

The Jersey Broadcaster

NEWSLETTER OF THE NEW JERSEY ANTIQUE RADIO CLUB

January 2004

Volume 10 Issue 1



MEETING/ ACTIVITY NOTES

Reported by Marv Beeferman

Happy New Year! 2003, under the leadership of President Phil Vourtsis, was another banner year for the New Jersey Antique Radio Club; here are just a few of the highlights:

- We ended the year with a total of 204 members and our books in the black.
- The "Jersey Broadcaster" kept members informed on a monthly basis of upcoming activities and local events with a few restoration, technical and historical comments thrown in for good measure.
- The club's web page is going strong.
- The club sponsored radio exhibits at the Barnegat Library, the Cranbury Museum, the Garden State Philharmonic's "1940's Radio Show," the Trenton Computer Festival and provided technical support for the re-enactment of Orson Welle's 65-year old Halloween broadcast of "War of the Worlds."
- InfoAge and the National Broadcaster's Hall of Fame took a few more steps to becoming a full reality.
- The club sponsored a Broadcast Band DX contest and Home-brew Radio Receiver contest.
- Members were treated to lectures and demonstrations on such diverse topics as the Theremin, color television development, a historical retrospective of early radio and TV, the chemistry and development of batteries and laying out and fabricating an electronic chassis.
- Repair clinics were hosted by the David Sarnoff Library in March and July (including a "Hands on History of Radio").
- The club sponsored swapmeets in June, September and November.



MEETING NOTICE

The next meeting of the NJARC will take place on Friday, January 9th at 7:30 PM at the David Sarnoff Library in Princeton NJ. See the NJARC web site or contact Phil Vourtsis at 732-446-2427 for directions. Technical Coordinator Al Klase will offer a presentation entitled "Radio Building Blocks - Part 1." Al describes the entire series as follows:

"We'll review the basic electronic components and their use in the functional blocks common to all radio systems. Armed with this basic information, we'll consider how filters, amplifiers, detectors and power sources form the architectures of regenerative, TRF and super-heterodyne receivers. Along the way, we'll hopefully learn to read schematics and apply simple analytical tools such as Ohm's law.

- Mini-auctions and show-and-tell sessions kept our meeting attendance strong throughout the year (over 1/4 of the membership at every meeting!).

this year's dues (make out checks to NJARC) to our membership secretary at the address below or plan to pay at the next meeting...we've got a great 2004 planned for you!

**MARSHA SIMKIN
33 LAKELAND DRIVE
BARNEGAT, NJ 08005**

Note: Your mailing label reflects your dues expiration date (i.e., "1/04"). An "H" code designates an honorary member with no payment due.

Our holiday party was described by many as "the best ever" and major credit has to be given to Marsha and Jerry Simkin for their hard work; it gave the party a very professional flavor. The "social hour" arranged by Shari and Gary D'Amico was also a very nice touch. For all those who helped with check-in, cake, coffee, setup and cleanup...a well-deserved THANK YOU! Also, a special thanks to David Sarnoff Library Executive Director Alex Magoun for his generosity in allowing use of both the auditorium and the library area.

Entertainment provided by the Mystery Grab Bag and a 1930's film of "Major Bowes Original Amateur Hour" was just enough to top off a fun-filled evening. For those of us who decided to wait the extra hour or so (unplanned traffic put off our guest's 7:30 arrival), the reward was an



Founding members Jerry and Marsha Simkin, Shari and Gary D'Amico and Tom Provost do the cake cutting honors at our holiday party.

- Our tube and capacitor programs maintained their bargain prices.
- Our holiday party was a huge success, attracting close to 100 members.

I'm sure that many more items can be added to the list, since each person seems to find their own individualized benefit from being a member of the NJARC. But what is probably a common thread for all of us is the fellowship of sharing a mutual interest with good friends. Is it worth \$20 (\$25 for a joint membership)? If you think it is, then please take a few minutes to send

THE JERSEY BROADCASTER is the newsletter of the New Jersey Antique Radio Club (NJARC) which is dedicated to preserving the history and enhancing the knowledge of radio and related disciplines. Dues are \$15 per year and meetings are held the second Friday of each month.

The Editor or NJARC is not liable for any other use of the contents of this publication.

PRESIDENT:

Phil Vourtsis
13 Cornell Place
Manalapan, N.J. 07726
(732)-446-2427

VICE PRESIDENT:

Richard Lee
154 Hudson Terrace
Piermont, N.Y. 10968-1014
(845)-359-3809

SECRETARY/EDITOR:

Marv Beeferman
2265 Emerald Park Drive
Forked River, N.J. 08731
(609)-693-9430

TREASURER:

Sal Brisindi
203 Cannon Road
Freehold, N.J. 07728
(732)-308-1748

SERGEANT-AT-ARMS:

Dave Snellman
Box 5113
New Britain, PA 18091
(215)-345-4248

TRUSTEES:

Ray Chase
Gary D'Amico (732)-271-0421
Martin Friedman (732)-238-1047

TECHNICAL COORDINATOR:

Al Klase
22 Cherryville-Stanton Road
Flemington, N.J. 08822
(908)-782-4829

TUBE PROGRAM:

Gary D'Amico
84 Noble Street
South Bound Brook, N.J. 08880
(732)-271-0421

SCHEMATIC PROGRAM:

Aaron Hunter
23 Lenape Trail
Southampton, N.J. 08088
(609)-267-3065

CAPACITOR PROGRAM:

John Ruccolo
335 Butcher Rd.
Hightstown, N.J. 08520
(609)-426-4568

WEB COORDINATOR:

Dave Sica
(732)-382-0618
<http://www.njarc.org>

MEMBERSHIP SECRETARY:

Marsha Simkin
33 Lakeland Drive
Barnegat, N.J. 08005
(609)-660-8160

amusing talk by Danny Stiles spanning his 56 year career in radio. Stiles started on WHBI in 1947 and for a time was the Cat Man playing rhythm and blues on WNYC. Then he returned to pop and he's played it ever since - one of the last and most determined standards-bearers of the Boswell Sisters, Frank Sinatra, George M. Cohan, Fanny Brice and a host of others. Many of Stiles' records come from his own huge collection of old 78s and excerpts can be regularly heard over WNSW, WPAT and WNYC. NJARC Vice President Richard Lee presented Danny with a token of appreciation from the club for "keeping the faith" - a vintage RCA microphone.



A nice ending to the evening was the club's purchase of some 700 discards from the David Sarnoff Library. These books will form the backbone of the club's permanent library. It was nice to see everyone chip in and fill their trunks until the books can be moved to a permanent location. As the lists come in (Tom Provost was the first to catalog his holdings), they will be organized by Marsha Simkin for distribution.

Our next Repair Session will be held at the David Sarnoff Library on Saturday, January 17. If you're new to the club, contact Al Klase at 908-782-4829 or Phil Vourtsis at 732-446-2427 for details. It is also important to give Al a call and tell him what items you plan to work on or need help with so he can get an idea of what to expect. Also, be reminded that the 2004 BCB DX contest runs from January 23 through February 1st with logs due by February 7th. More details are included in this month's *Broadcaster*.

**THE
WESTERN ELECTRIC
NO. 6025-B
AMPLIFIER**

By Marv Beeferman

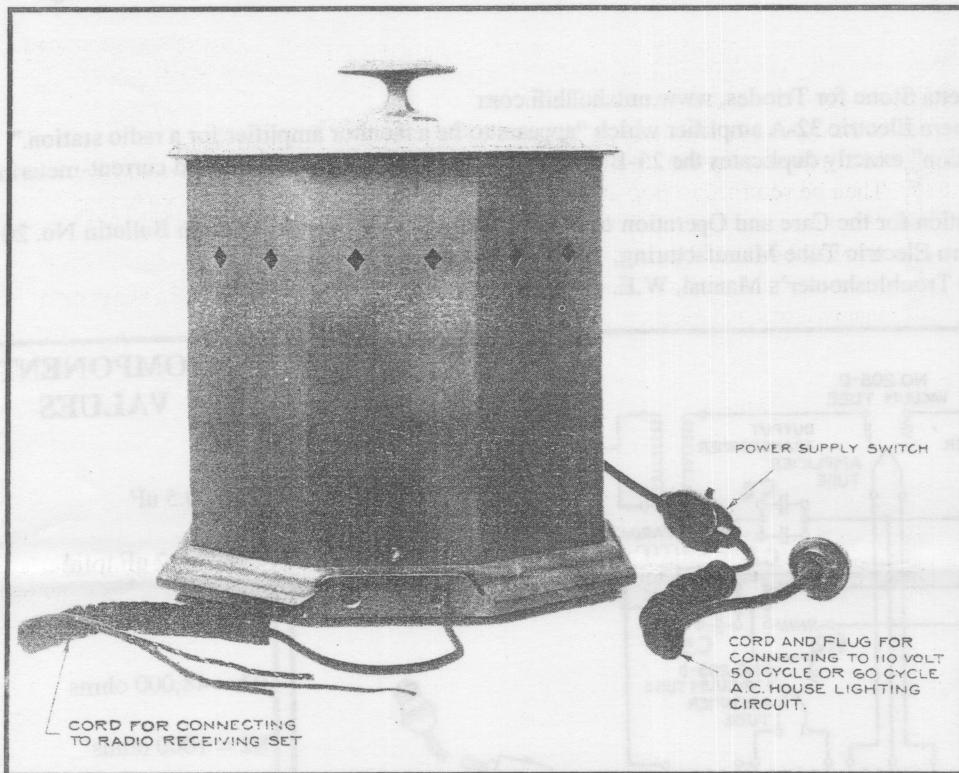
One of the items included in the InfoAge National Broadcasters Hall of Fame inventory is the Western Electric 25-B amplifier. When I first saw it during our initial inventory, only its rarity attracted my attention; what I presumed to be a simplicity justified by the amplifier's 1924 vintage didn't seem to arouse any particular technical interest. However, a second unit showed up as part of an estate sale which the club will maintain as part of its permanent collection. Luckily, the amplifier's instruction bulletin was included as part of the sale and, once I got a look at the circuit diagram, my interest was aroused.

For starters, the title of the bulletin is "Information for the Care and Operation of the No. 6025-B Amplifier." But don't try to search the Web for this model number; you won't get any hits. As was common in the early days of radio, the 6025-B consists of a 25-B amplifier and two Western Electric 205-D vacuum tubes. Since the amplifier metal tag identifies it as a "25-B" and since most collectors don't have the original documentation, it is commonly, but erroneously (unless it's missing its tubes) referred to as the "25-B."

The amplifier's octagon-shaped metal enclosure is very unique, more like something you might find used to contain candy or cookies. It is equipped with a phone-tipped cord for connection to a radio's final audio stage to supply an additional stage of amplification provided by one of the 205-D's. From the bulletin:

"Thus if satisfactory volume is obtained in a headset from the detector tube of a radio receiving set, one or two stages of audio-frequency amplification plus the No. 6025-B Amplifier will provide sufficient energy to operate a loud speaking telephone so as to be audible throughout a good sized room."

The amplifier requires no batteries. The second 205-D serves as a rectifier with power supplied from a 110 VAC source



using a standard line cord for connection to a light socket; the only control on the amplifier is the line cord on-off switch. Speaker connections are made to a terminal block on the bottom of the amplifier.

So far, the basic design is pretty mundane until the circuit diagram (page 4) is analyzed. What is found is sometimes referred to as a "cathode-coupled parallel-feed circuit," a circuit which predates the invention of indirect-heated triodes, power rectifiers, pentodes and negative feedback. Another term that has been suggested, giving proper credit to the originator, is "Western Electric coupling."

The 205-D direct-heated triode used as the amplifier was introduced in 1924 for use as an AF amplifier or modulator where an output of approximately 1 watt was required. Note that its plate is loaded by a "retardation coil," otherwise known as a plate choke. The primary of the output transformer is returned through parallel capacitors (2 uF total) to the virtual cathode of the 205-D (the center tap of the filament supply). Although not immediately obvious, the tube is biased through a 1K ohm resistor that returns to ground.

Also note that there is no cathode-bypass capacitor; instead, the grid is bypassed to ground through a 0.5uF capacitor. This is only possible with an input transformer, since the entire secondary "floats" and doesn't need to be referenced to ground.

The floating secondary provides a differential drive to the grid/virtual-cathode input pair of the 205-D. The usual RC-coupling practice of AC-grounding the cathode masks the fact that tubes respond to a differential drive between the cathode and grid. This circuit takes advantage of the higher impedance grid circuit to reduce the size of the typical cathode-bypass capacitor. (Bypass capacitors are sized to match the impedances of the circuit they are bypassing. Cathode impedances are the "lowest-impedance" node of a vacuum tube, so the cathode-bypass capacitor must be the largest.)

The input circuit mirrors the output circuit, with the return side of the transformer connected not to ground, but to the cathode. Since all four pins of the 205-D are transformer-coupled, the nodes don't have to meet at ground, as they do in an RC-coupled circuit. In the 25-B, they all meet at the virtual cathode of the amplifier.

Although the entire circuit seems a little complex for its purpose and vintage, keep in mind that the 25-B amplifier predates the invention of the rectifier tube...the single 205-D acting as a rectifier is evidence of that. Also, the use of only a single 205-D as a half-wave rectifier instead of using a pair for a much quieter full-wave rectifier, is an indirect comment on the bass response of the 1924 vintage speaker and the cost of an extra 205-D. Original Western

Electric amplifiers were designed in an era when music sources were restricted mostly to a 100 Hz to 5 kHz bandwidth, the speakers of the day never went down to 60 Hz and the concept of "high fidelity" was very novel.

As an aside, many audiophiles are revisiting the unusual signal paths found in pre-1930's Western Electric amplifiers. Not surprisingly, Western Electric as a telephone company, with its long experience with audio, transformer coupling and long-distance signal transmission, was responsible for many unique "firsts." My collection includes a Western Electric 7A amplifier dating from 1922 at the dawn of electronic amplification. When you picked up a phone and asked for "long distance," the 7A was the circuit that amplified your voice and sent it to the next city, over many miles of twisted-pair wire. Thus the phrase "line stage," the "line" referring to a telephone line, not a component sitting two feet away. Telephone technology migrated to studios and radio stations, which used the services of AT&T long lines to build the first radio networks.

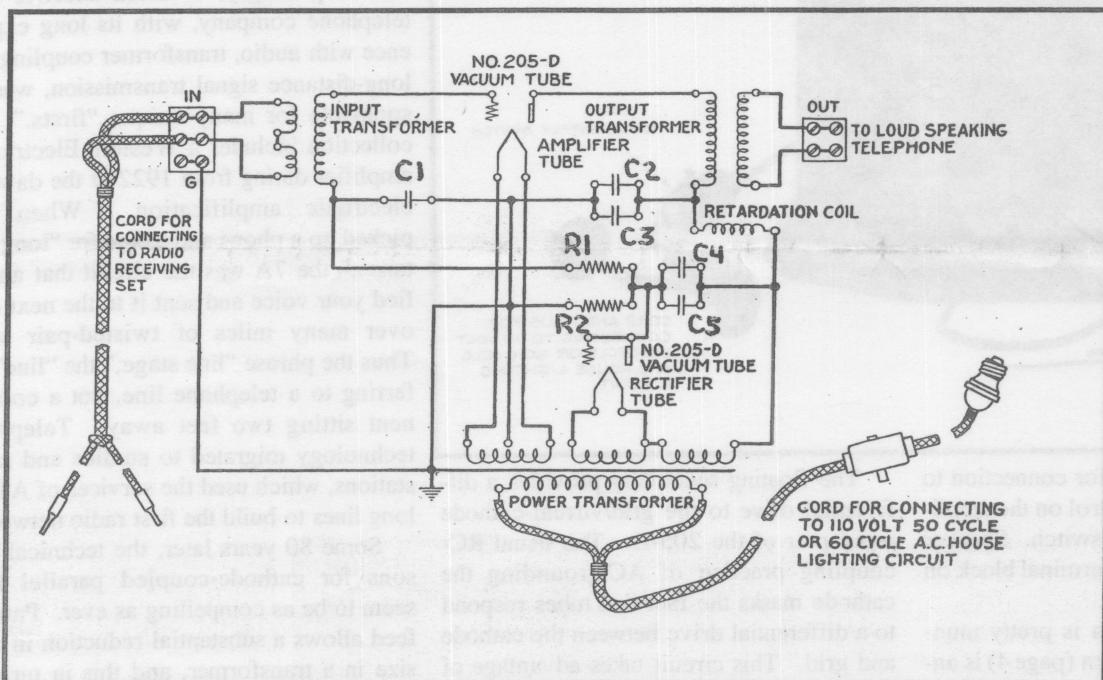
Some 80 years later, the technical reasons for cathode-coupled parallel feed seem to be as compelling as ever. Parallel feed allows a substantial reduction in core size in a transformer, and this in turn reduces stray capacitance and thus improves high frequency response. Distortion goes down as well, since the transformer core no longer has to accept a heavy DC current, which uses up most of its "permeability allowance." With no DC flowing through the primary, a transformer designer can take advantage of low-distortion cores.

In addition, connecting the return of the primary to the driver-tube cathode gives a further improvement by shortening the AC loop around the audio circuit. By careful rationing of the cathode-bypass and transformer-return capacitor, most power supply noise can be canceled. (A vacuum tube amplifies the difference between the cathode and the grid; if noise that appears at the plate can be reduced in the right ratio at the cathode, it will cancel power supply noise appearing at the plate.)

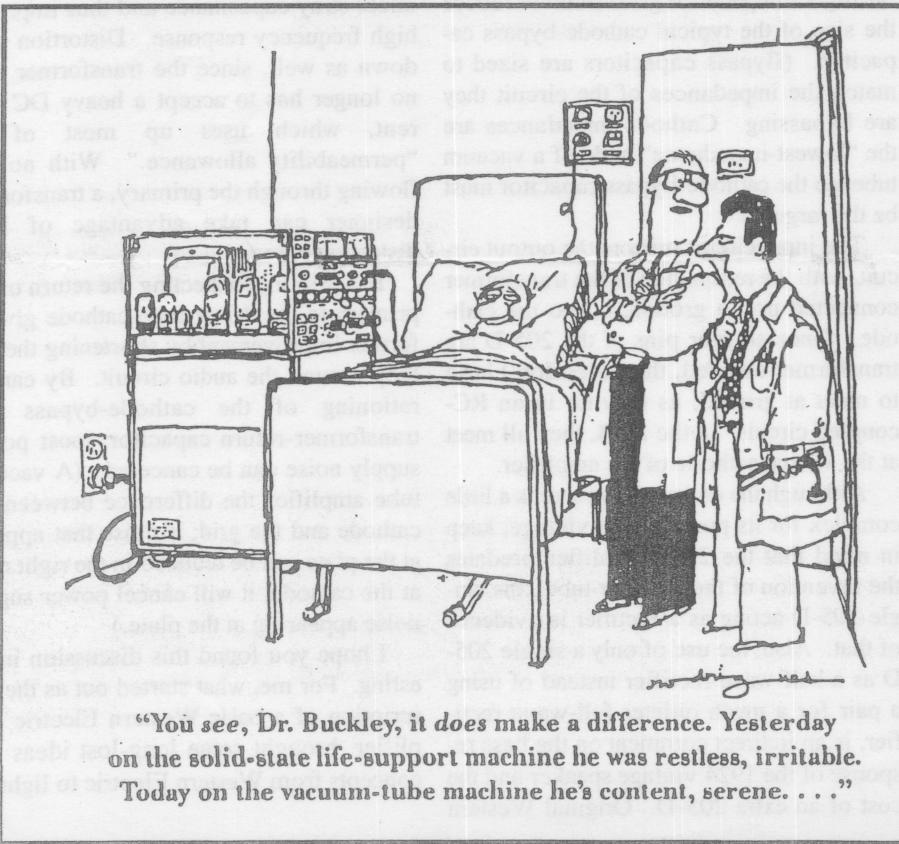
I hope you found this discussion interesting. For me, what started out as the description of a basic Western Electric amplifier, brought some long-lost ideas and concepts from Western Electric to light.

REFERENCES:

1. Lynn Olson, Western Electric - Rosetta Stone for Triodes, www.nutshellhifi.com
Note: Lynn's article describes the Western Electric 32-A amplifier which "appears to be a monitor amplifier for a radio station." What is labeled the "parallel-feed output section" exactly duplicates the 25-B with the exception of a normally-closed current-metering test jack in the bias circuit.
2. Western Electric Company, Information for the Care and Operation of the No. 6025-B Amplifier, Instruction Bulletin No. 201.
3. Bernard Magers, 75 Years of Western Electric Tube Manufacturing, 1994, Antique Electronic Supply
4. John R. Rider, Volume I - Perpetual Troubleshooter's Manual, W.E. page 1-3.



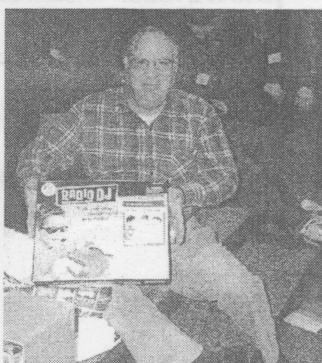
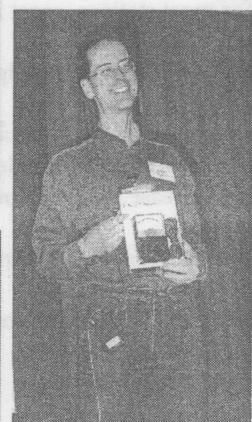
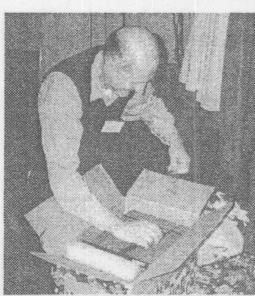
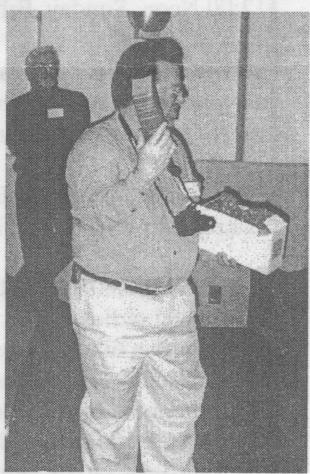
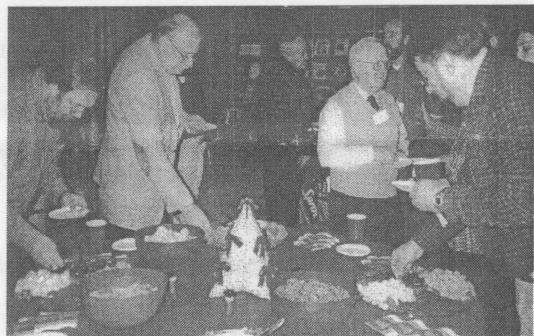
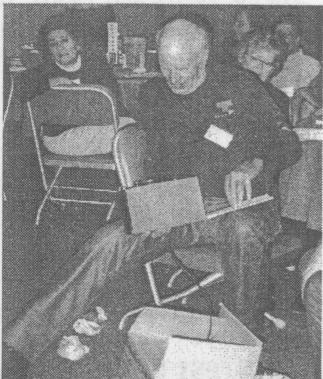
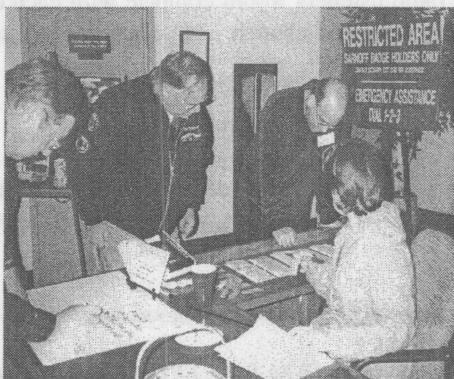
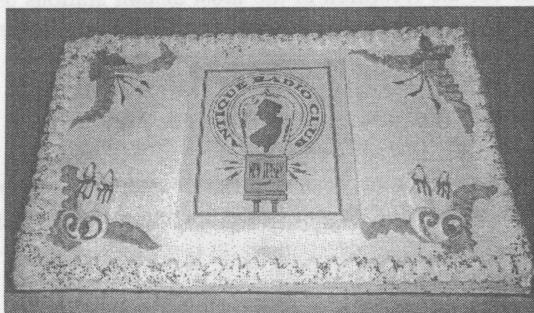
COMPONENT VALUES

 $C1 = 0.5 \mu F$ $C2/C3 = 2 \mu F$ total $C4/C5 = 2 \mu F$ total $R1 = 48,000$ ohms $R2 = 1000$ ohms

**SORRY DOC, YOU'RE
BOTH WRONG...**

**OUR CONTENTED
PATIENT JUST
SENT IN HIS DUES
FOR 2004 AND IS
LOOKING FORWARD
TO ANOTHER
GREAT YEAR!**

HOLIDAY PARTY - 2003



The 2004 NJARC BCB DX Contest

In the 1920's and 1930's, some radio listeners would compete with each other for the reception of the most distant stations using the same receivers that we now restore and cherish. We can recapture some of the excitement that the early DX'ers experienced in our own contest.

Official Contest Rules

THE OBJECT: To use vintage radios receivers to receive **broadcast-band** signals from the greatest possible distance. Performance will be judged by the total mileage for your ten best loggings during a 24-hour session. You will be competing against competitors using similar receivers.

ELIGIBILITY: The contest is open only to members in good standing of the New Jersey Antique Radio Club.

CONTEST PERIOD: The contest period will be from 12:00 Noon, local time at receiving location, Friday, January 23, 2004 through 12:00 Noon, Sunday, February 1, 2004..

SESSIONS: Contestants may submit logs for any two 24-consecutive-hour sessions (noon to noon) during the contest period. You may use only one receiver during a session. That means you may not "bird dog" the simple radio with a more complex radio. You may submit logs for two different receivers. They need not be in the same category.

FREQUENCIES: The Broadcast Band, as defined for the contest, will be from 530 to 1600 kilocycles. No stations on the new extended band, 1610 to 1710 kilocycles, will be counted since many early radios did not cover those frequencies.

RECEIVER CATEGORIES:

- A - Crystal radios
- B - Primitive tube receivers (homebrew also) -1 to 2 tubes plus power supply
- C - 1920's Battery sets (homebrew also) -batteries or modern power supply is OK
- D - Other tube radios sold for home entertainment.
- E - Amateur, commercial, and military tube-type communications receivers.
- F - Transistor radios introduced before 1970.

ANTENNAS: Anything you like.

LOGS: Submit a log for each of your contest sessions (maximum of two). Each log header should include contestant's name, address, phone number, category, and description of receiver and antenna. Please include your listening address if it is different from your mailing address.

Make a log entry for each station you claim to have heard. Stations must be positively identified. (This is being done on the honor system, and is a somewhat variable concept. If you hear Boston weather on what you know is 1030KC, then go ahead and log WBZ. However, just because you heard a signal on 1160KHz doesn't mean you heard KSL in Salt Lake City.) The contest committee reserves the right to disallow what it feels are outrageous claims. Each entry should include time, frequency, call letters, location, and optional comments. Although we're only judging your ten most distant loggings, submit as complete a log as possible. The committee may make special awards for most stations, most interesting log, etc. as it sees fit.

A log sheet can be provided for convenience. You may reproduce it or generate a similar one of your own.

Logs must be postmarked not later than midnight February 7, 2003.

DISTANCES: Distances to stations will be calculated by the committee and will be based on great circle distances from Freehold, New Jersey for listening posts within a 100-mile radius of Freehold. We will calculate mileage for other entries based on actual listening location. In all cases, please indicate your ten best loggings to make our job easier.

Submit logs to: Tom Provost, 19 Ivanhoe Dr., Robbinsville, NJ 08691

Questions: Al Klase - 908-782-4829, Tom Provost - 609-243-2508

The following are 50KW stations operating nights on "clear" channels. This info is meant to be helpful, but may not be definitive.. Al Klase, January 1999. Revised October 2001.

530 Radio Vision Cristiana Turks and Caicos	780 (US Clear) WBBM Chicago KKOH Reno, NV	1010 CBR Calgary CFRB Toronto WINS New York	1180 (US Clear) WHAM Rochester, NY VOA (Radio Marti) Marathon, FL
540 (Canadian Clear) XEWA San Luis Potosi, MX	790 CFCW Camrose, AB CIGM Sudbury, ON	1020 (US Clear) KDKA Pittsburgh KCKN Roswell, NM KTNQ Los Angeles	1190 (US/Mexican Clear) WOWO Fort Wayne, IN KEX Portland, OR XEWK Guadalajara, MX
CBK Watrous, SA WQTM Pine Hills, FL			
640 (US Clear) CHOG Richmond Hill, ON	800 (Mexican Clear) XEROK Juarez, MX PJB3 Bonaire, NA	1030 (US Clear) WBZ Boston KTWO Casper, WY XEQR Mexico City	1200 (US Clear) WOAI San Antonio CFGQ/CJBZ Ottawa, ON CKXM Victoria, BC
650 (US Clear) WSM Nashville KENI Anchorage, AK	CKLW Windsor, ON CHRC Quebec City		
660 (US Clear) WFAN New York KTNN Window Rock, AZ CFFR Calgary, AB	810 (US Clear) WGY Schenectady, NY KGO San Francisco WKVM San Juan, PR	1040 (US Clear) WHO Des Moines, IA	1210 (US Clear) WPHT Philadelphia
670 (US Clear) WMAQ Chicago KBOI Boise, ID	820 (US Clear) WBAP Fort Worth-Dallas (new) Halifax, NS	1050 (Mexican Clear) XEG Monterrey, Mexico CHUM Toronto WEVD New York	1220 (Mexican Clear) XEB Mexico City WKNR Cleveland
680 (US Clear) KNBR San Francisco WRKO Boston WPTF Raleigh, CJOB Winnipeg CFTR Toronto	830 (US Clear) WCCO Minneapolis	1060 (US/Mexican Clear) KYW Philadelphia XEEP Mexico City CKMX Calgary	1500 (US Clear) WTOP Washington, DC KSTP Minneapolis
690 (Canadian Clear) CBF/CIQC Montreal XETRA Tijuana, Mexico CBU Vancouver,	840 (US Clear) WHAS Louisville, KY	1070 (US/Canadian Clear) KNX Los Angeles CBA Moncton, NB	1510 (US Clear) WLAC Nashville KGA Spokane, WA WNRB Boston
700 (US Clear) WLW Cincinnati,	850 (US Clear) KOA Denver WEEI Boston KICY Nome, AK	1080 (US Clear) WTIC Hartford, CT KRLD Dallas	1520 (US Clear) WWKB Buffalo, NY KOMA Oklahoma City
710 (US Clear) WOR New York KIRO Seattle WAQI Miami	860 (Canadian Clear) CJBC Toronto	1090 (US/Mexican Clear) WBAL Baltimore KAAY Little Rock, AR XEPRS Rosarito, Mexico KMPS Seattle	1530 (US Clear) WSAI Cincinnati, OH KFBK Sacramento, CA
720 (US Clear) WGN Chicago KDWN Las Vegas	870 (US Clear) WWL New Orleans KAIM Honolulu, HI	1100 (US Clear) WTAM Cleveland KFAX San Francisco	1540 (Bahamas Clear) ZNS-1 Nassau, Bahamas KXEL Waterloo, IA WDCD Albany, NY
730 (Mexican Clear) XEX Mexico City CKLG Vancouver, BC CKAC Montreal	880 (US Clear) WCBS New York KRVN Lexington, NE CHQT Edmonton, AB	1110 (US Clear) WBT Charlotte, NC KFAQ Omaha, NE XERED Mexico City	1550 (Mexican Clear) XERUV Jalapa, Mexico CBE Windsor, ON
740 (Canadian Clear) CBL Toronto CBX Edmonton WWNZ Orlando, FL KCBS San Francisco KTRH Houston	890 (US Clear) WLS Chicago	1120 (US Clear) KMOX Saint Louis KPNW Eugene, OR	1560 (Cuban Clear) WQEW New York KNZR Bakersfield, CA
750 (US Clear) WSB Atlanta KFQD Anchorage, AK	900 (Mexican Clear) XEVW Mexico City CHML Hamilton, ON	1130 (US/Canadian Clear) WBKR New York KWKH Shreveport, LA CKWX Vancouver, BC	1570 (Mexican Clear) XERF Ciudad Acuna, MX CKLM Montreal
760 (US Clear) WJR Detroit KFMB San Diego	920 CBO Ottawa, ON	1140 (US/Mexican Clear) WRVA Richmond, VA, XEMR Monterrey, MX KHTK Sacramento, CA CFXX Calgary	1580 (Canadian Clear) CBJ Chicoutimi, QU KCWW Tempe, AZ KBLA Santa Monica, CA XEDM Hermosillo, Mexico
770 (US Clear) WABC New York KKOB Albuquerque, NM CHQR Calgary, AB	940 (Can/Mex Clear) CBM Montreal XEQ Mexico City KFRE Fresno, CA	1160 (US Clear) KSL Salt Lake City	
	980 CBV Quebec, QU		
	990 (Canadian Clear) CBW Winnipeg CKGM/CTX Montreal XET Monterrey, Mexico		
	1000 (US/Mexican Clear) WMVP Chicago KOMO Seattle XEOY Mexico City	1170 (US Clear) WWVA Wheeling, WV KVOO Tulsa, OK	

CONNECTIONS

Free exposure for buyers and sellers! Unless requested otherwise, each ad will run for two months in both the *Jersey Broadcaster* and the *Delaware Valley Oscillator*. All buying and selling transactions are the responsibility of the parties involved.

FOR SALE

Check out NJARC's capacitor program for those most commonly needed replacements. Contact John Ruccolo at any club meeting or call him at home (609)-426-4568 to find out what's available. All proceeds go to the club.

13" Zenith color TV (1987) - \$30
12" GE color TV (1985) - \$20
Tom Musacchio, 609-448-0787

The NJARC tube program offers clean, tested, boxed tubes at very reasonable prices with availability at any club meeting (no dealers, please...not for resale). Proceeds go to the club. Of course, donations of radio-type tubes in any condition are welcome. See Gary D'Amico at the next meeting.

1931 Sparton model 15 wooden console radio. Original condition; works. Has hole in grill cloth and is missing a small piece of trim. \$125 or best offer. Marjorie Ford, 8 Brookview Rd., Boonton Twp., NJ. 973-334-8283 marjorieford@att.net

Atwater Kent 70, console, type L chassis, type N speaker (10"), cabinet in A1 condition, has all tubes and worked until tuner clutch started slipping. John Edelhauser, 1515 Silo Ct., Manasquan, NJ 08736 732-223-7203

Magnavox Sportsman model AW-24, all wave, 7 transistor, 2-band portable, in good condition and working. Joe Bentrovato, 84 E. Munson Ave., Dover, NJ 07801. (973) 361-7392 JBentrovat @ msn.com

"Radio in the Home" magazine, December 1925. Other issues also considered. Also looking for Sparton radio ads from 1928-1929 Liberty magazines. John Okolowicz, 624 Cedar Hill Rd., Ambler, PA 19002, john@grillecloth.com

WANTED

YOUR AD HERE...FREE TO 200 MEMBERS

TYPICAL BCB DX CONTEST LOG

(Note: Mileage is for information only and not required; totals will be computed by Tom Provost)

NAME: Al Klase
ADDRESS: 22 Cherryville-Stanton Rd.
Flemington, NJ 08822
PHONE 908-782-4829

RECEIVER: Skywaves Contest Crystal Set
ANTENNA: 65-Ft. 3-Wire Flat top at 30 Ft.
CATEGORY: 1