QRZ NEWS

A MONTHLY PUBLICATION OF
SOUTHERN PENNSYLVANIA AMATEUR RADIO CLUB, INC
PO BOX 1033 - LANCASTER, PA 17608-1033
(Founded June 1960)
AN AFFILIATED SPECIAL SERVICE CLUB OF THE ARRL, INC.
"Public Service through Communication"
Website: WWW. K3IR.org
Email address: k3ir@arrl.net
Repeaters: 145.230 - 449.975 - Packet 145.030 - ATV 923.250, FN10se

July 2010

President's Message

A Day (and night) In The Field

Field Day 2010 – described on the cover of the June edition of QST as "Unparalleled Outdoor Fun". I don't know about that but the SPARC edition was a good time.

A more detailed description may be found elsewhere in this newsletter but I wish to add my impressions. A hard working group showed up at the SPARC repeater site on Saturday morning to prepare for the event. Our coordinator for the weekend was Jon, K3QF. I'm not sure how many of you are aware that not only has Jon worked a lot of DX but he was DX when serving in the mission field.

A decision was made early on that we would act in the intended spirit of field day and operate under a tent, using auxiliary power and antennas installed for the day only. We would operate using no permanent buildings or antennas. We also wanted to attract neighbors and friends for a visit. Posters were placed in businesses in the area and an "Open House" sign was installed at the entrance.

Set up went well and a number of people stopped in to see what we were up to. SPARC members had a chance to conduct tours and explain the purpose of amateur radio and field day.

The start time rolled around and operations began, but not without some difficulty. A couple radios would not transmit and we found that bright sunlight and orange LCD displays do not mix. In the spirit of Ham radio a variety of sunshades were fashioned out of cardboard boxes and radio problems were sorted out and the fun began.

We had a good mix of experienced operators and fairly new Hams which only added to the fun and spirit of the operation. By evening the operation was running smoothly so I retreated to the repeater building to work on some club projects. Earlier it had come to my attention that I would have to leave in order to teach my Youth Sunday School class Sunday morning. I was deeply

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involved in moving some equipment when I realized that the time was approaching 4:00 AM. I ran home, got a few hours sleep and was in my usual pew by 9:00 AM. Pastor Don, KB3IQJ, had taken vacation that week (humm?) so we were blessed by a presentation by a singing group called A Wing and A Prayer. After Church I had a short lesson with my Youth Class and sent them home early. I jumped into the Imprezza and returned to the site as fast as its little wheels would carry me. As I pulled in the driveway I saw an antenna coming down. It seems that by 11:00 the operators could not find any new stations and seeing as we had successfully reached our goal of exceeding last years point total a decision was made to halt operations and begin to tear down. Several members who could not stay to operate returned to aid with the cleanup. Everything was put away and we enjoyed a good lunch, thanks to George, W3FEY and his daughter.

Was field day 2010 a success? You bet! Can we do more next year? Yes we can! If you missed the action this year mark the last weekend of June on your calendar and plan on being a part of the fun in 2011.

Harry, WA3FFK

MINUTES OF THE JUNE 2010 MEETING OF THE SOUTHERN PENNSYLVANIA AMATEUR RADIO CLUB (SPARC)

Held Tuesday, June 22, 2010 at 7 PM at the Rapho Township Municipal Building

The following members and guests were present:
George Gadbois, W3FEY
Paul Herr, KD8WY
Steve Hass, KB3SJU
Dianne Gadbois
Gerry Wagner, KB3SSZ
Jim Silvius, KW3E
Mike Warner, N3XPD

The meeting was called to order at 7:01 PM by George Gadbois, with a round robin introduction by name and call.

- The minutes from the prior membership meeting were read. On a motion by Jim Silvius and a second by Steve Hass, the minutes were approved as read.

- George presented the Treasurer's report, which was current as of 31 May 2010. On a motion by Gerry Wagner and a second by Mike Warner it was approved as read pending review by the audit committee.

- Steve Hass noted that his work schedule requires more notice for work party participation. Steve asked what had happened to the suggestion to offer our site to WLAN for their tower. George Gadbois explained that the counterpoise for an MF antenna would not fit in our one acre lot, and by the time of the newspaper announcement, the move of the WLAN station was a done deal approved by the FCC.

- Gerry Wagner updated the Field Day schedule for Jon Rudy who was participating in the Peach Bottom drill.

<u>New Business</u>

Paul Herr called attention to the Wide Vigilance III drill scheduled for late September. Details to follow.

On a motion by Paul Herr and a second by Mike Warner the meeting was adjourned.

Respectfully submitted,
N. Dianne Gadbois

A Day in the Field

Field Day 2010 at our Repeater Site was a success. Note some of the photos documenting the day as attached. Over 600 contacts were made with four transmitters and as many antennas. All operations were conducted from our raised tent and all antennas were temporary ones erected just for the 24 hour period. All power was from Grant Beauchamp's 5 KW generator which operated flawlessly. Most modes were used to include CW (thanks Jon), FM, and of course SSB on all bands. Many of our operators stayed over night manning the radios during the entire 24 hours.

Jon earned us extra points powering his self contained station from solar energy and batteries for the entire period and led with the number of contacts.

Gathering the rays!

Jim, Mike and George suppled the other 3 radios. The biggest problem was seeing the displays on the non portable rigs and the computer screens used for logging.

Solar energy is great but not in the wrong place. N3XPD

We await Jon's compilation of our logs and our final submission to ARRL to see how many points we earned in total.

Once again George's daughter, Dianne, did a superb job of catering the meals which were

scrumptious. **Kudos to George & Dianne.** With the 90 degree temperatures we went thru a lot of sodas and water which we had available in our ice filled coolers. We posted an Open House sign and had a few visitors stop by including our Amish neighbor, Dave, who graciously offered the club use of water from his wind mill pumped tank any time we needed it.

K3IR OPERATORS

Name	Call
Jon Ruby	K3QF
Mike Warner	N3XPD
Gerry Wagner	KB3SSZ
Grant Beauchamp	KB3KIN
Mark	KB3NCJ
Steve Hass	KB3SJU
Ricky Beauchamp	Guest
Jim Silvius	KW3E
Harry Bauder	WA3FFK
George Gadbois	W3FEY

GUESTS

Amish Farmer Dave from across the road
Woodworker Patrick and kids Megan and Caleb (Followup his Father / FiL commo in Navy?)
Mark of RRRA. KB3NCJ
Don Pickel, RRRA President, KB3LHT
Dave Sarraf, N3NDJ
George's Dianne (culinary)
Steve's Grandson Chris
Grant's son, Ricky
Mike's son Dan and two grandsons

Gerry Wagner, KB3SSZ

Guest op KB3NCJ

Field Day Report by Jon Rudy

2010 Field Day Entry Form

2010 Rules

Datestamp: 2010-06-28 13:42:44 PDT
Confirmation: f5018f19b4c7fddf

Use the following link if you want to update your Field Day entry:
http://www.b4h.net/cabforms/fielddayupdate.php?callused=K3IR&confirmation=f5018f19b4c7fddf

Thanks for using the web to submit your 2010 ARRL Field Day entry. Print this page to use as proof that you submitted your entry.

Call Used:**K3IR** GOTA Station Call:**(none)** ARRL/RAC Section:**EPA** Class:**4A**

Participants:**11** Club/Group Name: **Southern Pennsylvania Amateur Radio Club (SPARC)**

Power Source(s): **Generator, Battery, Solar**

Power Multiplier: **2X**

Bonus Points:

Description	Points
100% Emergency power	400
Natural power QSOs completed	100
Youth participation Youth operators=**1** Youth participants=**4**	20
Submitted via the Web	50
Total Bonus Points	**570**

Score Summary:

	CW	Digital	Phone	Total	
Total QSOs	403	1	212		
Total Points	806	2	212	1020	Claimed Score = 2,040

Submitted by:
Jon Rudy, K3QF
C/O SPARC
Box 1033
Lancaster PA 17608-1033
E-mail: jonK3QF@gmail.com

Comments:
We posted an Open House sign at the entrance to our club/repeater site and had a few visitors stop by including our Amish neighbor, Dave, who graciously offered the club use of water from his wind mill pumped tank any time we needed it. Is there a bonus for wind powered showers?

Jon Rudy – K3QF
SPARC Field Day Coordinator

Recycle Program

Recycling is not restricted to club members. Help SPARC and help a green initiative. Aluminum cans are easy to collect and they bring a good price. Recycled paper prices are up a little.

Recycling is an important part of the income required to keep the club operational. All recycling revenue is now being applied directly to the SPARC site mortgage.

Please take recyclables to Dave Payne's mini recycling center at 1373 Malleable Rd, Columbia or to a SPARC club meeting.

The SPARC heavy duty pickup truck previously used for transporting recycled paper is now for sale. If you know anyone who might be interested, contact Dave Payne, N3LOM.

Coming Events

Saturday/Sunday, 24-25 July 2010 MS BIKE – Lancaster contact Dick, WA3USG wa3usg@verizon.net for details.
***
Monday-Sunday 20-26 September 2010 Wide Vigilance III drill. No details available at this time. Expect the early part to be table top exercises with any Amateur participation probably on Saturday.
***
Sat Sept 25**Mid-Atlantic States VHF Conference**

NEW LOCATION: Quality Inn Conference Center--969 Bethlehem Pike--Montgomeryville, PA One Day Conference for experts and beginners alike hosted by the

Mt Airy VHF RC Club.

Full info at: http://packratvhf.com/ web-based registration open soon. One price $70 early-bird includes CD, light breakfast, lunch, snack & buffet dinner.
Raffles and Door Prizes--Indoor selling and outdoor tailgating VHF gear testing--Friday Night Hospitality Room--FREE BEGINNERS SESSION (must register)

Editor's Notes

The Summer Es season started great this year, but early July has not seen much double hop in this area. The CQWW VHF contest was underwhelming for Es. All this can change at any time so keep watching 6m for Es.

Note the article by Jim Ibaugh on free Internet resuources for those who want to get started in Amateur Radio or to upgrade their present license later in this issue. No Morse Code test is required to get any class of license, but serious DXing requires knowledge of the code. Very important tip, learn to receive code before you touch a key. I can't believe some of the 'fists' I hear on the air today.

If you just can't deal with learning Morse code, there are computer programs to copy and send code from your computer. The perfect sending is what will give away your secret.

73, George, W3FEY

ARES/RACES

As part of the SPARC commitment to emergency communications, the SPARC repeater system is maintained as available for linking with other area repeaters.

Lancaster County RACES VHF Net is held on the first Tuesday of the month at 2030 hours local time. Presently being held on the 145.310 MHz repeater.

The Lancaster County primary ARES/RACES repeater is on 145.310 MHz with minus offset and 118.8 PL.

Combined York County Amateur and ARES/RACES NET convenes at 8:30 PM (2030) Mondays on 146.97.

Pennsylvania RACES HF Nets are held at 3993.5 kHz LSB on all Sundays except holidays.
The statewide net is on the first Sunday of the month at 0800 hours local time.
The Central Area (including Lancaster County) net is at 08:30 local time.

SPARC Nets

SPARC holds nets on the 2nd, 3rd, 4th, and 5th Tuesday (every Tuesday except the first) at 2100 local time on 145.230 MHz minus offset and a PL of 118.8. The 449.975MHz repeater is linked to the 2m repeater for the
net.

Club Officers

President Harry Bauder – WA3FFK
Vice-President: George Gadbois – W3FEY
Secretary - Dave Sarraf. - N3NDJ
Treasurer - Ted Freedman - K3KSA
Repeater Trustee - Dave Payne - N3LOM

Past President - Mike Warner – N3XPD
Board of Directors - Jim Silvius – KW3E

Nearby Nets of Local Interest

York County Sponsored Nets:

Combined York County Amateur and ARES/RACES NET convenes at 8:30 PM (2030) Monday on 146.97.

Tuesday Nets (Note new schedule for Technical Net)
Elmer/DIGITAL NET -- Tuesday, 8 PM on the York 146.97 Repeater --
The first 15 minutes or so will be open to questions. DIGITAL Communications testing will continue after that.
Friday Digital Net
Friday evenings starting at 8 PM on the 146.610 (PL:131.8 Hz) EARS repeater on Ephrata Mountain.

This is an excellent Digital net called by Bob, AB3GF. Check in is by digital, BPSK125.
It is an informal, well run net with plenty of Digital transmissions along with discussion by voice.
***

NTS-EPA
AA3RG and Echolink Traffic Net" (EAETN) meets every Thursday at 8:00pm on AA3RG-R 146.640(-) Tone 82.5 both Echo Link and 2m radio check ins welcome. No previous experience needed. Just perfect for new hams on 2m or EL on AA3RG-R CONFERENCE.

Please join in and let others know about it as well.
73 -Scott N3SW EPA STM
***

Delaware Co. Mobile Sixers Net Schedule
Sunday 2000 50.550 MHz USB

PACKRAT MONDAY NIGHT NETS

Visit the Mt Airy VHF Radio Club at: www.packratvhf.com for the latest information on VHF/UHF nets.

2M Northeast SSB Net Mon – Fri, 0700 check on 144.200MHz for possible DX openings. 0730 – 0830 net on 144.176MHz. This is a very long running net that runs from NJ up the coast to RI and beyond.

QRZ News Publication

QRZ News is published monthly on the second Tuesday of each month, two weeks before the monthly meeting. Deadline for article submission is the second Monday of each month. If a large amount of editing is required, earlier submission is requested.

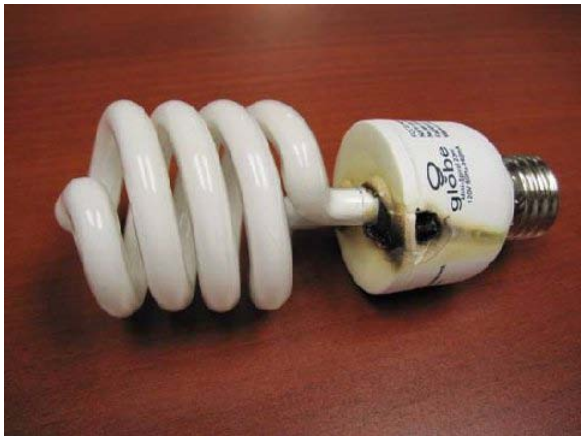
We operate on an exchange basis with other non-commercial publications. Articles printed in QRZ News may be reprinted in a not for profit publication provided proper credit is given. Reprinted articles require permission from the original source.

QRZ News is archived at
http://www.k3ir.org/QRZ_News.html.
Documents are in PDF format.

Dave Payne, N3LOM, recently found a paper copy of the first quarter 1999 issue of QRZ News. This is the oldest copy of QRZ News in the archive. The next oldest copies are from 2001.

CFL Safety Warning

Below is a picture of a CFL light bulb from my bathroom. I turned it on the other day and then smelled smoke after a few minutes. Four inch flames were spewing out of the side of the ballast like a blow torch! I immediately turned off the lights. But I'm sure it would have caused a fire if I was not right there. Imagine if the kids had left the lights on as usual when they were not in the room.



I took the bulb to the Fire Department to report the incident. The Fireman wasn't at all surprised and said that it was not an uncommon occurrence. Apparently, sometimes when the bulb burns out there is a chance that the ballast can start a fire. He told me that the Fire Marshall had issued reports about the dangers of these bulbs.

Upon doing some Internet research, it seems that bulbs made by "Globe" in China seem to have the lion's share of problems. Lots of fires have been blamed on misuse of CFL bulbs, like using them in recessed lighting, pot lights, dimmers or in track lighting. Mine was installed in a normal light socket.

I bought these at Wal-Mart. I will be removing all the Globe bulbs from my house.

Information from dholman@cfl.rr.com

This report forwarded by Jim Silvius, KW3E

Ed Note: We have previously reported infant failures and short life for CFLs. I have heard of the above described type of failure, but this is the first picture I have seen. My experience has improved as I upgraded from the very low price CFLs available from local discount stores.

See the QRZ News archive at http://www.k3ir.org/QRZ_News.html for earlier articles. I guess we need someone to make a technical article index for QRZ News.

George, W3FEY

QUICK PATH TO TECHNICIAN

CLASS FCC LICENSE

By James L. Ibaugh, AA3C

After a young visitor observed my QSO with N3CXY (XYL Shari) on 145.230MHz, he asked me how quickly could he qualify for a license. I told him that I know of a weekend training program that produced many licensed ham radio operators. He asked me to outline a crash home study steps to use in his few free hours. I told him I would put together a DOUBLE QUICK STEPS list for his next visit .

[1.] Tools: Computer and Internet connection. If you don't have a PDF Reader yet, down load a FREE Adobe PDF Reader 9.3.3 link:
http://get.adobe.com/reader/

[2.] All hams should have FCC Regs: FREE!
http://www.gpo.gov/fdsys/pkg/CFR-2009-title47-vol5/pdf/CFR-2009-title47-vol5-part97.pdf Government URL supplied.

[3.] LINKS: EXAM POOL DOWN LOAD, FREE! Questions & Answers to the tests!
http://www.arrl.org/arrlvec/pools.html
Technician:http://www.ncvec.org/downloads/Revised%20Element%202.Pdf

General:http://www.ncvec.org/downloads/2007General.pdf **General Diagrams:** http://www.ncvec.org/downloads/G7-1.pdf **Extra:**http://www.ncvec.org/downloads/Final%202008%20Extra.pdf *The Extra class question pool PDF contains 12 schematic diagrams.* **Down load and save Technician exam element PDF, MSWord or TEXT format which ever format you need.**

[4.] Study Q&A's: *Public Domain material.*

T1A01 (D)[97.3(a)(4)] (First Q&A Page7) For whom is the Amateur Radio Service intended?

A. Persons who have messages to broadcast to the public

B. Persons who need communications for the activities of their immediate family members, relatives and friends

C. Persons who need two-way communications for personal reasons

D. Persons who are interested in radio technique solely with a personal aim and without pecuniary interest

(Why don't they use periods with answers?)

The question number line has the correct answer indicator, upper case letter in parentheses: "T1A01 (D)[97.3(a)(4)]". The first read through, read the question and only the correct answer, ergo "(D)". Completely ignore the faux (false detractor) answers. Second or third time through the Q&A pool, put your thumb over the correct answer indicator and pick out the correct one. Keep track of your score and when you are over 50% you may be ready for the next step.

[5.] "On-Line Practice Exams Practice with the actual questions until you're confident of success!" [ARRL source: www.ARRL.ORG **]**

Practice exams online (ALL FREE):

www.QRZ.com www.eham.net

www.KB0MGA.net www.AA9PW.com

[6.] When you are getting 90% or better you are ready for the big show. Here in Lancaster County, one testing session is held at the Fire Training Center just off the Salunga exit of RT283. Sessions are scheduled in even numbered months (Feb,Apr,Jun,Aug,Oct& Dec.) on the third Thursday at 7:00PM. If that is not convenient try the Exam Locator:

http://www.arrl.org/find-an-amateur-radio-license-exam-session **There is a $16 exam fee per exam session, take one or all three exams.**

[7.] Find a club to help you get on the air after you pass your exam and receive your FCC assigned call letters. Try www.K3IR.org **or use search for clubs page:**

http://www.arrl.org/find-a-club

[8.] If you don't have any radio gear, you may use www.EchoLink.org **system if you have a valid Amateur Radio Operators license, minimum of Technician Class.**

I have been a Volunteer Examiner and a license preparatory instructor since 1965, when we had 3 speed code tests and 5 classes of license exams. Now we have NO CODE and only three classes of license. It is much easier to get a ham radio license today. Good luck in your studies. Hope to meet you on the air.

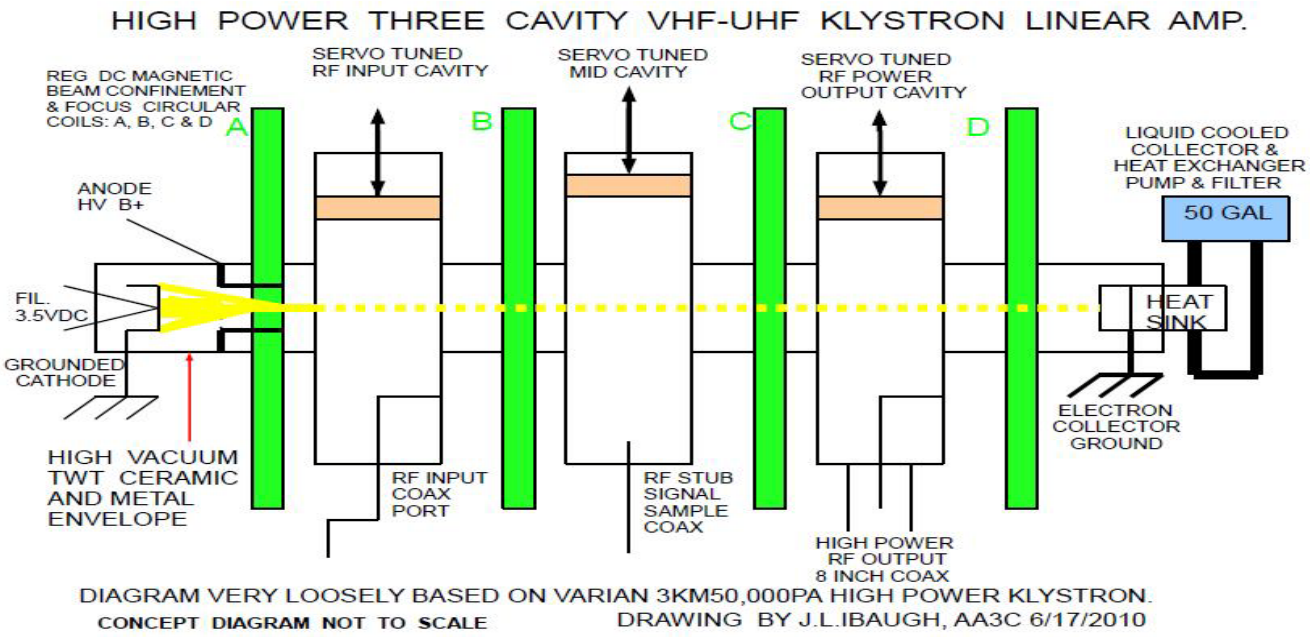
73's de AA3C - Jim,

AA3C@ARRL.NET

AA3C@AMSAT.ORG

K3UIG-K7UGA Errata

The hyperlinks were inadvertently omitted from the K3UIG-K7UGA article published last month. I revised file has been posted on the QRZ on line archive with the hyperlinks intact. See http://www.k3ir.org/QRZ_News/QRZnewsJune2010R2.pdf



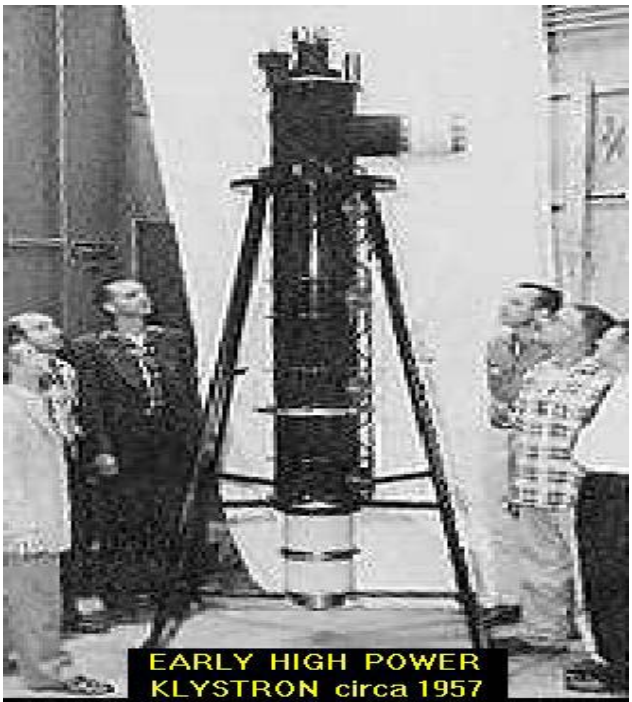
Klystron Linear Amplifier

By James L. Ibaugh, AA3C

The pseudo-Greek word klystron comes from the stem form **κλυσ** - (klys) of a Greek verb referring to the action of waves breaking against a shore, and the end of the word electron. Hence, the name Klystron. However, in German, they say that electrons are moving in "Klystern". Klyster is the German word for CLUSTER, BUNCH or KLUMP. The tube could have been called the Klumpitron. Klystrons are also commonly known as **Traveling Wave Tubes** (TWTs, pronounced "t-waa-t's").

The brothers, Russell and Sigurd Varian, of Stanford University are the inventors of the klystron. Their prototype was completed in August 1937. The Varians went on to found Varian Associates to commercialize the technology (for example to make small linear accelerators to generate photons for external beam radiation therapy and other medical research). In the Varian brother's 1939 paper, they acknowledged the contribution of A. Arsenjewa-Heil and Oskar Heil (wife and husband respectively) for their **velocity modulation** theory in 1935.

Upon publication of the Varian paper in 1939, news of the klystron immediately influenced the
work of US and UK researchers working on radar equipment and other military research. The work, dealing with electron acceleration and deceleration, of physicist W.W. Hansen



was instrumental in the development of klystron and was cited by the Varian brothers in their 1939 paper. Russell and Sigurd Varian are in photo.

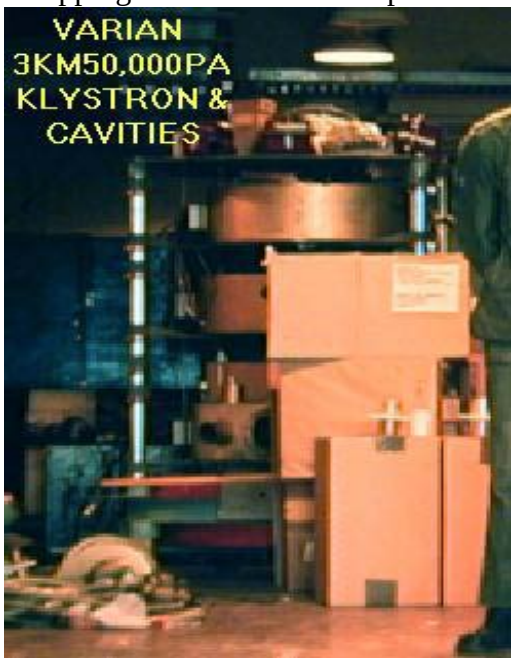
So, just what is a Klystron?

The Klystron in our study (K-tube) is a ceramic and metal high vacuum electron beam radio frequency power amplifier tube. There are several basic types of modern klystrons. Two types of common klystrons are usually used in VHF/UHF/SHF (not limited to) radio, television or radar transmitters, use either internal or external resonance cavities. Internal cavity tubes are usually fixed frequency and external cavity tubes are frequency tunable. Klystrons are almost always used as an amplifier rather than an oscillator. Oscillating reflex klystrons have big frequency instability, bandwidth, noise problems and may be used for baking or heating jobs.

Besides the ceramic and metal vacuum tube envelope, the important parts of the three cavity klystron in our case study are:

- Electron Gun with high current filament (heater) and external E & I metering circuits. All meters were analog.
- Thermionic electron emission cathode, usually connected to ground through an external cathode current meter circuit.
- Anode plate with attached Einzel lens cylinder, both run at HV B+ (up to) 50KV with external E (voltage) metering circuit.
- External: Three large (~3 ft dia.) gold plated (inside and outside) resonance cavities with attached remote servomotor controlled frequency changing tuning plungers. Three front panel controls.
- External: Four actively regulated DC magnetic electron beam confinement and focus circular coils; (green) A, B, C and D. Four foot diameter toroid coils wound on ferrite cores. Four front panel controls.
- Internal high current electron collector heat sunk via liquid cooled external high flow multistage heat exchange system. Collector ground current monitored via external, well RF bypassed metering circuit (front panel display).
- External: 8 inch output power 50ohm dry nitrogen gas pressurized coax up to 9dB gain 200-400MHZ stacked antenna.

The above description loosely outlines the Varian 3KM50,000PA VHF/UHF Klystron. The next photo shows a replacement K-tube in partial assembly on the K-tube transport and assembly trolley. Note the gold plated cavities clam shelled around the K-tube. It is a 18 hour job with two crews (12 men) to get a K-tube from shipping crate to on the air operational



testing. Then “proof of spec test”, 2 more hours!

The final K-tube destination was the inside (third cabinet) of the AN/FRT-49 Electronic Guidance Signals Transmitting Set, VHF/UHF, 225-400 MHz. High power klystron amplifier.

Equipment designed for comm and data link. Has two 20 KW (avg pwr) RF amplifier channels for CW, FSK, FM & PULSE TRAIN DATA(noAM). 120/208 vac, 60 Hz, 179 kva. 45,200 lbs, volume approx= 3200 cu ft. 400 sqft floor space(10'x40'). TO: 31S1-2FRT49. Power Gain= up to +40 dB (1 watt in = 10KW out). GAIN & LOSS =

10(Log (Po/Pi)). 2 watts of drive signal yields 20KW output. We ran with about +30dB gain so, 20 watts in to get 20KW output (less stress on tube, less self oscillation by-products and less RF noise). The exciter had a pair of RCA beam power 4CX250W's, no problem with drive power. The third wide cabinet from the left which had 7.5 foot tall doors (K-tube is seven foot tall) is where the tube is installed and operated. Note all the front panel controls are analog except operation timer.

Tube type: **3 K M 50,000 P A**

3 = Three cavity.
K = Klystron.
M = Multi frequency (tunable).
50,000 =Tube power dissipation in watts.
P =RF Power tube.
A =RF Linear Amplifier

In the pseudo pulse mode (data packets) the duty cycle was controllable. Specs said the ideal modulation level was 10% or less. So 90% of the time the K-tube is waiting for the next packet. If the average power is 20KW averaged over 100% of the packet cycle, the peak power must be close to about 200KW peak power output. Then add in antenna gain of about 9 dB and therefore ERPpk would be about 800KW! I spent as much time in the copper screen work room as I could.

This looks like my old work station, they all look alike. Needed the copper screen room to keep radar and data pulses out of the sensitive receiver alignment equipment. There is a VHF/UHF AN/GRR-7 tube type receiver on

the bench, probably being aligned to a new Xtal frequency. I worked on at least 100 'R-7's at the 682nd GATR. Rather work on AN/GRT-3 transmitters.

I reported to the 682nd Radar Sq. in 1966 after graduating from the USAF Air University's Communications Electronics curriculum, serving my year of training and internship at the 774th Radar Sq. The 682nd had the first real AN/FRT-49 radio transmitter sets I saw outside of the AF Technical Manual TO: 31S1-2FRT49. I studied it at the 774th not knowing that I would become a FRT-49 NCO Crew Chief the very next year. I became Crew Chief because I knew chemistry and the other crew members didn't. Long story.

I was on duty at my GATR (Ground to Air Transmit Receive) duty station after two weeks of orientation (squadron duty), when a very loud klaxon horn started to blast away. Klaxon horn is the sound you hear when a submarine

does a crash dive (in the movies). All the GATR troops ran in the direction of the FRT-49's area. A big cloud of **blue** steam was billowing out of the CHANNEL BRAVO-49 and the GATR NCOIC SrMSgt was throwing switches and turning knobs trying to save the K-tube. Someone killed the HV. Data burst signal was quickly transferred over to CHANNEL ALPHA-49 (shown in photo) and was running a cool 25KW average output (~250KW Pk). The NCOIC saved the K-tube. He **ordered** me to get the TO(31S1-2FRT49) and fix BRAVO! I first turned off the coolant pump and the spritzing and blue steam stopped. Next, I reduced the filament current very, very slowly down from 700 AMPs, so the negative thermal shock would not break the very brittle thorium tungsten 2450 watt heater filament. This K-tube cost ~$10,000 (1966$'s), average life 15,154 hours transmitting time (50% on line time).

My investigation found that a coolant hose had cracked and spritzed the blue colored liquid coolant mix all over the inside of the K-tube cabinet. My next set of tools were the mop, several sponges and two buckets.

The K-tube coolant was 50 gallons of 50% Ethylene Glycol (poison) and 50% deionized distilled H2O. The TO (Technical Operations) manual didn't say any thing about it being **blue**. I knew that Ethylene Glycol was colorless and so was Hydrogen Hydroxide (H,OH=H2O).

I reported this to the NCOIC. He grabbed his copy of the TO and five minutes later he was on the phone with the squadron supply NCOIC. He told me to go back to work and close his office door on my way out. Back to my mop and bucket work.

Turns out someone in supply switched our high priced pure lab grade colorless Ethylene Glycol $3.50/gallon for blue automotive antifreeze at $1/gallon. That's how I got to be the new FRT-49 NCO Crew Chief. I and one A1C had to clean and flush out the blue stuff from both systems and put the good stuff in during staggered scheduled FRT-49 maintenance down times.

Back to the title subject. The electron gun is a diode (like the electron gun in your TV CRT); it has a filament to heat the cathode up to a high enough temperature to "boil off" large amount of electrons. These thermalized electrons are pulled away from the cathode area and accelerated by the very high positive electrical fields of the Anode element at up to +50KV. The concave shape of the cathode emission surface and the shape and placement of the anode ring plate accelerates and funnels the electrons into a narrow high density beam. At this point the beam is "CW" unmodulated, evenly spaced electrons, all traveling at about the same speed. The tightness of the very high energy (high power) electron beam is maintained at first, by the Einzel Electron Lens attached to the anode ring. The Einzel lens is a metal tube in the center of the TWT and is at the same positive voltage as the anode. The beam confinement is further tightened by current fine adjustment of the "A" magnetic electron beam confinement and focus circular coil positioned externally, at 90 degrees to the beam, between the electron gun and the signal input/modulation cavity.

ELECTRON VELOCITY MODULATION

The Klystron in the diagram above has three cavities and are spaced equidistant along the TWT. Each cavity is shaped into clam shell halves and clamp the tube body over a ceramic section of the envelope. There are three ceramic section "wave windows" that the cavities are centered over and clamped to the tube. The RF signal in the "buncher" input/modulation cavity passes through the ceramic "wave window" section and interacts with the high energy electron beam. The interaction takes the form of electron velocities changing depending on which phase of the wave through which the electron passes. One phase slowed the electrons down and the next phase accelerates the electrons passing through it at that time. This deceleration and acceleration causes the steady beam to form bunching of electrons into klumps or clusters which are a linear analog of the input signal.

This is velocity modulation where a small amount of RF power changes the continuity of the high power electron beam in such a way as to produce a very high power gain.

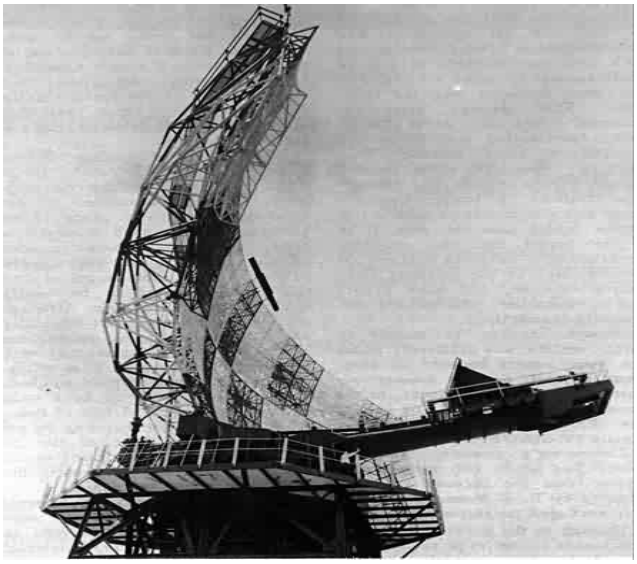
The modulated (bunched) electron beam passes through the second (MID) cavity and if the cavity is tuned to the drive frequency, there will be a sympathetic induced resonance in the cavity. This induced RF wave may reinforce the bunching effect and increase the efficiency of the modulation depth and constrain drifting or loose electrons which reduces body current. Body current is the result of loose or wayward electrons hitting the tube wall. This is lost power and monitoring circuits and display meters are provided for each metal body sections. Body current is reduced by very careful adjustment of the magnetic electron beam confinement and focus circular coils "A", "B" and "C". Magnetic coil "D" has a slightly different function, de-focusing the residual beam to protect the catcher plate from sputtering melted metal in the tube.

The "MID" cavity is sometimes called the "REBUNCHER" cavity since it could increase the efficiency and therefore, the power gain. It could also be "sidesaddle tuned" (one sided stagger tuned) to increase the system bandwidth or even be tuned to a parasitic oscillation (they sometimes happen when the amplifier gain exceeds 50dB) and short spurious signals to ground through the sampler stub signal port. To reduce power gain the "MID" cavity could be detuned, tuned far from input frequency, not frequency or wavelength related to the input.

The "Catcher" power output cavity removed about 85% to 95% of the RF power delivered to the cavity by the modulated electron beam.
The cavity's pickup loop has to be heavy duty and not soldered, residual heat could melt soldered connections or even small gauge copper wire. Tools made with ferrous metals were taboo.

After the electron beam passes through the output cavity and up to 95% of the RF power removed, there is still a lot of power left in the beam. The electron "BACKSTOP" called the "Catcher Element" needed to have very high temperature resistance and heat sunk to an external heat transfer and elimination system.
A two stage heat removal system was used. The first stage was a tank of 50 gallons of 50% high grade Ethylene Glycol (with no additives) and 50% deionized distilled H2O mix. The fluid was then pumped through a heat transfer part attached to the external metal end of the "Catcher Element" which is grounded thru a meter circuit.
The hot fluid was pumped through air blown radiators in a large cabinet just to the left of the large exit doors on the FRT-49 photo. The hot air was vented out through a large wall exhaust port.

A little over a year's duty at 682nd and the USAF cut orders on me and sent me to the Alaskan Air Command and the 626th Radar Sq.
The SAGE Air Defense System was brought fully on line around 1963 with a total cost of approximately $12,000,000,000.oo (1963 $'s) or about $120,000,000,000 in 2010 $'s. The SAGE system functioned from 1963 to 1983 when the last unit was shut down. That is 20



years of duty for $6,000,000,000.oo per year for SAGE air defense in 2010 $'s. Our tax money.
There is a 6ft airman standing on the walkway under the feed horn gantry. The 80 ton azimuth

search antenna of the AN/FPS-24 was turned into 80 tons of scrap iron. Note the SQUAK ID transponder antenna on the top of the search reflector. GATR maintained transponder TR sets.

The 682nd Radar AC&W Sq. was disbanded around 1980 and equipment removed around the same time period. The radar tower building was bricked up and now is called the "Mystery Box of Mount Uminhum".

There goes the AN/FRT-49 Klystron control cabinet off to the scrap yard or garbage dump.

Goodby HV power supply, etc. Total waste!

73's de AA3C - Jim ex-USAF Sgt/30454
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