

Ottawa Amateur Radio Club

Groundwave

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April 2016

April home brew night is almost here. Be sure and bring in one of your projects for show and tell.

See you at the meeting.

Ian Jeffrey, VE3IGJ
Editor



Check out our Web Page: www.oarc.net

**Next Meeting 7:30 pm, Wednesday, April 13th
in the Colonel By Room at Ottawa City Hall**

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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 which is on the second floor 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 are noted 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 146.940(-)** to pass traffic and to make announcements of interest to Amateurs in the National Capital Region.

The Rubber Boot Net runs week days at 07:30 on VE3MPC, 147.150 + hosted by Mike, VA3TJP. The Rubber Boot net has been running since the early 1980's and is popular for the early risers and the go to work crowd.

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 that 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 VE3MPC **147.150(+)**. 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.

The Phoenix Net meets Tuesday evenings at 20:00 on VE3MPC (147.150+, no tones).

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.

The Ottawa Amateur Radio Club bulletin "Groundwave" is published and distributed to club members. Publication dates may vary but it is hoped that the bulletin arrives at its destination before the events listed in it have expired. The bulletin is not published for July and August when meetings do not occur. Every effort is made to provide accurate information in the bulletin, however we are all human and mistakes can be made. The OARC accepts no responsibility for any damages that may result from this. The opinions expressed in this bulletin are those of the author.

Voice (VHF) 146.940/146.340 100Hz CTCSS required
 (UHF) 443.300/448.300 100Hz CTCSS required

VE3TVA Amateur Fast Scan Television Repeater
 Currently off the air and looking for a new home.

IRLP Node 2040 146.940/146.340 (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 Monday night Capital City FM Net from 20:00 to about 21:45.



February Minutes

February 10, 2016

1937 Meeting started by Glenn VE3XRA

Guests

Jocelyn VE3JCT

Georges VA3LZY

Membership (Janice VA3PAX)

Has lots of unclaimed badges. Will probably put in a new order for badges for those who have ordered recently.

Battery Keeper Project (Wayne VE3CZO)

Have completed the third session. This coming Saturday will be the 4th session. In the third session, Glenn had a presentation of the Battery Keeper hardware and will cover the firmware this coming Saturday. If anyone needs help, Wayne is available via email. Wayne is at the initial stages of designing another project involving charging a secondary battery from a car's electrical system, called "A Battery Top-Up for Rovers", and is requesting vehicle battery data from any interested members. What Wayne needs is the battery voltage with the car engine off, the battery voltage with the car engine at idle, and the battery voltage with the car engine at a medium rpm such as 3000rpm.

Wayne's email: ve3czo@gmail.com

VHF Super Conference 15-17 April (Glenn VE3XRA) To be held in Sterling, Virginia (near Washington DC) Several OARC members will be attending. Further information: vhfsuperconference.com or contact Glenn.

Dayton Hamvention 20-22 May 2016 (Glenn VE3XRA) Several members will be attending again this year. For further information, please contact Glenn.

CN Cycle for CHEO: Sunday, May 1 (Harold VA3UNK) Time commitment: 0730 to 1300. Looking for bike mobiles as well as fixed locations. Low key event but a lot of fun. Three lengths of cycling (15km, 35km and 70km), plus 2K and 5K

Dates to Remember

2016

- Feb. 20, 21 Canada Ski Marathon
- Apr. 13 Homebrew Night
- Jun. 8 OARC AGM and Elections
- Jun. 25, 26 Field Day
- Jul. 1 RAC Canada Day Contest
- Sep. 10 Hamfest
- Sep. 30 Membership Renewals Due
- Nov. 1 Joe Norton Award Subm. Due
- Dec. ?? RAC Winter Contest

walks. Starts at the War Museum, heads west on the Sir John A Macdonald Parkway, then south on the Queen Elizabeth Driveway and back north on Colonel By Drive, then east on the Sir George Etienne Cartier Parkway, and back to the War Museum. Any members interested in volunteering for this event should contact Arthur VA3BIT at va3bit@rac.ca. For members who would like to participate in raising funds for CN Cycle for CHEO, please refer to their website at cncycle.ca.

Lanark Highlands Forest Rally: Saturday, May 7 (Mike VE3FFK) A car rally in McDonalds Corners (near Perth) that could use many radio volunteers. For more information contact Mike or their website at: lhfr.ca

Rideau Lakes Cycle Tour: June 11-12 (Mike VE3FFK) A weekend bicycle ride from Ottawa to Kingston on Saturday, and back to Ottawa on Sunday. Need mobiles in tour vans as well as radio operators at various fixed points. For further information, please contact either Mike or Tyler VA3DGN. General information on the Tour can be found at www.ottawabicycleclub.ca/rlct

Lap the Gats June 19 (Mike VE3FFK) A charity bicycle ride for raising funds for Parkinsons research that usually has several hundred cyclists on a closed road course in Gatineau Park. A low key event that needs about 6-8 hams. For further information, please contact Mike.

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mk's Word

Although past issues have seen me write about the omni-directional gain antenna, the software defined antenna, and even the Tree Elephant Yagi for the Hey Geoff! bands, there is still a little room to improve the old signal squirter -or at least some of the definitions we still use. With that, let me introduce you to the concept of polarization. Not that old vertical, horizontal, and circular stuff either.

We all remember the good old days when horizontal polarization was defined as "when the E field is parallel to the ground" and for vertical it was perpendicular. That was ok back when we dragged our knuckles on the ground and our flying machines went almost all the way to the stratosphere. But what use is that when you are in space, and good old ground isn't even visible? If the antenna is pointed straight up you can't seriously say it is horizontal, can you? If we're goin' to Mars and stuff, we need a better definition.

So here goes: North Polarization (Ta Daa) If your antenna (or its E field if you insist) is parallel to the line between the star Polaris and the Southern Cross or thereabouts, it is North polarized. If it is at right angles to this, it is NotNorth polarized. For circular polarization, let's just say that if the antenna is pointed at Polaris and the E field goes around like the fingers on your left hand when your thumb is pointed at the same star, it is Left Hand Circular Polarized. If not, it is... well, I will let a smart person somewhere decide what to call the other one.

Now, if you stick a dipole on a satellite and give it a spin, is it circularly polarized? What if you spin it really fast, like a million times a second for a 1 MHz antenna? What if you spin it in the other direction? I dunno either.

73 Happy April
mk VE3FFK

Email Inventor Dies

Internet Hall of Famer **Ray Tomlinson** died on Sun Mar 6, 2016.

Tomlinson was the man who basically invented email as we know it today, including making the choice to use the "@" sign in an email address. He was 75.

Tomlinson invented email, a system where a user on one network could send a message to someone on another network, in 1971.

He proceeded to win many awards over his lifetime for email. But he couldn't say what the first email ever sent actually said.

When asked about it in an interview with the New York Times in 2009, Tomlinson explained, "I sent a number of test messages to myself from one machine to the other. The test messages were entirely forgettable and I have, therefore, forgotten them."

Ode to the Key

In days of old when ops were bold
and sidebands not invented,
the message passed by pounding brass
and all were well contented.

-- Unknown

"The optimist proclaims that we live in the best of all possible worlds; and the pessimist fears this is true."

-- [James Branch Cabell](#)



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Groundwave

April 2016

Desktop Electronic Circuit Factory

In the 3D world we first had subtractive manufacturing machining, where a block of steel was machined down to any detailed object. Now, we have 3D additive manufacturing where a computer controlled printer is used to print layers of various materials to create solid objects.

Similarly, in the printed circuit board world, we originally had subtractive manufacturing where copper was chemically etched from, or in some cases machined directly off, the surface of a copper-clad fiberglass board. Now, we have additive manufacturing where a computer controlled 2D printer lays down tracks of conductive "ink" on different types of substrate including traditional FR-4 board.

A new product, Squink, from BotFactory Inc., uses an inkjet printhead and low resistivity conductive ink to fabricate circuit traces in just a few minutes on a variety of stiff and flexible substrates. Gerber or image files

(JPEG, BMP, PNG) are loaded into the printer's web interface which can then print them on the substrate in minutes.

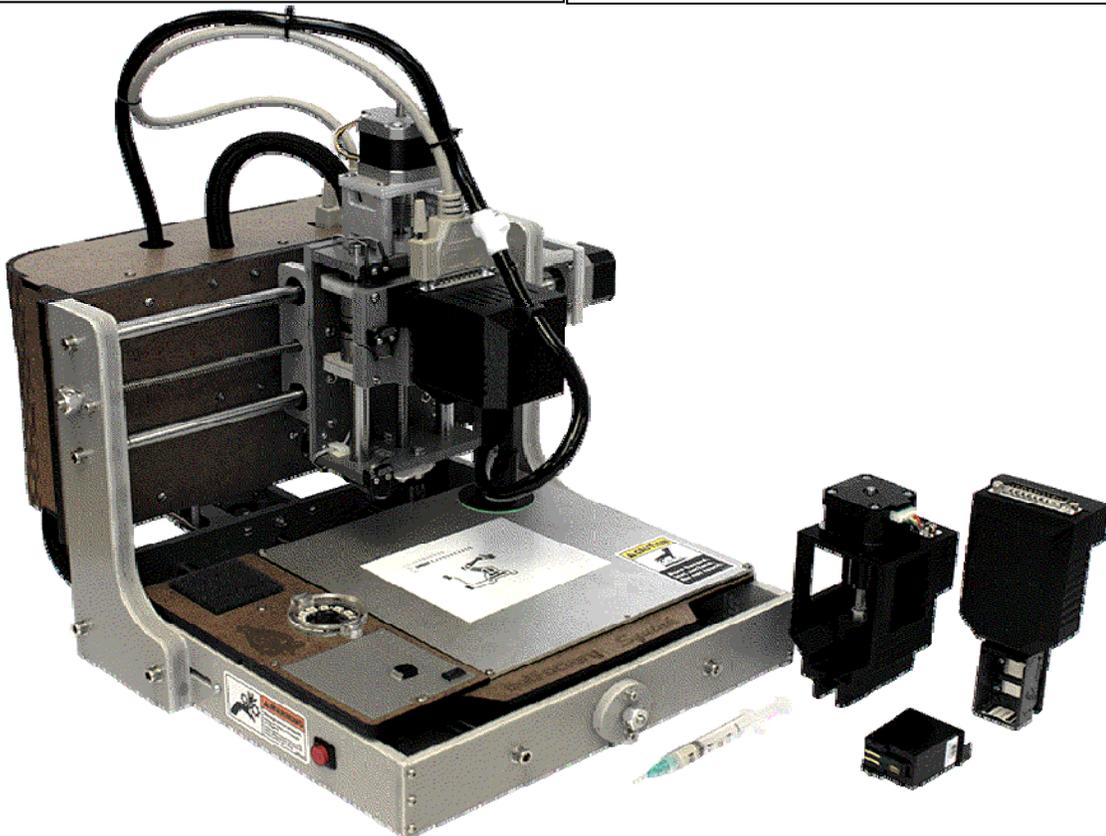
Then, using an extruder toolhead, it can lay down solder paste or conductive glue on printed or pre-fab boards. The pasting algorithm calculates the amount of paste needed for each component by analyzing the shape of the pads.

The Pick and Place feature to place components (surface mount only at the present) on the printed circuit uses on-board computer vision. It corrects offsets and rotation errors before placing every component.

There is no manual for Squink, as every step of the process is explained using pictures and animations. Connect to Squink via Ethernet or WiFi and use your browser to interface with the machine. Squink can be updated of the internet as well.

Boards up to 6" x 6" with feature size down to 10 mil (0.254 mm) can be printed. Ink resistivity can be either 50 or 40 mohms/sq. The smallest 10 mil traces are rated at up to 250 mA.

The product retails for USD 3,000. For more details see <https://www.botfactory.co>





Wireless 101: Basic Physics of Radio

By Lou Frenzel

With all the wireless design activity going on these days, it makes me wonder just how many engineers are actually educated in wireless principles anymore. Not many, I suspect. From what I have seen of EE education, the curricula are still based on classical circuit theory, basic devices, some linear, and a massive dose of digital, along with microcontrollers and related software programming. No radio theory.

For this reason, I thought I would explain one basic wireless concept that might help illustrate how wireless works: free space path loss (FSPL). If you are working on an Internet-of-Things (IoT) or other wireless product, this may be helpful. And you won't have to learn Maxwell's equations.

FSPL is the attenuation a radio signal experiences on its way from transmitter (Tx) to receiver (Rx). It is usually expressed in dB. Radio signals in the VHF, UHF, microwave, and millimeter-wave frequency bands travel in a straight line that we call line of sight (LOS). In general, the attenuation is proportional to the square of the distance (d) between the Tx and Rx. The attenuation is also proportional to the frequency of operation (f).

FSPL determines how far you can transmit reliably for a given factors such as transmitted power (P_t), received power (P_r), transmitter antenna gain (G_t) receiver antenna gain (G_r), and receiver sensitivity (R). The power is in watts, of course, and antenna gains are power ratios. Antenna gains are unity if you assume an isotropic source (spherical radiation pattern). If you use a dipole or its equivalent, the power ratio is 1.64. Both antennas should have the same polarization.

All these factors are summed up in what is known as the Friis formula:

$$P_r = P_t G_t G_r \lambda^2 / 16 \pi^2 d^2$$

Distance (d) is given in meters and wavelength is also in meters. Remember $\lambda = 300 / f_{\text{MHz}}$.

The key takeaways from this formula are that the power at the receiver gets smaller as distance is increased and as the wavelength gets shorter. In other words, for a given transmit power and fixed antenna gains, the signal at the receiver gets smaller at the higher frequencies. The higher the frequency, the greater the FSPL. Higher frequencies are great, as they offer lots more bandwidth and antennas are shorter. The range is more limited, however.

The Friis formula is messy to handle, so a more convenient form has been created using decibels.

$$\text{FSPL (dB)} = 32.45 + 20 \log(f) + 20 \log(d)$$

The frequency (f) is in MHz and distance (d) is in kilometers.

As an example, what is the FSPL for a 2.4 GHz signal at 100 meters?

$$\text{FSPL (dB)} = 32.45 + 20 \log(2400) + 20 \log(0.1) = 32.45 + 67.6 - 20 = 80 \text{ dB}$$

Now that you know the path loss, you can consider some other factors like transmitter power (P_t). You can express it in dBm (milliwatt reference). Assume a power of 400 mW.

$$\text{dBm} = 10 \log(P_t / 1\text{mW}) = 10 \log(400) = 26 \text{ dBm}$$

Knowing the path loss and the transmitter power, you can figure the received power. P_r will also be in dBm.

$$P_r = P_t - \text{FSPL} = 26 - 80 = -54 \text{ dBm}$$



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Now let's add the antenna gains. The formulas assume isotropic antennas. This gives an antenna gain (G) of 1. A dipole or its equivalent has some gain—specifically, a 1.64 power ratio that translates to a gain of 2.15 dB. If both transmitter and receiver use a dipole, the calculation goes like this:

$$P_r = P_t + G_t + G_r - \text{FSPL} = 26 + 2.15 + 2.15 - 80 = -49.7 \text{ dBm}$$

The missing quantity in all this is receiver sensitivity (R). This is a specification of all wireless receivers, and is the smallest signal the receiver can process. It is given in - dBm. Assume a value of -98 dBm. As you can see, since -47 dBm is greater power level than -98 dBm, the receiver will get enough power with a good margin.

Using the transmit power, receiver sensitivity, and antenna gains, you can compute the maximum path loss for this combination.

$$\text{FSPL (max)} = P_t + G_t + G_r - R = 26 + 4.3 - (-98) = 128.3 \text{ dB}$$

From this figure you can rearrange the FSPL formula and calculate the maximum possible range (d) for this situation. The math is left to you but the range is 25.8 km.

For any given design, you can use this process to get a first approximation how your system will work. You can play around with the factors and optimize your design. Just remember we are using LOS FSPL. There are no obstacles between transmit and receive antennas. If you introduce walls, trees, etc., you will need to increase path loss accordingly. Reflections and multipath, diffraction, and scattering are also not accounted for. Attenuation estimates for these factors are available, but beyond the scope of this blog.

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MS Bike Tour Aug 6-7 (Mike VE3FFK) Another bicycle tour that runs from Metcalfe to Cornwall on Saturday, and back to Metcalfe on Sunday. Most volunteers are at fixed locations. We could use 8-12 hams for this event. Please contact Mike for more information.

OARC Annual General Meeting in June (Glenn VE3XRA) Would like people to consider executive positions they may be interested in. At least one directors position will be vacant. As well, we urgently need a replacement Groundwave editor as Ian will be retiring from the position at the end of this membership year.

Field Day (June 25-26) (Glenn VE3XRA) The Field Day Committee currently has four members but needs more people to help out. If interested please contact Glenn or Greg VE3YTZ.

Carp Hamfest: Saturday, September 10 (Ed VE3WGO) Need about 25 volunteers. Please think about helping out and Ed will bring a sign-up sheet at the April meeting.

RAC General Meeting: Saturday, Sep 10 (Glenn VE3XRA) To be held in Newfoundland in Hearts Content to coincide with the 150th anniversary of the Cable Museum.

Homebrew Night: April meeting Have broadened the definition of eligible homebrew presentations to include methods and procedures for ham radio, as well as hardware and software projects. We need judges to determine winners for the Clare Fowler award and People's Award.

Have & Wants—Wayne needs statistics for his Battery Top-Up project. Please contact Wayne at ve3czo@gmail.com.

Recent Contact—Bryan VE3QN worked Rodrigues Island (3B9) on 20m CW.

SSB DX Contest (last weekend) Bryan: Just in for the fun of it. 150 contacts. Band condi-

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tions good. Managed to work Cape Verde, Morocco. Most contacts were from South America.

Greg VE3Y TZ: Fun Contest. About 275 contacts including Senegal, Japan and Hawaii. The 10m and 15m bands were open. A good contest for beginners.

Ontario QSO Party June 16
WW WPX 26 March (SSB)
WW WPX 28 May (CW)

International Amateur Radio Day: April 18 (Glenn VE3XRA) Celebrated on this day due to IARU being founded on April 18, 91 years ago. The traditional HF bands (160m, 80m, 40m, 20m, 10m) we use date back to two years after the IARU was founded.

Show & Tell—None

Announcements:

Norm VE3LC: OVMRC mini-fleamarket at the aviation Museum next Wednesday (16 March).

Canadian Ski Marathon—Richard VE3UNW has CSM pins and books for anyone needing/wanting them.

Presentation: An Introduction to Extension Cords by Greg VE3Y TZ and Rick VE3IHI Greg started with a safety video then continued with how to read extension cord labelling. Rick followed Greg's presentation with a practical demonstration on how to coil an extension cord so as to avoid kinks and damaging the internal construction of the cord. The procedure is sometimes called the "Over and Under" technique. Demonstration videos can be found on YouTube.

Glenn closed the meeting at 2105.

Minutes taken by VA3BIT



PAVE PAWS

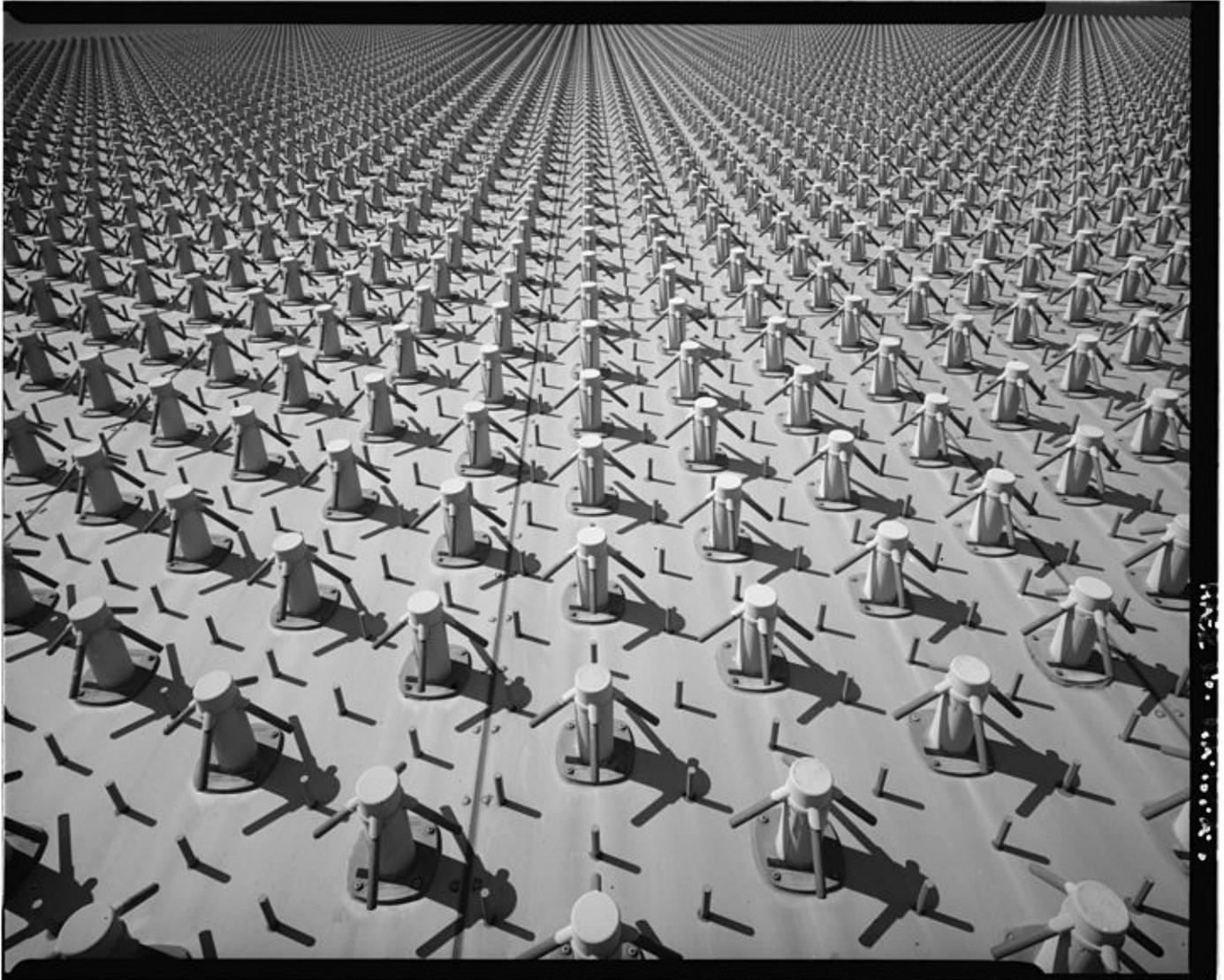
PAVE PAWS (Phased Array Warning System) at Cape Cod

The unique aspect of this radar system is the dual-faced phased array antenna technology. This system differs from a mechanical radar, which must be physically aimed at an object in space to track or observe it. The phased array antenna is in a fixed position and is part of the exterior building wall. Phased array antenna aiming, or beam steering is done rapidly by electronically controlling the timing, or phase of the incoming and outgoing signals. Controlling the phase through the many segments of the antenna system allows the beam to be quickly projected in different directions. This greatly reduces the time necessary to change the beam direction from one point to another, allowing almost simultaneous tracking of multiple targets while maintaining the surveillance

responsibility.

The large fixed antenna array using its beam focusing, improves system sensitivity and tracking accuracy. A phased array antenna, as any other directional antenna, receives signals from space only in the direction in which the beam is aimed. The maximum practical deflection on either side of antenna center of the phased array beam is 60 degrees. This limits the coverage from a single antenna face to 120 degrees. To provide surveillance across the horizon, the building housing the entire system and supporting antenna arrays is constructed in the shape of a triangle. The two building faces supporting the arrays, each covering 120 degrees, are therefore able to monitor 240 degrees. The array faces are also tilted back 20 degrees to allow for an elevation deflection from three to 85 degrees above the horizon. The lower limit provides receiver isolation from signals returned from ground clutter and for environmental microwave radiation hazard protection of the local area.

The picture below shows a close-up of the array.





2015-2016 Membership Application/Renewal
 Ottawa Amateur Radio Club Inc., Box 8873, Ottawa, Ontario K1G 3J2

- Single \$25 (\$20 after Feb 1, 2016)
- Family \$30
- Junior \$15 (under 18 years of age)
- New Ham - Free (if licensed in current Membership year)
- Emailed *Groundwave* Mailed *Groundwave* (add \$10.00)

Please Note: Membership year is September 1, 2015 to August 31, 2016.

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 \$10.00 plus tax). Ordered badges will be available in January.

Do you want an OARC NAME TAG? Yes Second or Replacement Yes

ORDER DETAILS - As to appear on badge:

First Name _____ Call Sign _____