

Ottawa Amateur Radio Club

# Groundwave

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*Merry Christmas and Happy New Year*

December 2013

In what is now an annual tradition for the December meeting, Trivia Night will be held on December 11 and just the way you like it - loud and crazy. So form your teams, and make a noisemaker! For the benefit of new members, this means that, instead of listening to a speaker, you will be challenged to answer a broad range of questions related to Amateur Radio, à la Reach for the Top. As per usual, you can either play individually, or else form teams of any manageable size (max 4 players). Don't forget to come up with a goofy radio-related name for your team (how about "One Antenna with Three Radials"?). Prizes will be given to teams who answer the most questions correctly and to runners-up. Each individual or team will need to bring a noisemaker of some kind, in order to signal the moderator when you have a right answer. Your noisemaker could be as primitive as a boy scout whistle or as complex as a buzzer circuit. The more homebrew it is, the better; that way you can enter it in the mini homebrew contest afterwards. If you forget your noisemaker, don't worry—one will be provided. The evening promises to be great fun as always.

Janice Neelands, VA3PAX



*Check out our Web Page: [www.oarc.net](http://www.oarc.net)*

**Next Meeting 7:30 pm, Wednesday, December 11th  
in the Colonel By Room at Ottawa City Hall**

<b>In This Issue....</b>			
Club Information	2	Romulan Cloaking Device	6
Minutes	3	Solar Cycle Prediction	7
Dates to Remember	3	Satellite Launch	8
mk's Words	4	Membership Form	9
Hams on TV	5		

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Ottawa Amateur Radio Club

# Groundwave

*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.*

**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 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.

*Please support your local radio organisations. They support you!*

**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 SWAP Net** is a service provided and conducted by Ed Seib, VA3ES. This feature appears on the Capital 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](mailto:va3es@rac.ca).

**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.

**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) 146.94/146.34 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 146.94/146.34 (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.



## November Minutes

November 21, 2013 meeting of the OARC

Vice President Tyler Tidman (VE3DGN) in the absence of President Glenn MacDonell opened the meeting at 7:30 pm.

Tyler invited Past President Dave Green (VE3TLY) to brief the members on the status of the Diefenbunker Project (For those not following the Diefenbunker project, briefly, the OARC had agreed to pay 50% towards the installation of a tower.) Dave reported the Diefenbunker Executive could not agree to proceed and fund the remaining 50% and therefore we will not see construction this year. Dave also mentioned that the club will be operating the Diefenbunker station (VE3CWM) during the Canada Winter Contest (see <https://www.rac.ca/en/rac/programmes/contests/files/2013%20Winter%20Contest%20Rules%20and%20Entry%20Form%20-%20English-French.pdf>) on Saturday, December 28, 2013. Any club member interested in joining the fun can contact Dave and he will see to it that you are taken care of.

Janice Neelands (VA3PAX) reminded everyone that per tradition, the December meeting will be Trivia Night. Janice went over the rules, which are found elsewhere in this month's Groundwave.

Clayton Smith (VE3IRR) reminded everyone of the club project which this year will investigate Software Defined Radio. There will be 6 sessions starting in late January/early February. Those participating will receive a dongle, an inter-connect cable and a USB stick with SDR software. The dongle and cable should be available by the December meeting, the USB stick will be provided in January. For those interested in exploring the HF bands, an up-converter is available, but partici-

## Dates to Remember

### 2013

- Sep. 7 Hamfest
- Sep. 30 Membership Renewals Due
- Nov. 1 Joe Norton Award Subm. Due
- Dec. 28 RAC Winter Contest

### 2014

- Feb. 8, 9 Canada Ski Marathon
- Apr. 9 Homebrew Night
- Jun. 11 OARC AGM and Elections
- Jun. 28, 29 Field Day
- Jul. 1 RAC Canada Day Contest

pants are on their own. Interested members should see Wayne Getchell (VE3CZO) with their \$45 to get in on the fun.

Tyler reminded the membership that the club is still looking for a Secretary. Anyone ready to take the job will be given a free club membership for the 2013-2014 year.

Mike Kelly (VE3FFK) told members that the Tall Pines Rally is coming up. Volunteers are always welcome. Anyone interested should see Mike.

Jamie Cashin (VA3JME) explained that a DMR repeater was being installed at VE3TST. Anyone interested can obtain info from Michael Myers (VE3ORF). Jamie also reported that with the recent good conditions, a German station was heard on their 10 metre repeater.

Norm Rashleigh (VE3LC) told members that with his new Tentec Omni, remote HF operation was now possible. Anyone interested can contact Norm.

George Roach (VE3BNO) announced the passing of Ed Morgan (VE3GX SK) a bastion

*(Continued on page 4)*



## mk's Word

It's deadline time again, and I have no column BUT I was yakking with someone and we got on to the topic of how "the rig" actually works. So I wrote down my understanding of how the receiver in my IC 7200 wonder toy does what it does. After writing it all out, I thought it would be an interesting thing to share with the Groundwave crowd.

Those DSP gurus among you can correct me on the points I got wrong, and fill me (and the rest of us) in on the weak point in this description, which is the demodulation bit. The rest of you can correct me on whatever you can find, especially if I overlooked something. For the rest of the gang out there, compare it with what your first receiver looked like. Did your first commercial rig's manual have a "How it works" page, or pages? How does this compare with the receiver you studied to get your ticket?

Omitted from this description are the Preamp, attenuator, display, power supply, the details of how the direct digital synthesizer generates the local oscillator signals and the details of digital to analog and analog to digital conversion.

From the antenna:

Low pass filter the incoming RF to chop off everything over 60MHz. Shove the remaining RF through one of 9 filters, depending on what frequency is on the front panel frequency display.

Run the RF through a mixer/filter/amplifier string to bring the desired signal to 64.455 MHz for good image rejection. Run this signal through a mixer/filter/amplifier string to bring the desired signal to 455 MHz for most of the gain and to narrow the bandwidth a bit more. Do it all again at 15.625 kHz, so the signal is finally low enough for the DSP to be able to keep up.

This is where the digital toys start to work. Digitize the incoming 16 kHz signal. Do a Fourier transform on the resulting data. Remove any frequency components outside of the range requested by the width and bandpass tuning controls. Remove any frequency components as required by the manual or automatic notch requests. Remove any frequencies that do not have strong correlations with previous time samples (frequency components that appear and then disappear within a few milliseconds). This is the noise reduction function. The higher the noise reduction, the longer a signal must be present before it will be allowed to remain in the data.

Remove any low frequency components that have large harmonic components. This process removes narrow, low frequency signals and their related harmonics. It is the noise blanker. Apply an AGC algorithm to the remaining data by adding a number to each data point until for one point the value is some maximum number. Save the value of this added number (the AGC value) for further processing. Do whatever processing is needed to make sense of the SSB, AM or CW modulation. Do an inverse Fourier transform on the resulting data.

Based on the AGC number, generate an analog AGC signal for the analog 455 kHz and 64 MHz IF stages. Put the data through a digital-to-analog converter to present audio to the audio frequency chain for delivery to the speaker.

In putting this together I notice that there is nothing in the manual that says HOW the radio does what it does. Are they trying to save paper, or have they decided we don't need to know how things work any more?

73 mk VE3FFK

(Still not afraid to take the covers off of equipment)

*(Continued from page 3)*

of the Ottawa Amateur radio scene. Ed was particularly involved with the Ottawa Valley Mobile Radio club. The OARC membership expressed its condolences to Ed's XYL, Doreen.

On that sad news, George then took the floor and spoke on this evening's major topic, which was the History of the First Ten Years of club repeater VE2CRA. The membership began to appreciate that VE2CRA was very cutting edge technology-wise for repeaters at its time. Thanks for the presentation George and thanks for all the work you put into installing VE2CRA. It was a significant effort.

Ron, Margaret's (VA3VXN) father, was this evening's only guest. Harold (VE3UNK) was the 50/50 winner. He took home the princely sum of \$19.

Minutes prepared by: Greg VE3Y TZ



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December 2013

## Hams on TV

### TV Show Featuring Fictional Ham Sparks Crop of New Hams

Fans of the ABC Television show “Last Man Standing” may be aware that its main character, “Mike Baxter” — played by Tim Allen — is supposed to be a radio amateur, KAØXTT. While it may come as no surprise that the sitcom’s producer is a ham — John Amodeo, NN6JA — several radio amateurs also are on the production crew, and their number just increased, with help from the Greater Los Angeles Amateur Radio Group (GLAARG) VEC. The show’s “Thanksgiving” episode, which airs Friday, November 22 (8 PM ET), will feature a scene with “Baxter” in his basement ham shack. Amodeo said that for the first time in the series, Baxter will briefly talk on the radio. In response, viewers will hear a pileup created by using the voices of hundreds of real hams, sent in to the production company.

In the scene, the Mike Baxter character appears with his grandson “Boyd,” played by Flynn Morrison. The episode was shot in mid-October. According to Amodeo, Mike heads to his basement ham shack to escape a houseful of guests waiting for Thanksgiving dinner to be served. This episode of the show is only the second to include ham radio as a story element and the first in which Tim Allen’s character is shown operating his ham station.

At an exam session on November 9, the “Last Man Standing” crew added eight new Technician class hams to its crew as well as its first General upgrade. GLAARG volunteer examiners Norm Goodkin, K6YXH; Naomi Goodkin, WB6OHW, and Rob Antonacci, AA6RA, administered the test session. Including the additional new hams, the show’s behind-the-scenes crew complement now boasts 14 Technician, one General, and two Amateur Extra class operators.

In “Last Man Standing,” Allen’s character Mike, a pickup-driving sporting goods marketing manag-

er, must spend more time in his female-dominated household after his wife gets a promotion at work. The couple’s three daughters are not prepared for the shift to his stricter parenting style.

From the ARRL Website

*(Continued from page 7)*

The smoothed aa index reached its minimum (a record low) of 8.4 in September of 2009. Using Ohl's method now indicates a maximum sunspot number of  $70 \pm 18$  for cycle 24. We then use the shape of the sunspot cycle as described by Hathaway, Wilson, and Reichmann [Solar Physics 151, 177 (1994)] and determine a starting time and amplitude for the cycle to produce a prediction of the monthly sunspot numbers through the next cycle. We find a maximum of about 65 in the Summer of 2013. The predicted numbers are available in a text file, as a GIF image, and as a pdf-file. As the cycle progresses, the prediction process switches over to giving more weight to the fitting of the monthly values to the cycle shape function. At this phase of cycle 24 we now give 80% weight to the amplitude from curve-fitting technique of Hathaway, Wilson, and Reichmann Solar Physics 151, 177 (1994). That technique currently gives similar values to those of Ohl's method.

Another indicator of the level of solar activity is the flux of radio emission from the Sun at a wavelength of 10.7 cm (2.8 GHz frequency). This flux has been measured daily since 1947. It is an important indicator of solar activity because it tends to follow the changes in the solar ultraviolet that influence the Earth's upper atmosphere and ionosphere. Many models of the upper atmosphere use the 10.7 cm flux (F10.7) as input to determine atmospheric densities and satellite drag. F10.7 has been shown to follow the sunspot number quite closely and similar prediction techniques can be used. Our predictions for F10.7 are available in a text file, as a GIF image, and as a pdf-file. Current values for F10.7 can be found at: [ftp://ftp.geolab.nrcan.gc.ca/data/solar\\_flux/daily\\_flux\\_values/fluxtable.txt](ftp://ftp.geolab.nrcan.gc.ca/data/solar_flux/daily_flux_values/fluxtable.txt).

From <http://solarscience.msfc.nasa.gov>



## Romulan Cloaking Device

Michigan Tech News, March 22, 2013

Michigan Technological University's invisibility cloak researchers have done it again. They've moved the bar on one of the holy grails of physics: making objects invisible.

Just last month, Elena Semouchkina, an associate professor of electrical and computer engineering at Michigan Tech, and her graduate student, Xiaohui Wang, reported successful experimental demonstration of the use of non-conductive ceramic metamaterials to cloak cylindrical objects from microwave-length electromagnetic waves. Previously, Semouchkina had designed a non-conductive glass metamaterial cloak that worked with infrared frequency waves, which are shorter than microwaves.

Then, scarcely was the ink dry on their report in the IEEE Microwave and Wireless Components Letters, a journal published by the Institute of Electrical and Electronics Engineers, when they developed a different cloaking approach and published it in the American Institute of Physics journal, Applied Physics Letters.

This time, they used ordinary dielectric materials such as ceramics having differing dielectric permittivity—a measure of the response of a substance to an electrical field—instead of metamaterials, which are artificial materials with properties not found in nature. They found that they were able to cloak larger cylindrical objects and cloak them more effectively than they had using metamaterials.

This research, just published online and supported by the National Science Foundation (NSF), also won Wang an honorable mention in an IEEE student papers competition. Wang's paper will be listed in the Technical Program Booklet at an upcoming IEEE International Symposium on Antennas and Propagation. He received \$1000 IEEE grant to travel to the symposium to present this work.

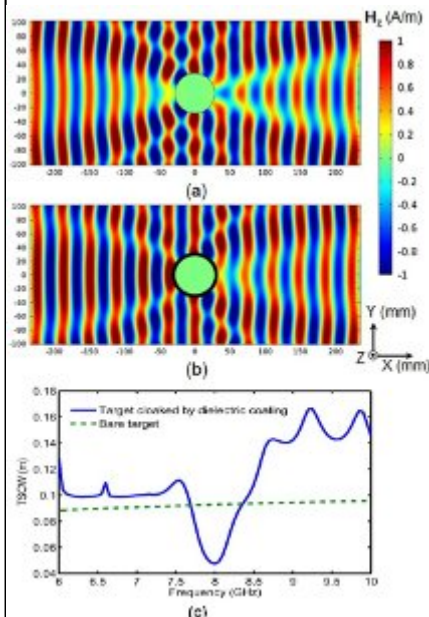
According to their report in the Applied Physics Letters article, Semouchkina and Wang designed a new kind of cloak that uses a very thin multilayer dielectric coating made of natural material, not metamaterial. They compared it through mathematical analysis and computer simulations to a metamaterial cloak of similar size but based on a different principle, called transformation optics.

"The new cloak demonstrated better cloaking efficiency than did a similarly sized metamaterial cloak designed by using transformation optics relations," said Semouchkina.

The new cloak outperforms previous cloaks, which caused more reflection and more shadows, as well as distortion of the electromagnetic waves, the researchers reported. It is eight to nine times thinner than metamaterial cloaks and much simpler to make, they noted.

"The multi-layer dielectric cloak could easily be scaled to work in a variety of frequency ranges," Semouchkina said. "The design procedure developed in this work could be used to further advance the cloak parameters and for adjusting it to practical needs."

Cloaking may sound like a magic trick or something out of a movie, but it could prove useful in national security, law enforcement or other applications.

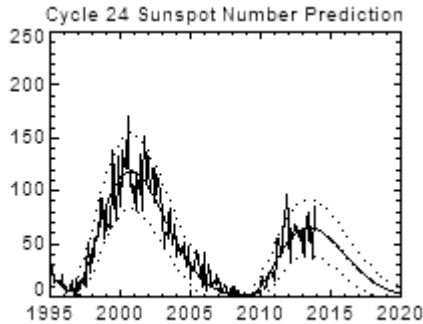


a) shadow behind metal cylinder under plane wave illumination; b) front reconstruction after passing cylinder cloaked by thin multilayer dielectric; c) total scattering cross width for cloaked & bare cylinders. (b) & (c) demonstrate the cloaking effect.



## Solar Cycle Prediction

The current prediction for Sunspot Cycle 24 gives a smoothed sunspot number maximum of about 65 in the Summer of 2013. The smoothed sunspot number has already reached 67 (in February 2012) due to the strong peak in late 2011 so the official maximum will be at least this high. The smoothed sunspot number has been flat over the last four months. We are currently over four years into Cycle 24. The current predicted and observed size makes this the smallest sunspot cycle since Cycle 14 which had a maximum of 64.2 in February of 1906.



Predicting the behavior of a sunspot cycle is fairly reliable once the cycle is well underway (about 3 years after the minimum in sunspot number occurs [see Hathaway, Wilson, and Reichmann *Solar Physics*; 151, 177 (1994)]). Prior to that time the predictions are less reliable but nonetheless equally as important. Planning for satellite orbits and space missions often require knowledge of solar activity levels years in advance.

A number of techniques are used to predict the amplitude of a cycle during the time near and before sunspot minimum. Relationships have been found between the size of the next cycle maximum and the length of the previous cycle, the level of activity at sunspot minimum, and the size of the previous cycle.

Among the most reliable techniques are those that use the measurements of changes in the Earth's magnetic field at, and before, sunspot minimum. These changes in the Earth's magnetic field are known to be caused by solar storms but the precise connections between them and future solar activity levels is still uncertain.

Of these "geomagnetic precursor" techniques three stand out. The earliest is from Ohl and Ohl [*Solar-Terrestrial Predictions Proceedings*, Vol. II. 258 (1979)] They found that the value of the geomagnetic aa index at its minimum was related to the sunspot number during the ensuing maximum. The primary disadvantage of this technique is that the minimum in the geomagnetic aa index often occurs slightly after sunspot minimum so the prediction isn't available until the sunspot cycle has started.

An alternative method is due to a process suggested by Joan Feynman. She separates the geomagnetic aa index into two components: one in phase with and proportional to the sunspot number, the other component is then the remaining signal. This remaining signal has, in the past, given good estimates of the sunspot numbers several years in advance. The maximum in this signal occurs near sunspot minimum and is proportional to the sunspot number during the following maximum. This method does allow for a prediction of the next sunspot maximum at the time of sunspot minimum.

A third method is due to Richard Thompson [*Solar Physics* 148, 383 (1993)]. He found a relationship between the number of days during a sunspot cycle in which the geomagnetic field was "disturbed" and the amplitude of the next sunspot maximum. His method has the advantage of giving a prediction for the size of the next sunspot maximum well before sunspot minimum.

We have suggested using the average of the predictions given by the Feynman-based method and by Thompson's method. [See Hathaway, Wilson, and Reichmann *J. Geophys. Res.* 104, 22,375 (1999)] However, both of these methods were impacted by the "Halloween Events" of October/November 2003 which were not reflected in the sunspot numbers. Both methods give larger than average amplitude to Cycle 24 while its delayed start and low minimum strongly suggest a much smaller cycle.

*(Continued on page 5)*



## Massive Satellite Launch

### Massive Satellite “Cluster” Launch of November 21

A Dnepr launcher lifted off from Dombarovsky, near Yasnny, Russia, on November 21 carrying more than two dozen satellites from 13 countries. Several of the satellites carry Amateur Radio payloads, marking this as the largest single deployment of ham radio satellites.

Some of the satellites into orbit will be contained within the Italian UniSat-5 microsat package. UniSat-5 includes a pair of UHF transceivers operating 9k6 GMSK AX25 protocol. From “PocketQube” launchers, UniSat-5 will deploy several smaller satellites, and one of the smaller satellites will release yet another satellite, reminiscent of decorative Ukrainian eggs within eggs. UniSat-5 will deploy Eagle-1 (BeakerSat-1, see below), Eagle-2 (\$50Sat, see below), Qube-Scout S1, estar-2 (CW and 1k2 AFSK UHF downlink), Wren, and PUCP-SAT-1, which in turn will disgorge Pocket-PUCP, a tiny spacecraft built by students in Peru that will carry four temperature sensors and transmit the data using a 10 mW CW UHF transmitter using 30 kHz FSK.

Scheduled to be among the other Amateur Radio-payload carrying satellites is FUNcube-1, a 1U CubeSat that is a collaboration between AMSAT-UK and AMSAT-NL. It will carry an “educational beacon” (1200 baud BPK — daytime operation) and a 20 kHz wide U/V inverting SSB/CW transponder running 300 mW PEP (nighttime operation). A project begun in 2009, FUNcube-1 will provide a signal directly to schools, with the “target audience” students at the primary and secondary levels.

FUNcube-1 is the middle 1U CubeSat of three sharing a 3U launch vehicle pod. The other two are ZACube-1 — the first South African satellite — and HiNCube from Norway, which will identify and transmit house-keeping data in the 70 centimeter band in CCSDS protocol. ZACube-1, in addition to carrying VHF and UHF communication equipment, has a 20 meter beacon that will transmit on 14.099 MHz.

Another Amateur Radio satellite, Delfi-n3Xt, is a 3U CubeSat developed by the Technical University of Delft in the Netherlands. It will feature a 40 kHz wide U/V transponder that will be activated after other ex-

periments are completed, as well as a high-speed S-band downlink.

Triton-1 and Triton-2 are 3U CubeSats each carrying a science mission and an Amateur Radio payload. Triton-1 includes two single-channel U/V FM-to-DSB transponders. Triton-2 will have a single-channel U/V FM-to-DSB transponder and a single-channel U/S FM-to-FM transponder. The science mission is expected to last 3 months, after which the Amateur Radio payloads will be activated.

Beakersat-1, also called Eagle-1, is a FemtoSat (mass between 10 and 100 g) built to the 2.5 U PocketQube form factor by undergraduate students at Morehead State University in Kentucky. Downlink telemetry will be transmitted to the ground station via Morse code.

\$50Sat, also called Eagle-2, will transmit data telemetry about the satellite’s operation, a sequence of call signs in slow FM Morse and some key data as fast FM Morse (120 WPM). The main data payload will be transmitted as FSK RTTY, which should be readily heard on the ground with basic Amateur Radio equipment. \$50SAT is a collaborative educational project between Professor Bob Twiggs, Morehead State University, and Howie DeFelice, AB2S; Michael Kirkhart, KD8QBA, and Stuart Robinson, GW7HPW.

These small satellites also are on the November 21 Dnepr launch roster:

CubeBug-2, a 2U CubeSat developed by the Argentinian Ministry of Science, Technology and Productive Innovation, INVAP SE, Satellogic SA, and Radio Club Bariloche.

GOMX-1, a student-built Amateur Radio 2U CubeSat, is being flown under the auspices of a government research grant covering space-related radio research.

NEE-02 KRYSAOR, which will carry a 720p HDTV camera to send live video from space using a 900 mW transmitter in the 910 MHz (33 centimeter) band.

Also onboard are UWE-3, built by students at Germany’s Julius Maximilians-University of Wurtzburg; BRITE-PL1, the first Polish satellite.

From the ARRL website

## 2013-2014 Membership Application/Renewal

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

- Single \$25 (\$20 after Feb 1, 2014)
- 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, 2013 to August 31, 2014.**

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.

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

ORDER DETAILS - As to appear on badge:

First Name \_\_\_\_\_ Call Sign \_\_\_\_\_