



*Dinner time!*

## ***The Aero Aerial***

The Newsletter of the Aero Amateur Radio Club  
Middle River, MD  
Volume 14, Issue 2  
February 2018

Editor Georgeann Vleck KB3PGN

### ***Officers***

President	Joe Miko WB3FMT	Repeater	Phil Hock W3VRD Jerry Cimildora N3VBJ
Vice-President	Jerry Cimildora N3VBJ	VE Testing	Pat Stone AC3F
Recording Secretary	Lou Kordek AB3QK	Public Service	Bob Landis WA3SWA
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		Contests	Bob Venanzi ND3D Charles Whittaker KB3EK

Website: <http://w3pga.org>

Facebook: <https://www.facebook.com/pages/Aero-Amateur-Radio-Club/719248141439348>

# About the Aero Amateur Radio Club

## Meetings

The Aero Amateur Radio Club meets at 7:30 pm on the first and third Wednesdays of the month at Essex SkyPark, 1401 Diffendall Road, Essex. Meetings begin at 7:30 p.m. local time. Meetings are canceled if Baltimore County Public Schools are closed or dismiss early.

## Repeaters

**W3PGA**      **2 M :** INPUT : 147.84 MHz, OUTPUT : 147.24 MHz, PL 123.0  
**W3PGA**      **70 Cm:** INPUT : 444.575 MHz, OUTPUT : 449.575 MHz, PL123.0  
**W3JEH**      **1.25 M:** INPUT : 222.24 MHz, OUTPUT : 223.84 MHz

## Club Nets

Second Wednesday Net – 10 Meters (28.445 MHz) @ 8 p.m. Local Time

Fourth Wednesday Net – 2 Meters (147.24 MHz Repeater) @ 8 p.m. Local Time

Fifth Wednesday Net – 70 Centimeters (449.575 MHz Repeater) @ 8 p.m. Local Time

## Radio License Exams

The Aero Amateur Radio Club sponsors Amateur Radio License Exams with the ARRL VEC. Examination sessions are throughout the year. Walk-ins are welcome; arrive no later than 30 minutes after start time. \$15 charge.

### 2017-18 Examination Schedule

Time:	1:15 pm		
Dates:	Sunday, Mar. 11		
Where:	White Marsh Library		

White Marsh Library, 8133 Sandpiper Circle, White Marsh, MD

Contact: Patricia Stone AC3F, email: [ac3f@juno.com](mailto:ac3f@juno.com), landline: 410-687-7209

## LOCAL AREA NETS

Day	Time	Freq. (MHz)	Net Name
Daily	9 – 10 am	145.330	Oriole Net
Daily	6 pm	3.820	Maryland Emergency Phone Net
Daily	6:30 – 7 pm	145.330 no PL	Balto. Traffic Net (b/u 146.670 PL 107.2)
Daily	7 pm & 10 pm	3.643	MD/DC/DE Traffic Net
2 <sup>nd</sup> Tue	7:30 pm	146.670	Baltimore County RACES Net
2 <sup>nd</sup> Wed	8 pm	28.445	Aero ARC Net
4 <sup>th</sup> Wed	8 pm	147.240	Aero ARC Net
5 <sup>th</sup> Wed	8 pm	449.575	Aero ARC Net
Fridays	7:30 pm	145.330	Back in the Day Net
When activated by NOAA		147.030	SkyWarn (primary)

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## **NET REPORTS**

### **1-10-18: 28.445 MHz, 20:10 to 20:25.**

W3PGA NCS Rich KB3VAE, KC3FRH Charles Parkville, KC3FBL Jim Parkville, W3VRD Phil Essex

Topics: FD menu, FRH may need help in spring putting a dipole up, VE testing this Sunday.  
4 stations on the net.

### **1-17-18: SNOW NET, 147.42r, 20:00 to 21:17 local.**

W3PGA NCS Joe Essex, KB3JVP Ken Middle River, W3VRD Phil Essex, KB3QWC Larry Middle River, KC3FRH Charles Parkville, WA3FSE Don Baltimore City, W3JEH Ron Perry Hall, W1ASA Izzy Baltimore City, KC3FBL Jim Parkville, KC3HZU Bill Edgewood, WA3QLY Tom Edgewood, K3TEL Arnold Towson, KC3FBM Franklin Parkville, KA3TCC Tom

14 members on the net

special 2 meter net, no meeting, Baltimore Co Schools were closed due to snow

### **01-24-18: 147.240 MHz, 20:00 to 20:50 local.**

W3PGA NCS Joe Essex, KB3JVP Ken Middle River, N3RES Ray Lutherville, KC3FBM Franklin Parkville, WA3FSE Don Baltimore City, KC3FBL Jim Parkville, K3TEL Arnold Towson, W1ASA Israel Baltimore City, KE3HAY Keon Baltimore City

9 Aero members on the net.

### **1-31-18: 449.575 MHz**

We did not have a 440 net tonight, because both repeaters were down. Drove past school at 21:15, lights in the parking lot and school, don't know the repeaters are down.  
Tried again at midnight still no repeaters.

Did however talk to Ron W3JEH, Ken NE3A, and Jim KC3FBL on Ron's 220 repeater.

Joe, WB3FMT

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## *Upcoming Second Meeting Presentations*

<i>Date</i>	<i>Topic</i>	<i>Presenter</i>
TBA	Contest Logging with N1MM	Bob ND3D
TBA	The Acu-rite Weather Station	?Kelly KC3APF

These presentations will be given at the Essex SkyPark FBO building after the business meeting.

*Any questions call Joe Miko at 443-956-0197. Presenters who wish to submit a description of their talk may email it to Georgeann at [KB3PGN@reagan.com](mailto:KB3PGN@reagan.com) for inclusion in the Aerial.*

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### *VE CORNER*

*by Pat Stone, AC3F*

The AERO VE Team held its sixth test session for 2017 on Sunday, January 14, 2018 at the White Marsh Library. We served 5 applicants. Congratulations to new Generals Nicholas Sach KC3KQY, Raymond Schruefer KB3YKO, and Cody Houck KC3ECG and new extra Alan Gilmore KC3EPI.

A very special thanks to VE's: WB3FMT, KD3TP, KB3VAE, KC3FBL, KC3FBM, K2ODG and AC0LP for assisting me with this session. You all did a great job. It was a pleasure working with all of you.

Our next test session for 2018 will be held at 1:15PM on Sunday, March 11 , at the White Marsh Library. Hope to see you then.

#### **Reminder: VE Testing Snow Plan**

If Baltimore County Libraries are closed for a testing day (Saturday or Sunday) the VE Testing session for that day will be canceled. Testing applicants that have pre-registered will be notified by phone. Due to the scheduling requirements of Baltimore County Library, we can't schedule a makeup session. Testing will resume on the next scheduled testing date. VE's will be notified by phone in the event of a closure.

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## *UPCOMING HAMFESTS and EVENTS*

### **Hamfests**

#### **Sunday, March 18, 2018: Winterfest 2018**

Time: 6 am - tailgating starts; 8 am - indoor sales area opens; 2 pm closing.

Northern Virginia Community College, Annandale Campus, 8333 Little River Turnpike Annandale, VA.

Sponsor: Vienna Wireless Society, Vienna, VA

Talk-in: 146.91 repeater

Admission for Attendees: \$10 at the door; students high school age and younger get in free when accompanied by an adult. Free admission for students with a college ID.

Website: <http://viennawireless.net/wp/events/winterfest/>

bargains on radios, antennas, radio-related publications, electronics/computer gear, test equipment, and components. Loads of vendors already lined up. Gear from commercial and hobbyist vendors.

VE exam sessions, \$15 fee

Contact: Thor Berglie, KK4UYT, Winterfest Coordinator, Vienna Wireless Society,

[thor.berglie@vws.bitsink.com](mailto:thor.berglie@vws.bitsink.com)

#### **Saturday, April 21, 2018: Delaware State Convention (Delmarva Amateur Radio & Electronics EXPO)**

Cheer Community Center, 20520 Sand Hill Rd., Georgetown, DE 19947

Website: [www.radioelectronicsexpo.com](http://www.radioelectronicsexpo.com)

Sponsor: Sussex Amateur Radio Association

Type: ARRL Convention

Talk-In: 147.090 (CTCSS: 156.7 Hz), Sussex County ARES® Primary Repeater, Millsboro, DE

Contact: Herb Quick, KF3BT, PO Box 1431, Seaford, DE 19973, Phone: 302-629-4949, E-mail:

[herb@hamiltongraphics.com](mailto:herb@hamiltongraphics.com)

#### **Saturday, June 30, 2018: Harrisburg Radio Amateurs Club Firecracker Hamfest**

Harrisburg Area Community College, 3599 Industrial Road, Harrisburg, PA 17101

Website: <http://www.w3uu.org>

Sponsor: Harrisburg Radio Amateurs' Club

Talk-In: 146.76 (CTCSS 100.0 Hz)

Contact: Tim Lehman, KB3OZA, PO Box 453, Hummelstown, PA 17036, Phone: 717-461-3398, Email:

[kb3oza@arrl.net](mailto:kb3oza@arrl.net)

You may view upcoming Hamfests at: <http://www.arrl.org/hamfests-and-conventions-calendar>

# Feature Article

## Amplifier ABC'S

by Joe Miko, WB3FMT

An amplifier is an electronic device that can increase the power of a signal. An amplifier uses power from a power supply to increase the amplitude of a signal. The amount of amplification provided by an amplifier is measured by its gain: the ratio of output to input.

An amplifier can either be a separate piece of equipment or an electrical circuit contained within another device. Amplification is fundamental to modern electronics, and amplifiers are widely used in almost all electronic equipment.

The first practical device that could amplify was the triode vacuum tube, invented in 1906 by Lee De Forest, which led to the first amplifiers around 1912. A triode vacuum tube is a three-electrode electron tube containing a cathode, control grid and plate.<sup>1</sup> Vacuum tubes were used in almost all amplifiers until the 1960's–1970's when the transistor, invented in 1947 by Bell Labs, replaced them. A transistor is a solid-state device made from semiconductor material with connections made at three or more points when the characteristics are different.<sup>2</sup> Today, most amplifiers use transistors, but vacuum tubes continue to be used in high power application in commercial, military and amateur radio services.

Amplifiers can be categorized in different ways. One is by the frequency of the electronic signal being amplified. For example, audio amplifiers amplify signals in the audio (sound) range of less than 20 kHz. Radio frequency (RF) amplifiers amplify frequencies and output power in the radio frequency range between 20 kHz and 300 GHz and beyond. Other types of amplifiers work with very low frequencies down to direct current. Another distinction is whether the amplifier is a linear or nonlinear.

Linear amplifiers are used to increase the output RF power of a radio transmitter. By linear we mean that it is an amplifier in which for a given change in the input a change in direct proportion will be obtained at the output.<sup>3</sup> The linear range is across the board, a gain of 10 changes 10 watts to 100 watts, 1 watt to 10 watts, etc.

Nonlinear amplifiers are devices whose output does not rise and fall in direct proportion to the input. The input wattage must equal to some threshold level to produce the desired output wattage: 3 watts in, 100 watts out; if less than 3 watts are applied no output; if more than 3 watts no increase in power over 100 watts. A Class C amplifier is a nonlinear amp!

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<sup>1</sup> Dictionary of Electronic Terms Editors and Engineers, LTD

<sup>2</sup> Dictionary of Electronic Terms Editors and Engineers, LTD

<sup>3</sup> Dictionary of Electronic Terms Editors and Engineers, LTD

An FM signal has a constant amplitude, so it carries no information in the envelope. A CW signal does carry information in the amplitude variations. Only the on and off states must be preserved, so a Class C amplifier retains the information content of a CW signal. However, modern CW transmitters carefully shape the pulses so that key clicks are reduced to the minimum practical value. A Class C amplifier will distort the pulse shape and make the key clicks worse. Therefore, except for FM, a linear amplifier is recommended for all amateur transmission modes.<sup>4</sup>

Some digital modes, such as RTTY using FSK, are a form of FM and can also use a nonlinear Class C, D or E amplifier. If these signals are not clean, however, a Class C amplifier may make them worse. Also, Class C or even D and E can be used for very slow CW, for very simple low-power CW transmitters or on uncrowded bands where slightly worse key clicks are not so serious. After all, Class C was used for many years with CW operation. Class of operation as it relates to tube-type amplifier design is discussed in more detail in a later section of this chapter.<sup>5</sup>

## **What are the classes of amplifiers?**

Power amplifiers are categorized by their power level, intended frequencies of operation, device type, class of operation and circuit configuration. Within each of these categories there are almost always two or more options available. Choosing the most appropriate set of options from all those available is the fundamental concept of design.<sup>6</sup>

The class of operation of an amplifier is determined by the fraction of a drive cycle during which conduction occurs in the amplifying device or for switch mode devices. (Switch mode amplifiers use different criteria.) The Class A amplifier conducts for 100% of the cycle. It is characterized by constant flow of supply current, regardless of the strength of the driving signal. Most of the amplifiers we use for RF applications and many audio circuits in receivers operate in Class A.

A Class B amplifier conducts for 50% of the cycle, which is 180 degrees if we examine the circuit with regard to a driving sine wave. A Class B amplifier draws no dc current when no input signal is applied, but current begins to flow with any input, growing with the input strength. A Class B amplifier can display good *envelope linearity*, meaning that the output amplitude at the drive frequency changes linearly with the input signal. The total absence of current flow for half of the drive cycle will create harmonics of the signal drive.

A Class C amplifier is one that conducts for less than half of a cycle. No current flows without drive. Application of a small drive produces no output and no current flow. Only after a threshold is reached does the device begin to conduct and provide output. A bipolar transistor with no source of bias for the base typically operates in Class C.

The large signal models discussed earlier are suitable for the analysis of all amplifiers classes. Small signal models are generally reserved for Class A amplifiers. The most common power amplifier class is a cross between Class A and B — the Class AB amplifier that conducts for more than half of each

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cycle. A Class AB amplifier at low drive levels is indistinguishable from a Class A design. However, increasing drive produces greater collector (or drain) current and greater output.

Amplifier class letter designators for vacuum tube amplifiers were augmented with a numeric subscript. A Class AB1 amplifier operates in AB, but with no grid current flowing. A Class AB2 amplifier's grid is driven positive with respect to the cathode and so some grid current flows. In solid-state amplifiers, which have no grids, no numeric subscripts are used.

While wide-bandwidth Class A and Class B amplifiers are common, most circuits operating in Class C and higher are tuned at the output. The tuning accomplishes two things. First, it allows different terminations to exist for different frequencies. For example, a resistive load could be presented at the drive frequency while presenting a short circuit at some or all harmonics. The second consequence of tuning is that reactive loads can be created and presented to the amplifier collector or drain. This then provides independent control of current and voltage waveforms.<sup>7</sup>

### Other Amplifier Classes D thru T

Other amplifier classes are Class D is a switch mode amplifier most often used for high-efficiency audio amplification. Class E and F use tuned output networks that let the amplifying device act like a switch but prevent high voltage and high current at the same time. Class G is similar to a Class B amplifier, but switches between two voltage levels to reduce power dissipation at low signal levels. Class I uses two devices driven with complementary pulse duty cycles to cancel harmonics and follow the input waveform. Class S is a variation on Class D, and Class T uses DSP to optimize pulse widths in a Class D amplifier.<sup>8</sup>

Therefore, except for FM which can use a Class C amplifier nonlinear, a linear amplifier is recommended for all other amateur transmission modes.

#### Amateur Radio Power Amp Information      *ARRL Handbook 2000 & 2018*

Amp Power Level	Intended Freq. MHz	Device Type	Amp Class	Amp Type	Conductive $\angle^\circ$	Efficiency >%	Modes
5 – 600 watts	1.8 - 500	Solid State	A	Linear	360°	25 – 35%	AM, SSB, CW
		Solid State	B	Linear	180°	65%	AM, SSB, CW
		Solid State	AB	Linear	>180° <360°	55%	AM, SSB, CW
		Solid State	AB2	Linear	>180° <360°	60%	AM, SSB, CW, FM, Dig
		Solid State	C	Non Linear	90°	80%	CW, FM, Dig
		Solid State	D - E	Various switch mode not commonly found in amateur service	Pulse	90%	
>300 watts	1.8 - 500	Tube	A	Linear	360°	25 – 35%	AM, SSB, CW

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		Tube	B	Linear	180°	65%	AM, SSB, CW
		Tube	AB	Linear	>180° <360°	55%	AM, SSB, CW
		Tube	AB2	Linear	>180° <360°	60%	AM, SSB, CW, FM, Dig
		Tube	C	Non Linear	90°	80%	CW, FM, Dig

#### Tubes vs. Solid State Amplifiers /Pros and Cons

Tubes Pros	Tubes Con
High Power 300 > 1,500 watts	Life Expectancy 10,000 – 20,000 hrs
Higher Operating Temperature 150° - 200°C 302° - 392° F	
Voltage Spikes – No effects	Cost per Tube \$29.95 and up for a single 811A tube
High SWR >4:1 No Problems	Foot Print and Weight
Coronal Mass Ejections and Electro Magnetic Pulse - Restive	

#### Solid State Pros and Cons

Solid State Pros	Solid State Cons
Power > 600 watts	
Life Expectancy 50,000 to 100,000 hrs	Lower Operating Temperature 75° - 100°C 167° - 212° F
Compact Circuit Design	Critical I/P voltage
No Tune Up	Cost per power transistor \$75 and up for a single power transistor
Manufacture ease	High SWR >3:1 Problems
Smaller Footprint and weight	Coronal Mass Ejections and Electro Magnetic Pulse - Damage
Reduced cost	

Now that we have covered a brief overview of amplifiers, why do you want one and some of the **hidden cost?**

It is estimated that a 600 watt Class AB2 amplifier will give you nearly 2 full S Units over a 100 watt transceiver. Is it worth it? And here is why.

Why do you want one? To make more contacts, where HF, VHF or UHF?

The Class AB2 will work all modes for the HF bands, it comes in either a Tube or Transistor model.

I am using an MFJ catalog for reference of usage and cost in this article.<sup>9</sup>

The average cost of an HF 600 watt amp runs between \$849 (Tube) to \$2,275 (Solid State).

To operate on 2 meters and 70 cm, Mirage has separate and dual amps running from 5 watts up to 200 watts. The price ranges from \$139 - \$519.

Now that you ordered the amp, what else do you need?

Well how about an antenna upgrade? If you can't hear them the amp won't do you any good, they may hear you but it a one way tunnel. With a new amp you must make sure your that the antenna will operate at the amp's output wattage. When using 20 meters your antenna should not glow a dull red at night!

Antenna Tuner and SWR meters may need to be upgraded to meet the increase power requirements?

If the back of your radio desk looks like the Griswold's Christmas lights connections, you may need an additional AC outlet.

Last but not least, do you have physical space on your desk or shelf for the new amplifier and or power supply? Just a few things to ponder.

I can't my G5RV jr, is rated at 200 watts, my MFJ-969 Tuner is 300 watts and power wise I think I can add a 15 watt night light. So I will just have to be content with an inverted V and 100 watts on HF. But I still have the touch screen on my FT-991.

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# From the Skies over Mt. Essex

## SKY Events for February 2018

**Jan 31<sup>h</sup>** - **Full Blue Moon no Full Moon** in February 2018.



Mt. Essex 4/3/2007

### Who took February's Full Moon?

Looks like January and March are the culprits! When February has no full Moon, January and March typically have two full Moons each (the second being widely hailed as a blue Moon). Much rarer is a 29-day February (in a leap year) with no full Moon. According to Peter Macdonald (*Journal of the British Astronomical Association*, December 1998, page 324), this oddity occurred in 1608 and won't happen again until 2572.<sup>10</sup>

Februaries with no Full Moon in the 3rd Millennium

The dates and times of all of the Full Moons from 2000 to 2999 inclusive, there are 12,368 Full Moons during that period. With a thousand Februaries there are 952 Full Moons. Forty-eight Februaries are missing a Full Moon. Counting the number of Full Moons which fall in February in a leap year, we find 240 of them. However, the thousand-year period from 2000 to 2999 has 243 leap years. (Remember that in the Gregorian calendar, century years are only leap years if they divide by 400, so 2100 will not be a leap year, and nor will 2200, 2300, 2500, 2600, 2700 and 2900.)

So there are 243 leap years, but only 240 of them have a Full Moon in February. This means that there will be just three leap years in which February will have no Full Moon. Those years are 2572, 2792 and 2944.<sup>11</sup>

Of the Februaries without a Full Moon, the last one was in 1999 the next four will run out this current century and are 2018, 2037, 2067 and 2094.

**Feb. 1<sup>st</sup>** – Regulus is 1.0° S of the Moon at 19:00UT

**Feb 2<sup>nd</sup>** – The Zodiacal Light is visible in N. Lat. after evening twilight for the next 2 weeks.

**Feb 7<sup>th</sup>** – Last Quarter Moon

**Feb. 15<sup>th</sup>** – Galileo born in 1564 A.D., and may have said “eppur si muove (and yet it moves)” following his trial in 1650. On appeal he was found not guilty on 10/31/2009. It's also a New Moon.

**Feb 18<sup>th</sup>** – former planet Pluto, was discovered by Clyde Tombaugh in 1930.

**Feb 20<sup>th</sup>** – John H. Glenn, Mercury Astronaut, first American in orbit, made 3 orbits of the Earth.

**Feb 22<sup>nd</sup>** – First Quarter Moon

**Feb 23<sup>rd</sup>** – Aldebaran is 0.7° S of the Moon at 18:00 UT and Supernova 1987A discovered.

### Planet Lookout at mid-Month

**Sunrise 07:24 EST and Sunset 17:06 EST**

**Mercury** Not visible in the Sun's glare.

**Venus** Dusk, Sets 18:26 EST, mag. -3.9, size 9.9 arc sec.

**Mars** Morning rises 02:19 EST, mag 0.9 and 6.3 arc sec

**Jupiter** Morning, rises 00:39 EST, mag -2.0 size 38.1 arc sec.

**Saturn** Dawn sky. Rises 04:03 EST, Magnitude 0.6 size 15.7 arc seconds.

**Uranus** Evening sky sets 22:56 EST mag 5.9 size 3.4 arc sec.

**Neptune** Dusk sets 18:57 EST. mag 8 size 2.2 arc sec.

10 Roger Sinnott Sky & Telescope

11 Once in a Blue Moon David Harper