. With the lossy line over twice as much power is delivered to the antenna. The lossy line actually produces a 4 db system gain! Building a poor antenna and then trying to compensate for it by using lossy coax is no way to design an antenna system. However, it does point out the fact that when designing a system, you have to consider all the parameters. There are broadband applications in which a 3 : 1 antenna SWR may not be avoid-

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Membership Application/Renewal

Ottawa Amateur Radio Club Inc., Box 8873, Ottawa, Ontario K1G 3J2

☐Single ($25, $20 after Feb 1)
☐Family ($30)
☐Junior ($15, under 18 years of age)
☐New Ham (Free if licensed in current Membership year)
☐Emailed *Groundwave* ☐Mailed *Groundwave* (add $5.00)

Please Note: Membership year is September 1 to August 31

Family Name: ____________________ First Name/Initials: ____________________

Address: ____

City: ______________ Prov: ______________ Post Code: ______________

Home Phone: ______________ Work Phone: ______________

E-mail address: ________________________ (For *Groundwave* mailing)

Callsign(s): ____
Qualifications: ☐ Basic ☐ Advanced ☐ Morse Code
Year Licensed: ______________ RAC Member? Yes ☐

Other Family Members

Name: ____________________ Callsign(s): ____________________
Qualifications: ☐ Basic ☐ Advanced ☐ Morse Code
Year Licensed: ______________ RAC Member? Yes ☐

Interests: ____

Comments/Suggestions: ____

All members who are in good standing on or before the December General Meeting will be eligible for a free one-time name badge. Members who wish a second or replacement badge may purchase one at the Club Price (approx $7.50 plus tax). Ordered badges will be available in January.

OARC NAME TAG Yes ☐ Second or Replacement Yes ☐

ORDER DETAILS - As to appear on badge:

First Name ______________ Call Sign ________________