



N.E.W.S. LETTER

The Publication of the North East Weak Signal Group



January 2011

Volume 20

Issue 1

President: K1WHS, Dave Olean
Vice President: WZ1V, Ron Klimas

Current Officers
NEWSLetter Editor: W1FKF, Don Twombly

Secretary: W1GHZ, Paul Wade
Treasurer: WA1MBA, Tom Williams

Next Meeting January 15, 2011

Storrs Library 1pm

Homebrew Project Extravaganza

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Don't Forget

**The North East Weak Signal Group
2 Meter VHF and Above Net
Every Thursday at 8:30 PM Local 144.250
W1COT, WZ1V or K1PXE Net Control**

MEMBERSHIP in the N.E.W.S Group is \$15 per year. Apply to Tom Williams, WA1MBA. Email tomw@wa1mba.org You may download an application from our web page

<http://www.newsvhf.com/>

The N.E.W.S. LETTER is the publication of the North East Weak Signal Group. Articles may be reprinted with proper credit given to the author and the N.E.W.S. LETTER. Send articles to Don Twombly, W1FKF 23 Maura Drive Woburn, MA 01801 Preferably via email with "Newsletter" in the subject line to donw1kf-news@yahoo.com

The President's Corner

Building radio equipment has been an integral part of ham radio since the early days when all stations were hand made out of necessity. Today the building tradition of ham radio is alive and well in the NEWS Group. The January 15th meeting for our club promises to be a good one with a smorgasbord of construction projects being highlighted. Wintertime, after all, is project time in New England. Mike, N1JEZ and Fred, N1DPM are working on several high power solid state projects. Some of these had their origins in the great TV analog purge of 2010. Several sources of solid state power amplifiers came available as a result. It is only natural that hams come to the rescue and turn the sow's ear into a silk purse. N1JEZ also has been sparking up some big Rhode & Schwartz 432 amplifiers that can fry eggs in 30 seconds. Other projects are a result of exciting new solid state devices coming on to the market that are forcing vacuum tube technology to the sidelines. Both Fred and Mike will let us know their progress in the high power solid state amplifier field. W1FKF will show off his USB Dongle Fun Cube SDR radio that covers 65-1700 MHz (If it arrives in time). On the other end of the spectrum, old geezer Dave, K1WHS will delve into bias circuits for large triode vacuum tube amplifiers and provide some actual data from different circuits. If there is time, he may even describe and provide pictures of the new 3 phase high voltage power supply that is keeping his ham shack from blowing off the hilltop.

The January ARRL contest / endurance test is almost upon us and we will be discussing club member's efforts in that arena too. The January contest is the one that separates the men from the boys. It is a great test of man and equipment. What better way to try out your new construction project than in the January contest! It should be a great meeting. We will start at 1 PM with a short business meeting. We have much to cover, so make plans to be at the Storrs Library Longmeadow MA. Saturday for the homebrew project extravaganza starting at 1 PM on Saturday.

From our Secretary

Minutes of NEWS meeting 13 November 2010

Storrs Library, Longmeadow, MA

Directors meeting 1225

NEWS Meeting, Storrs Library, Longmeadow, MA

President K1WHS called meeting to order 1316Z

Present were 27 members

Treasurers Report

Current balance \$3875

Now 83 paid-up members

NEW BUSINESS:

Suggested dates for next year

Jan 8 [NOTE - changed to 1/15]

Mar 19

May 14

Jul 9 (picnic)

Oct 15

Nov 19

K1MAP to confirm dates with Library

Motion by KB1LKV for these dates - Passed

General Discussion - Microwave Update Organization

W1SMS suggested tours of ARRL and Times Microwave

Volunteers:

N1JEZ - Audio Visual

KA1OJ - International Visitors

W1SMS - Registration

W1MKY and AF1T, AC1J - Prizes

K1MAP - Flea market, hospitality

W1TDS - Hospitality K1AE

KB1VC - Proceedings

W1GHZ - Speakers

WW1M - possible Haystack contact

VHF activity - possibly video for beginners, based on K1DS Packrats session. YouTube?

Meeting Adjourned

PROGRAM:

N1DPM described his 144 MHz EME work with a small array.

Fred has done well with only four short Yagis.

Some of the points I jotted down:

- Saddle clamps from DX Engineering
- Phasing lines are odd 1/4 wavelength long
- Measure everything!
- LNA is ATF 54143 by OZ5PIF, with good Return Loss

Submitted by W1GHZ

From our Treasurer

The treasury is in good health, and so is membership. I normally take a reading at the first of the year, and this year we are on the high side of our average of paid-up members at 93. We are having a January thaw right now, and I have a feeling in my bones that the bands are open, but family matters are keeping me out of the shack these days. Got my fingers crossed for the Jan contest. If I can't make it I hope everyone else can get on and have fun. Happy New Year!

Tom WA1MBA

Southeastern VHF Society

Huntsville, Alabama
April 29 - 30, 2011

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A COMPARISON OF VARIOUS TUBE AMPLIFIER BIAS CIRCUITS By David Olean K1WHS

January 2011

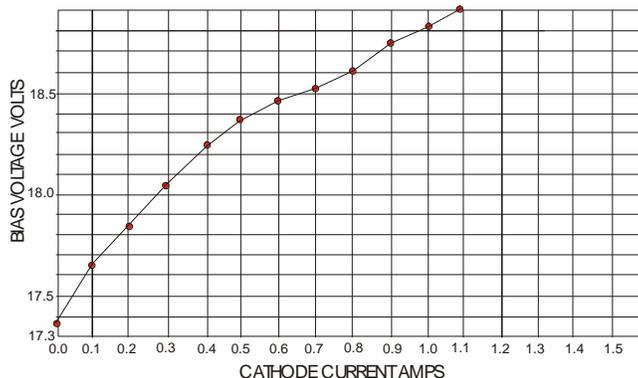
I recently undertook a project to evaluate a few different t circuits for controlling the cathode bias on larger transmit vacuum tubes. In the past I have had pretty good luck with 50 watt zener diodes in series with the cathode line to the B- terminal. Zener diodes are simple and effective way to set cathode bias, but they do have problems. One of the recent problems observed is that such large capacity zeners are getting hard to find. Another obvious problem is that you are stuck with the zener voltage of the part available. There is no easy way to adjust a 50 watt zener diode. There is no way to trim the voltage easily with a zener diode. Adding diode junctions reduces the regulation drastically and is not a good option.

In 2009, I built up a single band 10 meter amplifier¹ for use primarily during contests. You know the drill. A few guest ops show up who are great at running cw pileups. They may or may not be great at finessing along your power amplifier however. You might find that they worked several new mults, but neglected to see that the high voltage supply died and they damaged the tube by exceeding the grid dissipation of the expensive ceramic tube that you traded your first born son for. A suitable contest amplifier must be forgiving of operator errors, and it must also be reliable, producing clean output power, and running well within its ratings so as not to cause problems during extended use. The YC156 Eimac triode that I chose for the 10 meter amplifier fills the bill nicely. It will run at 1500 watts output all day with no problems. In fact the tube has a 5000 watt plate dissipation with a 2" height of water produced by the blower. I used a smaller blower, but the tube is still capable of some serious power output even with the smaller blower. In building up the amplifier, I was surprised at the amount of operating bias that was needed as compared to an 8877. I had to put two 14 volt 50 watt zener diodes (1N3313B) in series to achieve 28 vdc bias for class AB service. Plate voltage was about 3800 volts idling at about 150 milliamps or so. The amplifier worked very well and would produce 1500 watts output with 45 watts of RF drive. Plate voltage would sag to about 3500-3600 volts.

In December of 2010, in the ARRL 10 Meter Contest, I tried running the amplifier at my remote hilltop shack where I have a very heavy duty 3 phase 208 volt HV supply. It delivers about 5300 volts and I figured that the YC156 would work very well at the higher voltage with less drive required than at the lower plate voltage level. The amp did work quite fine, with full output available with 18 or 19 watts, but the idling current was ½ amp! Now it did not take a genius to realize that ½ amp idling current at 5300 volts is quite a lot of heat. We turned off the heat in the shack and relied on the amplifier to heat the room. We even turned on the exhaust fans to push the hot air outside the building, so we would not get too warm.

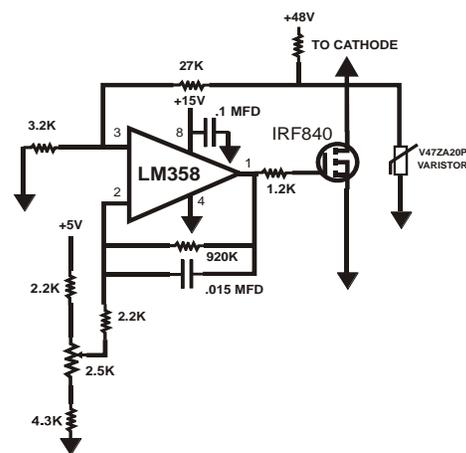
Every time we keyed the rig, 3000 watts of heat was generated and blown into the room. We were toasty warm all weekend. The solution to this dilemma was a new bias circuit that does not rely on zener diodes. I also had concerns that a zener diode is not the stiffest regulator around. Any variations in the bias voltage would introduce potential distortion products as the bias voltage would climb at higher currents causing the operating point of the tube to shift. I tried a few different bias circuits and measured the performance of each. The first circuit tried was adapted from a YC156 amplifier built by WV7U.² Hank, WV7U had used a high power OP AMP in the YC156. The part is no longer available, so I looked at a similar circuit that he used in a smaller 2 X 3CX800 HF amplifier. This time he utilized a LM358 OP AMP driving an IRF840 enhancement mode FET as a shunt regulator. The circuit looked intriguing. I also studied another circuit used by both G3SEK and WD7S in triode bias board kits that they each produce.^{3,4} I have known Ian, G3SEK for many years and know that he always does top notch work in any of his endeavors. His tetrode circuit boards are incredible for controlling tetrodes. His familiarity with European bias and screen circuit development convinced him to develop a commercial tetrode circuit board that has produced results where transmit vacuum tubes will deliver less distortion than the manufacturer specifies under ideal conditions! The secret is in very stiff regulated bias and screen supplies. With tetrodes, the screen supply is the often overlooked key element that determines how linear your amplifier will be. If the screen voltage is rock solid, the amplifier will sound very good. The same holds true with triodes and their bias circuits. A triode is much easier to get running than a tetrode, but they still want a stiff bias source in the cathode circuit! Holding the cathode bias voltage constant will produce lower distortion products than with a non stabilized source. I decided to measure the typical regulation of a 50 watt zener diode commonly used in triode amplifiers. The voltage across an 18 volt zener, a 1N2816B, varied by over 1.5 volts as current flow ramped up from 0 to 1.0 amp. This is the typical current variation for a large external anode triode such as an 8877.

1N2816B ZENER DIODE REGULATION

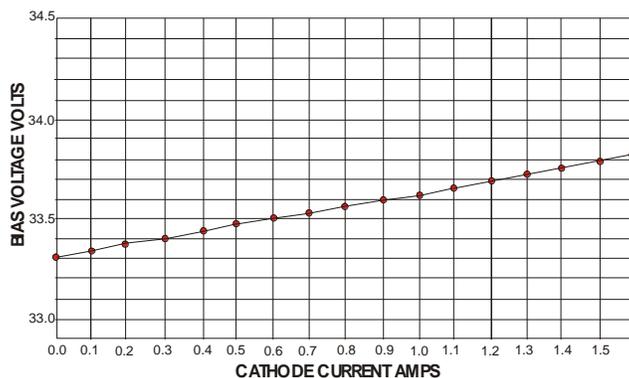


Over a range of 0 to 1.5 amps, the 50 watt zener will only maintain a 10% regulated voltage. Data for the 1N2816B indicates a 2.0 ohm impedance at a 700 ma test current. Clearly there are better solutions. The WV7U circuit for his monster YC156 amplifier used a PA46 power op amp shunt regulator. The PA46 is long obsolete, so current circuits make use of a small OP AMP driving an enhancement mode FET such as an IRF540 or IRF840. I chose an IRF840 for my YC156 ten meter amplifier. It is capable of controlling several amperes of current at several hundred volts with a suitable heatsink and judicious design to control dissipation. Here is the circuit I ended up using. The +15 and +5 volt sources were obtained from small three terminal regulators.

OP-AMP REGULATOR



IRF840 REGULATION



The YC156 needs around 34 or 35 volts of bias to limit plate current to reasonable levels with 5 KV plate voltage. WV7U tried 280 ma and 200 ma. Bias settings. He also rigged up a sophisticated two tone test setup to measure IMD. His findings with his PA46 bias circuit showed IMD levels of -45 or -46 dB with the two bias settings of 200 and 280 ma. and a plate voltage of 5500 volts with 4000 watts output. Clearly this is much better than needed in amateur circles. Many amplifiers struggle to produce distortion products better than -30 dB. He used heavy plate loading to produce these numbers. At 1500 watts the IMD levels should be even lower with everything else being equal.

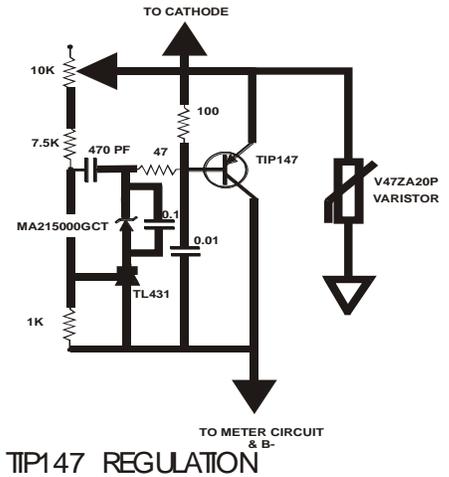
My first effort with the IRF840 was encouraging. I adjusted the circuit to provide a range close to 34 volts of shunt regulation, which is over twice the voltage of the single 50 watt zener diode that I measured. If you compare two zeners in series with a single zener diode, you get only one half the regulation performance of a single diode! While two diodes might sag by 3.0 volts or more at 28 volts of bias between zero current and 1 amp, the OP AMP design holds the bias to within about 0.3 volts or ten times better regulation than the zener diode pair.

Choosing a higher voltage 50 watt zener such as the 1N2825B (36 volts) will result in worse regulation than available from a lower voltage zener, but slightly better than two zeners in series.

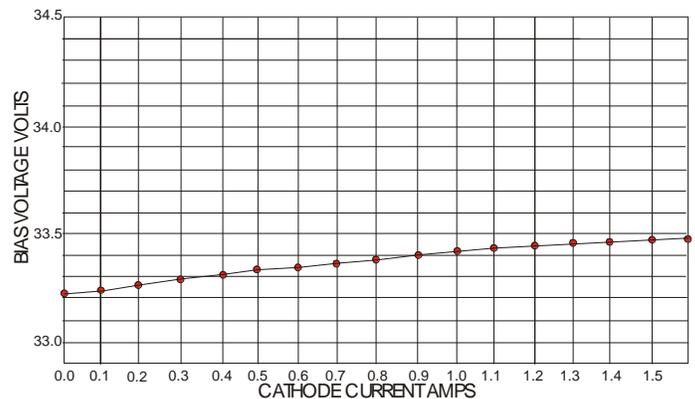
WD7S and Ian, G3SEK/GM3SEK use a different circuit to achieve precise control of triode bias. Both of these gentlemen provide kits that are very handy for building high performance amplifiers of the triode and tetrode variety. Their circuits for a bias shunt regulator are quite similar, and dispense with the discrete OP AMP in favor of a TIP147 PNP out darlington pair and a precision TL431 reference voltage source. The TL431 has it's own internal OP-AMP in a TO-92 package. Ian claims very precise shunt regulation with little variation under varying loads.

Next I tried the G3SEK/ WD7S TIP147 darlington circuit and adjusted the component values for a 33 volt bias setting similar to my OP AMP design. The TIP147 circuit utilizes a TL431 shunt regulator to drive the darlington pair. The small TL431 has a built in op amp and internal 2.5 volt reference voltage source and is capable of very good performance in such circuits. For my breadboard design, I used a more robust heatsink for the TIP147 to allow more time to take voltage readings! I also modified the design to accommodate bias voltages above 30 volts. The goal of this entire process was a better bias circuit for my YC156 amplifier, and the YC156 needs fairly high bias. (Similar to the GS35B Russian triode.) The final version will have a large heatsink to dissipate the almost 50 watts of heat generated by the shunt bias supply. I can install it in the air path of the tube blower as well, for cooler operation.

DIAGRAM OF TIP147 REGULATOR



The regulation performance of the TIP147 bias circuit modified for high cathode bias similar to the IRF840 circuit, is as follows:



The TIP147 circuit seems to have a bit better shunt regulation performance than the MOSFET version. Impedance of the TIP147 design was about 0.2 ohms at 1 amp of current. Possibly the op amp gain in the MOSFET design could be adjusted for improved performance. I suspect that more loop gain will improve the regulation, but there is a lot of component juggling required. I tried increasing the shunt current on the TIP147 circuit up to 2 amps and it seemed fine, holding at 33.5 volts. At 3 amps it decided to short out and die. I am not sure if it was a voltage spike from my old adjustable \$5 flea market power supply, or that 3 amps was just too much for it. In looking at the safe operating area curves, with 34 volts, about 2.5 amps is all that it can handle safely. It is also very prudent to install some form of surge protection in the event of high voltage arcs etc. My final designs utilize 43 volt MOVs as well as ceramic spark gaps from the top of the regulator to ground. This path will bypass the grid meter. Any excessive surges will, hopefully be blunted by these protection devices.

In any case, either of these two circuits are so much better than the simple zener diode arrangements as popularized in many Eimac 8877 and 3CX800 construction articles over the years. These "active" bias designs are a bit more complex than zeners, but the actual parts cost is actually quite low when compared to the cost of a single 50 watt zener diode. The last time I checked, 50 watt zeners cost \$11 each or more, while the FETs and darlington are in the \$2 price range. Other components needed are very cheap or already laying in your junkbox. As I see it, there is no reason to be using zener diodes these days for amplifier bias. I plan to make a few of these boards, and drop them into my new and existing tube amplifiers.

References

- <http://www.directivesystems.com/YC156.htm>
- <http://www.wv7u.com/yc156amp/yc156amp.html>
- http://home.earthlink.net/~wd7s/triode_control.htm
- <http://www.ifwtech.co.uk/g3sek/boards>

2011 North East Weak Signal Group VHF CALENDAR:

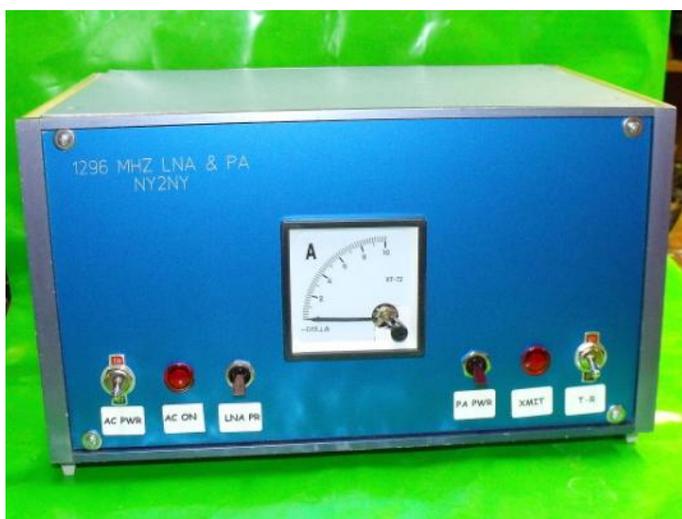
January 3, 2343Z - Quadrantids meteor shower
January 15, 1PM - 4PM - [N.E.W.S. Group Meeting](#)
January 22-24, 1900Z-0359Z - [ARRL January VHF Sweepstakes](#)
March 19, 1PM - 4PM - [N.E.W.S. Group Meeting](#)
April 11?, 1900-2300 Local - [144 MHz Spring Sprint](#)
April 22, 2110Z - Lyrids meteor shower
April 29-30 - [Southeastern VHF Society Conference](#)
April 29-30 - [New England Amateur Radio Festival - Deerfield, NH](#)
May 20-22 - [Dayton Hamfest](#)
May 14, 1PM - 4PM - [N.E.W.S. Group Meeting](#)
June 4 - [Rochester NY RARA Hamfest](#)
June 11-13, 1800Z-0300Z - [ARRL June VHF QSO Party](#)
July 9, 11AM - 4PM - [N.E.W.S. Group Picnic](#)
July 16-17, 1800Z - 2100Z - [CQ Worldwide VHF Contest](#)
August 6-7, 1800Z - 1800Z - ARRL UHF Contest
August 13, 0300Z - Perseids meteor shower
August 20-21, 6AM - 11:59:59PM - ARRL 10-GHz & up Cumulative Contest
September 10-12, 1800Z-0300Z - [ARRL September VHF QSO Party](#)
September 17-18, 6AM - 11:59:59PM - ARRL 10-GHz & up Cumulative Contest
September ??, 1900-2300 Local - [144 MHz Fall Sprint](#)
September ?? - [Mt. Airy \(PackRats\) VHF Conference](#)
September ??, 1900-2300 Local - [222 MHz Fall Sprint](#)
October 2 - [Mt. Airy \(PackRats\) Hamarama](#)
October ?, 1900-2300 Local - [432 MHz Fall Sprint](#)
October ??-?? - [New England Amateur Radio Festival - Deerfield, NH](#)
October ??, 0600-1200 Local - [Microwave Fall Sprint](#)
October 13-16 - [Microwave Update hosted by NEWS Group](#)
October ??, 2300-0300 UTC - [50 MHz Fall Sprint](#)
November 19, 1PM - 4PM - [N.E.W.S. Group Meeting](#)
November 17, ?????Z - Leonids meteor shower
December 14, ?????Z - Geminids meteor shower

NY2NY 1296 MHz

Just finally finished my LNA/PA transfer box for 1296 and now QRV with 75w into loop yagi from FN30rx. The box has a WA2ODO LNA, a W6PQL 75w PA, a +28v switching Power supply for the PA and the relays, +12v supply for the LNA and 2 coax transfer relays to switch everybody from RCVE to XMIT. After dumping 75w of RF into the back-end of my (first) LNA, I took the collective advice of the NEWS group and added a DEMI sequencer which switches the 2 T-R transfer relays in order and also independently switches the PTT and CW key line on my FT-736r for added protection. Also rewired the MOX switch on the FT-736r front panel to key the sequencer, not the transceiver. Everything seems to be working FB; worked W1ZC 339 in terrible winter condx.

Pixs of the box included; tnx to Dick W1ZC for supplying the surplus enclosure which just fits on the last open shelf in the shack.

I will be listening on Monday nites for any activity on 1296 and welcome skeds anytime-contact me at Jay@ny2ny.us.



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Don W1FKF donw1fkf-news@yahoo.com



40 ft of Rohn 25, (3 straight and one top section) Also has rotor plate, house bracket, etc. \$100

2 Cushcraft 432 mHz Boomers

(25 el each?) \$40 ea

100' of Andrew LDF4 cable with N/F connectors on each end. \$50

or the whole package for \$200.

N1BC, Bruce Carlisle

at 978-256 3704 or Ramurb@Yahoo.com

Microwave Up Date 2011

Sponsored by the NEWS Group **And The Eastern VHF/UHF Society** **October 13, 14, 15 & 16, 2011.**

The conference will be held at the Crowne Plaza Hotel in Enfield, Ct.

A block of rooms has been reserved for \$99 USD. This is the location where the Eastern VHF/UHF Conference has been held for the past 10 YEARS or so.

No Spring Eastern VHF/UHF Conference 2011

Brief program outline to date:
THURSDAY 10-13-2011 TBD

DINNER ON YOUR OWN, HOSPITALITY SUITE 7-11 PM.

FRIDAY 10-14-2011 REGISTRATION, INTRODUCTION, SPEAKERS, AUCTIONS, DEMONSTRATIONS AND INDOOR SWAP & SHOP IN THE EVENING.

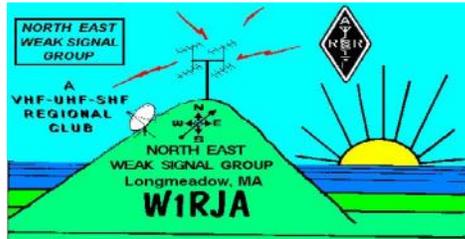
SATURDAY 10-15-2011 REGISTRATION, INTRODUCTION, SPEAKERS, AUCTIONS, DEMONSTRATIONS, VENDOR DISPLAYS, AFTER NOON TEST LAB TO 50 GHz, INTRODUCTION TO MICROWAVES, BAND SESSIONS, EVENING BANQUET, TRIVIA QUIZ, DOOR PRIZES.

SUNDAY 10-16-2011 8:00 - 12:00am OUTDOOR FLEA MARKET, ANTENNA RANGE.

Further info to follow as it develops.

Thank you,
Bruce Wood N2LIV n2liv@arrl.net
Conference Chairman

Paul Wade W1GHZ w1ghz@arrl.net
Program Chairman



N.E.W.S. Group

Membership Application

Name: _____ Call sign: _____ Grid: _____

Street: _____

City: _____ State: _____ Zip: _____

Phone (home) _____ - _____ - _____ Optional (work) _____ - _____ - _____

Email _____

ARRL member? Y N Electronic Newsletter Delivery? Y N

Operational Bands (circle) 50 MHz 144 MHz 222 MHz 432 MHz 903 MHz

1.2 GHz 2.3 GHz 3.4 GHz 5.6 GHz 10 GHz 24 GHz 47 GHz

76 GHz Light Other (list)

The North East Weak Signal [N.E.W.S.]Group is being established to form a camaraderie among fellow VHF-UHF-SHF enthusiasts, and support a convenient means to exchange technical information. We currently have 6 meetings per year, held at a centrally located facility, and provide a "NEWSLETTER" that is distributed 2 weeks prior to each meeting. Any contributions to this publication are appreciated and can be sent to: Don Twombly, W 1FKF 23 Maura Dr. Woburn, MA 01801 Email: donw1fkf-news (at) yahoo (dot) com. Dues are \$15/year. Remember, this group is formed by VHF'ers for VHF'ers.

Mail to:

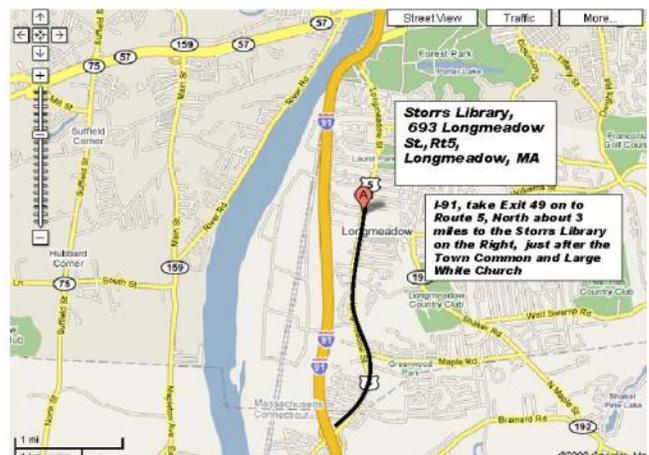
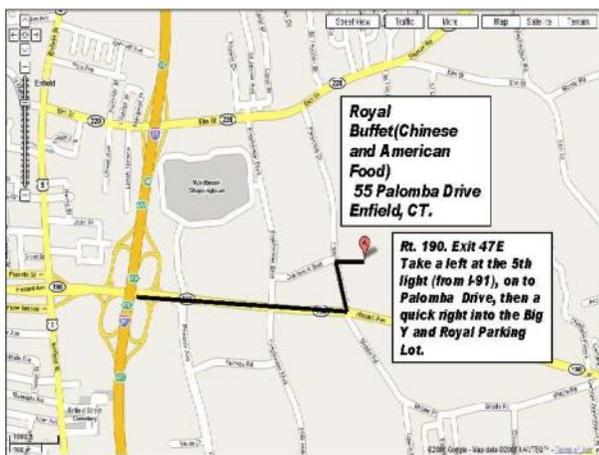
North East Weak Signal Group

c/o WA1MBA Tom Williams PO Box 28

Shutesbury, MA 01072

Email: [tomw \(at\) wa1mba \(dot\) org](mailto:tomw@wa1mba.org)

ARRL Affiliated Club

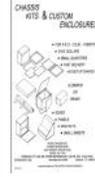




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Next Meeting January 15, 2011

Storrs Library 1pm

Homebrew Project Extravaganza

Don't Forget

**The North East Weak Signal Group
2 Meter VHF and Above Net
Every Thursday at 8:30 PM Local 144.250
W1COT, WZ1V or K1PXE Net Control**

North East Weak Signal Group

c/o WA1MBA Tom Williams PO Box 28 Shutesbury, MA 01072



Check your membership
expiration date on your mailing label!