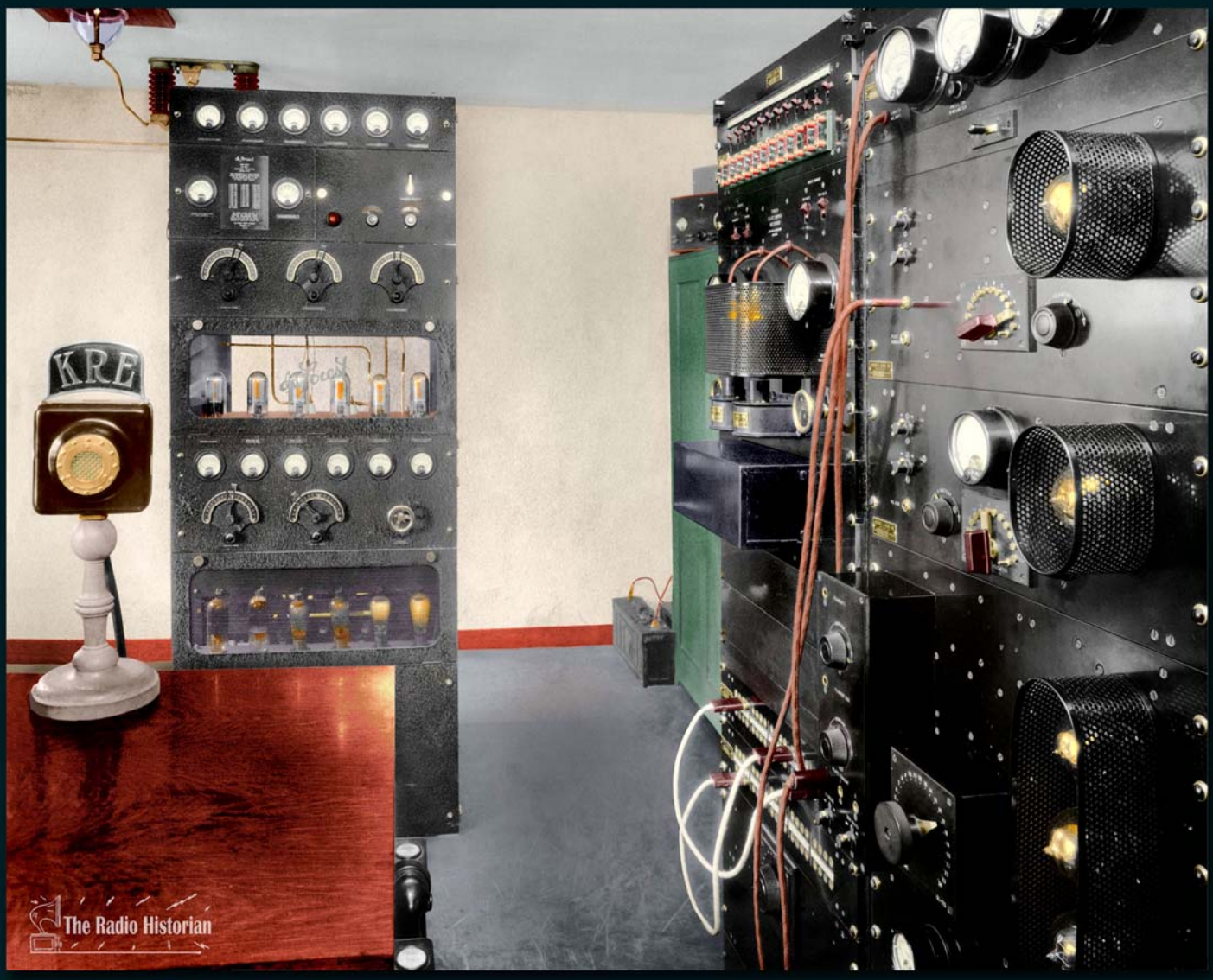
Volume 40, Number 2 Fall/Winter 2021

Journal of the

# CALIFORNIA HISTORICAL RADIO SOCIETY




**The Western Electric 100-G Transmitter in the KRE Studio in the First Congregation Church in Berkeley circa 1930.**

FOR THE RESTORATION AND PRESERVATION OF EARLY RADIO

FROM THE BIRTHPLACE OF BROADCASTING

# California Historical Radio Society

HOME OF THE BAY AREA RADIO MUSEUM & HALL OF FAME

The California Historical Radio Society (CHRS) is a non-profit educational corporation chartered in the State of California. Formed in 1974, CHRS promotes the restoration and preservation of early radio and broadcasting. Our goal is to enable the exchange of information on the history of radio, particularly in the West, with emphasis on collecting, preserving, and displaying early equipment, literature, and programs. Yearly membership is $30 ($40 non-USA).

## CHRS Museum in Alameda

CHRS has been fortunate, through the generosity of its donors, to purchase a home for the CHRS museum and education center. It is located at 2152 Central Avenue. The building was built in 1900 as a telephone exchange.

CHRS volunteers are actively restoring the building to make it optimal for use. Our goal is to create an environment to share our knowledge and love of radio and enable us to create an appreciation and understanding for a new generation of antique radio collectors and historians.

Please come visit us any Saturday 9am to 3pm. Visitors and groups welcome at other times by appointment; Contact Steve Kushman.

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## Contact us:

CHRS, PO Box 31659, San Francisco, CA 94131
or info@californiahistoricalradio.com

**Visit us at:** www.CaliforniaHistoricalRadio.com

### Officers & Directors

| | |
|---|---|
| Mike Adams | – Chairman, Webmaster |
| Steve Kushman | – President, Radio Central Project Manager |
| Scott Robinson | – Vice President, Technical Ops. |
| Jaime Arbona | – Secretary, Mailing |
| Richard Watts | – Treasurer, Membership, Journal Editor |
| Philip Monego | – Director at Large |
| Dennis Monticelli | – Education |

W6CF Trustee, John Staples, W6BM

### CHRS Central Valley Chapter (CVC)

Mike Loper – Chairman

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| Bart Lee | – Counsel Emeritus, Hist., Archivist |
| Len Shapiro | – BARM Executive Director |
| Walt Hayden | – Collection Mgr., RC Planning |
| Cynthia Edwards | – Collection System Mgr. |
| John Stuart | – Resident Engineer, Networks |
| Keith Scott | – Manager, Landscaping Ops. |
| Tom Bonomo | – Investments, Name Badges |
| Dave Billeci | – Video Production |
| Paul Shinn | – Amateur Radio Operations |
| David Vasquez | – Electrical Transcription Project |
| Larry Clark | – Technical Advisor & Librarian |
| Lunch crew: | Cynthia Edwards, Denny Monticelli, Keith Scott, Judy Mears, Betty Cosmos |

# Contents of the Journal

## COLUMNS



## FEATURE ARTICLES



**Front Cover:** **Colorized image of the KRE Transmitter circa 1930 by John Schneider, the Radio Historian.**

**Rear Cover:** **Volunteer activities at Radio Central.**

## From the Editor

I wish to thank all the authors for their articles, support, and scholarly contributions. John Staples summarizes his restoration of an RCA microphone; Paul Bourbin offers a perspective of technology in the spark era; Bart Lee walks us through replicating a spark transmitter; Amnon Fisher presents his approach to converting a battery operated farm set for AC operation; and Bart Lee gives an update on Very Low Frequency (VLF) activities. Also, the recipients of the 2021 Bay Area Radio Hall of Fame awards are summarized. Steve Kushman and Mike Adams provide updates and insights about CHRS as we carefully resume after the pandemic.

I am always in need of quality content related to broadcast radio, ham radio, and television. If you have something to contribute, I urge you to let me know. I am especially interested in technical content. It can be of two types, a narrow topic in depth or a more broad topic with less depth. Enjoy . . .


Richard Watts, jrchrs@comcast.net


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## From The President

by Steve Kushman

Well believe it or not, another year is winding down. This year and last have really been extraordinary times. Many changes everywhere you look. And for CHRS there have been some challenges. One of the challenges facing CHRS and thousands of other organizations is funding during the pandemic.

In usual times CHRS is funded in the following ways: We provide restored radio premiums for donations. We make available surplus donated equipment. We charge for yearly memberships. We have active eBay sales, and we receive generous donations of funds and equipment. Also, we raise funds by hosting promotional events, such as Radio Day By The Bay or an event at the Alameda Antiques Faire, and the Niles Antiques Faire. Again, remember those events happened in usual times.

So, in 2020 we had no face to face events. Our only sources of income for that lousy year came from donations and eBay promotions. I'm proud to say that CHRS remained financially positive in 2020. Despite the pandemic, we had generous eBay donors and many electronic and radio geeks were securing gear to keep them company in isolation :-)

It's been a different story in 2021. We held a swap meet in June where we made available a huge assortment of electronics surplus. We held 2 promotional events at the USS Hornet, and brand building events at the Alameda and Niles Antique Faires. All the events were very good for us as we took in ample donations. And people took home many beautiful, restored radios, some saved from the landfill, to live a new life. Also, we have taken in some very generous donations this year including $15,000 from a CHRS Life Member. And eBay promotions have been and added plus.

I've mentioned eBay a few times in this message. Now I would like to focus on this CHRS fund raising activity. For years now, CHRS has been taking in equipment donations in order to save it from the landfill. The material we couldn't use was put out as part of our events. Well in this SF Bay Area most collectors seemed to already have lots of this stuff. So, in order to get a larger audience and to find homes for gear, we decided to start offering items on eBay. And boy are we glad we did! Many pieces of gear have found new homes all around the world and CHRS has taken in some handsome donations for them.

Our commitment to eBay is just about a full time job. It isn't easy. Sometimes it's a pain in the butt. But… we have a passionate and dedicated team who know the importance of keeping the eBay wheel turning and producing fine results for CHRS. Our eBay team is led by CHRS Director Philip Monego. Philip is assisted by CHRS Member Carlos Perez. We really must say how pleased we are with the support given to CHRS by Philip and Carlos and commend them on their passion for our mission. Oh, by the way, Carlos is an extraordinary furniture restorer and has professionally restored many pieces for the CHRS museum collection, including the General Electric projection TV to his right, as well as pieces for our auctions.

Thank you both, Philip and Carlos for your hard work and dedication. And to Philip for the plush chairs in the TV gallery.

It's volunteers like Philip and Carlos that make CHRS one of the finest organizations of its kind. CHRS is full of great volunteers and supporters. We are so lucky to have them as members of CHRS!

Thanks to you all for your support. We look forward to next year when things should be back to normal.

My Best Regards to All, Steve

PS… I'm always available for your questions and comments at Steve@chrsradio.com

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Carlos Perez and Philip Monego.

## From The Chairman

by Mike Adams

These are exciting times for the California Historical Radio Society. We are organizing both our artifacts and our physical spaces, planning the best way to organize and present the stories we want to tell future museum-goers, students and our membership. Completion of our Great Room and the front entrance and 1900 façade will be the final focus of what we know as CHRS Radio Central. We thank our very dedicated volunteers for what we have accomplished under the leadership of President Steve Kushman.

**Bay Area Hall of Fame Awards:** And it was another successful Hall of Fame Class, 2021, announced this year on the CHRS You Tube channel. And we have just about completed the Hall of Fame, the final step being the programming of the interactive BARHOF database, our radio history.


Author/historian Ben Fong Torres and KCBS's Kim Wonderley announced this year's Radio Hall of Fame.

**Collections Database:** Walter Hayden and Cynthia Edwards are leading a group of fellow volunteers to create a database using museum software CatalogueIt. Every accessioned artifact has a photo and a QR Code. So far over 500 artifacts have been cataloged. Stay tuned for more news about this giant project. Thanks to Cynthia and Walt!

**Permanent Exhibits and Services:** We are more than a public museum. What we call a membership perk includes our highly popular radio repair shop led by Scott Robinson. And under volunteer Seth Arp hundreds of Bluetooth-equipped working radios have been restored and given to radio fans in the Bay Area when they donate to CHRS. Our complete communications library and wireless archive under Bart Lee and Bob Rydzewski is available to members-scholars for their research and publication needs.

Betty Cosmos, Cynthia Edwards, and Walter Hayden working to catalog the collection.

**Thanks Wayne:** Old school ties have brought Wayne Overbeck, N6NB, to the Bay Area with two SUV-loads of high quality donated ham equipment. In the 1980s Wayne and I were professors at the Communications School at Cal State Fullerton. I taught radio-TV-Film (what else?) and Wayne was in charge of broadcast law. Wayne brought a nice collection of equipment, part of which was donated by George Flammer III, W6MT. We can now talk to the moon, so-called moon-bounce. Little Green Men.

**Let's Get Small:** We long-time collectors are aging and downsizing our collections. It seems that several times monthly we are offered a collection by a member or a phone call from a member's wife saying, "my husband just died and I have a garage full of his radios." And, while we'll take donations of your radios, we are also encouraging contributions of cash to help complete our physical plant. There are plenty of projects that need your financial support. Thank you in advance.

Wayne Overbeck and George Flammer in the Ham Shack.

## CHRS Board Planning - Creating a Wireless Museum and Education Center:

I consider it an honor to have been a part, since the 1980s, of the CHRS Board of Directors. Recently, I find myself a part of the Exhibit Design Committee, along with officers/directors Jaime Arbona and Steve Kushman. The three of us have spent much quality time contributing to a solid plan for a communications museum and education center with exhibits that reinforce the interest of our membership.

It is our intent to plan a wireless history museum that will attract and enlighten the Bay Area museum-going public, and contribute to exposure and education of the K-12 science and history student. We, the Board and core volunteers, believe it is important that the history of radio and broadcasting, the legacy of broadcasters, engineers, and inventors, and the evolution of technology should not be lost. This knowledge and legacy should be offered to the Bay Area community, and to the young in a manner that relates to what they know. For example, telling the story of radio from its inception to the Smart Phone.

Collectors have done much to keep radio related artifacts out of the landfill, but in the future we have to do more to keep it alive. We have to expand collecting to sharing and educating. We believe that the most effective way to keep the history and fascination of radio relevant is through the stories that led to the creation of the wireless devices we take for granted. We want to tell the stories of the diversity of talent that made this happen, the voices and their legacy that emanate from the radios in the neighborhood that shaped culture and entertainment, and of course the importance of artifacts that evolved marks each point in time along this journey. Currently the displays at CHRS are focused primarily on artifacts. In the future we want to focus first on the story and make sure the story is told in a compelling way; we would then use artifacts to augment, reinforce the story, and tickle the viewers' curiosity.

Those who have been to Radio Central recently will know that many of the display areas have been initially configured and are in use. These spaces include Bay Area Hall of Fame room where the story and legacies in radio broadcasting will be told. The adjacent broadcast studio is now operational thanks to John Staples and John Stuart. The studio has the capability to simulate a vintage broadcast studio, perhaps educating and inspiring future broadcasters, podcasters, and bloggers. The studio is fully functional for digital transcription of historic media. The shop is the heart of technical restoration projects. Downstairs, the James Maxwell library is fully stocked and has been a source for research. The Television gallery and W6CF Amateur Station is fully operational and is regularly in use by members. The Hall of Communications under Bart Lee's direction is currently in progress and promises to be fully interactive with both vintage equipment and the latest Software Defined Radio (SDR) technology.

Next and perhaps most important is the configuration of the upstairs Main Gallery. The Main Gallery will be the visitors first impression and it is the best opportunity to tell the story. The design of the Main Gallery has been the focus of the Exhibit Design Committee. The results of the committee's work are found in the words and drawings of Jaime, Steve and me, with advice and consent from the CHRS Board and other interested and knowledgeable volunteers. This article is a brief status of our progress. First the caveat. This is an initial plan, the first one, not the final by any means. We believe this will be an iterative process that we hope will stimulate further ideas and suggestions from our membership and experienced museum consultants.

The flow of our design is a chronological circular path around the Main Room beginning in the earliest forms of technology-based communication, then progressing through time around the room to the present. We envision exhibits that tell the following stories through time. Follow along using Steve Kushman's proposed floor plan on page 8.

As the visitor enters in the lobby, he or she is encouraged to begin at the right in the late 1800s with telegraph. It will be followed by telephone switching and receivers. It is interesting that Radio Central was born as a Telephone Exchange in the early 1900s and that element will be included in the story.

Then wireless communication appears and began the century of wireless evolution, In the early, early 1900s, the killer application that brought that to life was telephony, especially maritime ship-to-ship and ship-to-shore based on spark technology. Early wireless communication found ground-to-ground and ground-to-air use in World War 1. In 1912,

Charles 'Doc' Herrold was first to broadcast concerts and other shows from his station KQW in San Jose; his regularly scheduled broadcasts predated by several years those of the later "first" radio station KDKA in Pittsburg in 1920.

By the 1920s consumer radio begins to become mainstream. Amateur radio and experimentalists are becoming active.

In the 1930s, radio and broadcasting matures and becomes big business. The depression has impacted many, yet radio thrives and grows. Radio becomes a significant source of information and entertainment. The same popular program might be heard emanating from most of the open windows in the neighborhood. Censorship was becoming established in broadcasting. Curiously, in the 1920s through 1930s television development was active. RCA demonstrates electronic television at the 1939 World's Fair even though television had been active in other countries, most notably in Great Britain and some parts of Europe from the late 1920s.

The 1940s were dominated by the impact of World War. Radio manufacturers were diverted for war time efforts like the development and production of radar, etc. Radio was the principle communication medium for the war effort both in the military and at home. It was essential in providing news, maintaining morale and generating support, and to provide welcome entertainment. After the war ended, radio and, a few years later, television played a central role moving the culture, returning veterans, and their young families forward.

In the 1950s and into the 1960s as the economy grew, technological innovation was accelerating. Radio continued to be an important medium for entertainment, but there was a transition afoot from radio to television as the tool for cultural impact and transformation. HiFi and Stereo offered a concert hall listening experience.

In the 1970s to now, computer and network technology evolved. Solid state technologies made radio, communication, and entertainment devices smaller, cheaper, and more pervasive.

Media formats evolved from vinyl and reel to reel to 4 and 8 track, then cassette, then CD, and now MP3. So, how many times did you have to re-buy the White Album?

By the 1990s came the internet and cell technologies. From that and the non-linear miniaturization of technology, came the coupling of radio technology and computer technology enabling handheld personal interaction. With that enabled anytime anywhere Facebook, Twitter, Instagram, TikTok, etc., etc.

In the center of the room will be portable "floating" exhibits so they can be moved to clear the Great Room to become an open meeting space.

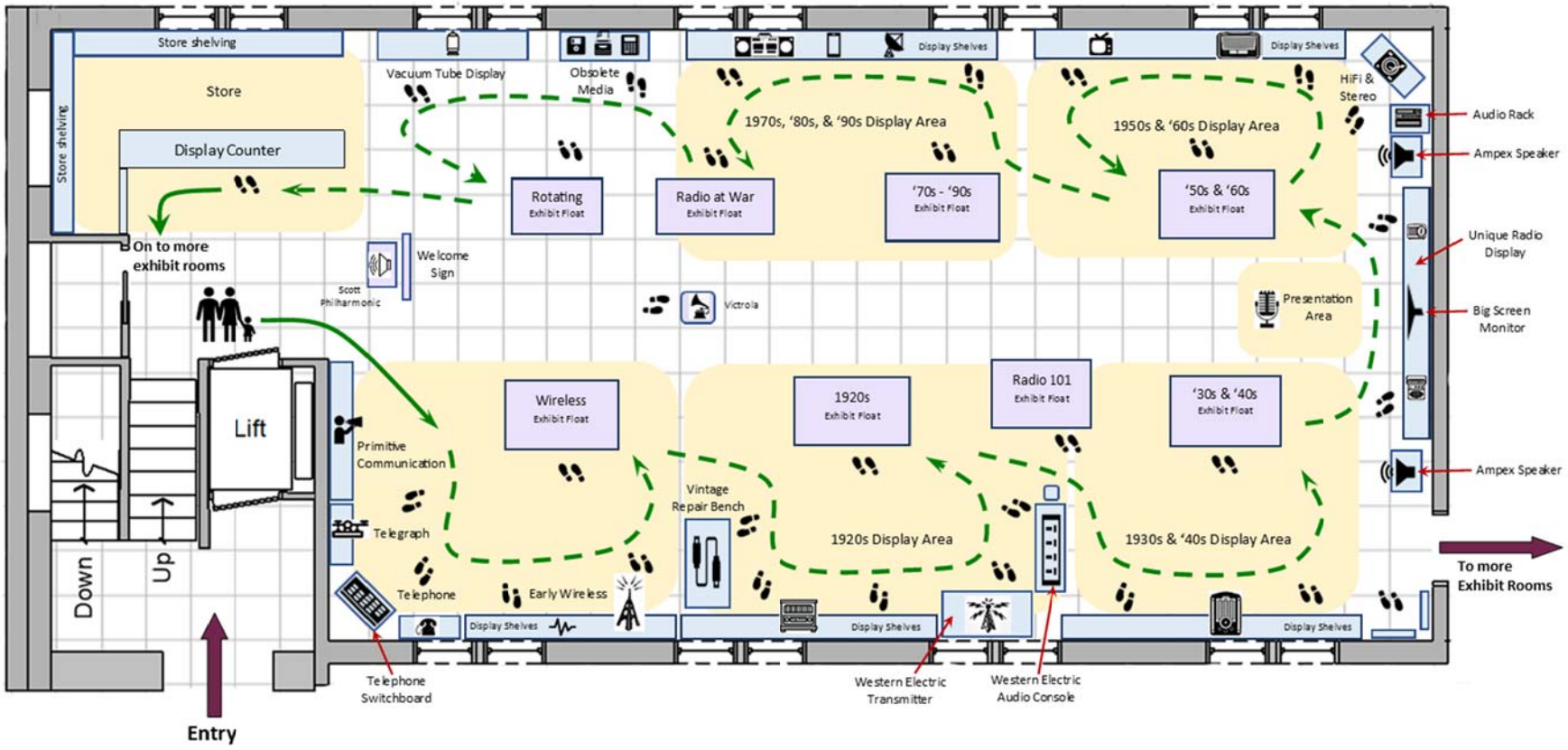
It is our intent that exhibits will be routinely updated with new content and artifacts to provide a fresh perspective of the story of radio and not become stale. Whenever possible we will design interactive exhibits: For example the museum guest will be able to operate our telephone and wireless spark gap transmitter, our 1940s TV camera and our 1950s radio station. Other artifacts of a given era that need some thought and construction will be introduced later in the life of an exhibit. Because a single historic device can connect to several stories, our brightest will keep those ideas coming. We need builders and writers.

It is a big story to tell, and it's an important story to tell. We live in a high knowledge part of the universe, so above all we want our educational plan to appeal to students and their parents. We want people to visit our museum and take home a greater appreciation for the accomplishments of those who preceded us and to get a sense of the challenges they solved.

Our challenge is to design an experience that will be embraced by at least four potential target audiences. First we want to present the artifacts and associated stories that our collector membership will continue to appreciate. Second we want to present the contribution and legacy of the Bay Area broadcast community. Third we want to remind the community of the evolution, nostalgia, and importance of radio. And fourth, and perhaps most important, is to educate the young who have no first hand experience of radio as to why it is relevant to them.

What the committee would ask of you, the reader, are your ideas and what you suggest to enhance this presentation and approach. Please let us know -- we want to hear from you.

# Designing the CHRS Great Room to Tell the Story of 100+ Years of Communication History




**LEGEND**

- Stationary fixtures and shelving
- Movable fixtures
- Floor space allocated
- Visitor flow

**NOTES:**

1. This is a working plan. Most configurations are flexible and may be adjusted as needed.
2. Displays by era will include examples of table radios, console radios, 2 way radio, telephone, television and other communication devices to tell the story of the era.
3. Stationary fixture displays will exhibit artifacts with descriptive text. Artifacts may also be placed within the assigned floor display area.
4. Movable fixtures or floats will display the stories in text and pictures of the era, people or subject.
5. All exhibits will contain interactive components wherever possible.
6. The Rotating Exhibit float will possibly display portable radios, novelty radios, radios manufactured locally, advertising, radios made for events, etc.
7. The Radio 101 float will exhibit on one side, the progression from crystals, to vacuum tubes, to transistors, to ICs. The next side will display radio and electronic components and what they do. Side three will show how radios were powered from wet cell and dry cell batteries, to AC current and then back to modern batteries. With a mention to solar and crank radios. Side four shows the progression from the telephone earpiece, to headphones, to horns, to speakers, to mini headsets to tiny wireless earbuds.
8. The Radio at War float exhibits communications from WW1, WW2, Korea and Vietnam and the advancements that were created by wartime needs.
9. The Presentation Area only shows the position of the speaker and not the actual floor space.

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## CHRS Central Valley Chapter News

by Michael Loper

The Central Valley Chapter of CHRS is working to cautiously adjust to life in a pandemic world. We have returned to many of our pre-Covid activities, but things are different. We are holding our monthly meetings outdoors as long as weather permits. We have resumed our socially distanced Wednesday evening radio repair workshops drawing five or six vaccinated members per week. Attendance at club functions has been down, but we look forward to our members re-engaging as the pandemic allows.

We cancelled our annual October swap meet. We hope to display radios at the Modesto Model A Club Swap Meet in January. We are also planning to display a sampling of our club members' radios at a local library, hopefully in November. For an update on all our activities, visit CVC at www.cvantiqueradio.com .

Scott Pruett, John Wallin, Archie Durham, and Jim Silva repainting the clubhouse.

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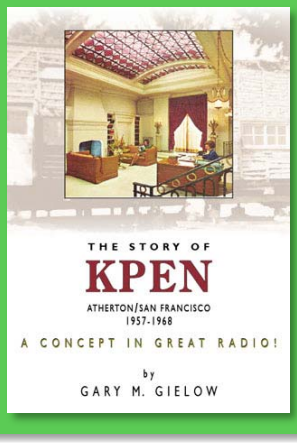
## CHRS Publications

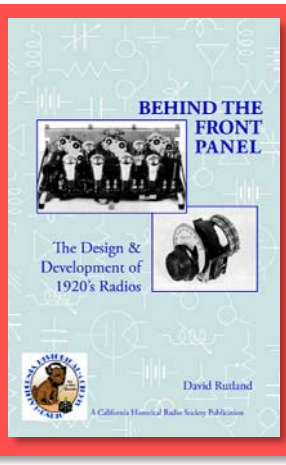
**The Story of KPEN: A Concept in Great Radio!** Gary Gielow has written a book chronicling the tales of two young men from Stanford, he and James Gabbert, who brought Stereo and new ideas to the FM radio band in the late 1950s and 1960s. This book is the definitive history of KPEN 101.3 FM, the 2015 BARHOF Legendary Station. 100% of the proceeds benefit CHRS.

Available in the Museum Store or on the website.



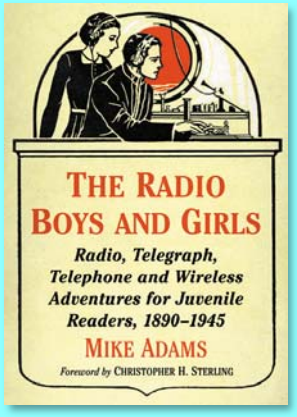

**Behind the Front Panel: The Design and Development of 1920's Radio** by David Rutland has been remastered by Richard Watts for CHRS. With emphasis on radio technology, Rutland describes the development of 1920s tubes and radio circuitry designs by De Forest, Marconi, and other inventors and manufacturers. A classic!

Buy at Amazon.com



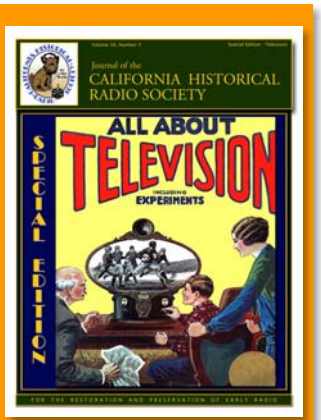

**The Radio Boys And Girls—Radio, Telegraph, Telephone and Wireless Adventures for Juvenile Readers 1890-1945** covers more than 50 volumes of wireless and radio themed fiction, offering a unique perspective on the world presented to young readers of the day. The values, attitudes, culture and technology of a century ago are discussed.

Available at Amazon.com




**CHRS Journal Special Edition — Television** a compilation of original articles on television, including articles by Malcolm Baird on his famous father, British television pioneer-inventor, John Logie Baird, Don Godfrey's historical bios on CF Jenkins and Philo Farnsworth, plus restoration and technical articles from CHRS members

Available at Amazon.com

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# Restoring the RCA 4-A-1 Condenser Microphone

By John Staples, W6BM

Condenser microphones, invented in 1916, were an improvement over the older, noisier carbon-button microphones, used until recently mainly in landline telephone handsets. The condenser microphone continues to be used today because of its wide frequency range and low-noise performance. Along with the ribbon microphone, invented in the 1920's and the dynamic microphone, these three technologies are all used today in high performance audio capture.

Franklin D. Roosevelt standing in front of an RCA 4-A-1 microphone among others.

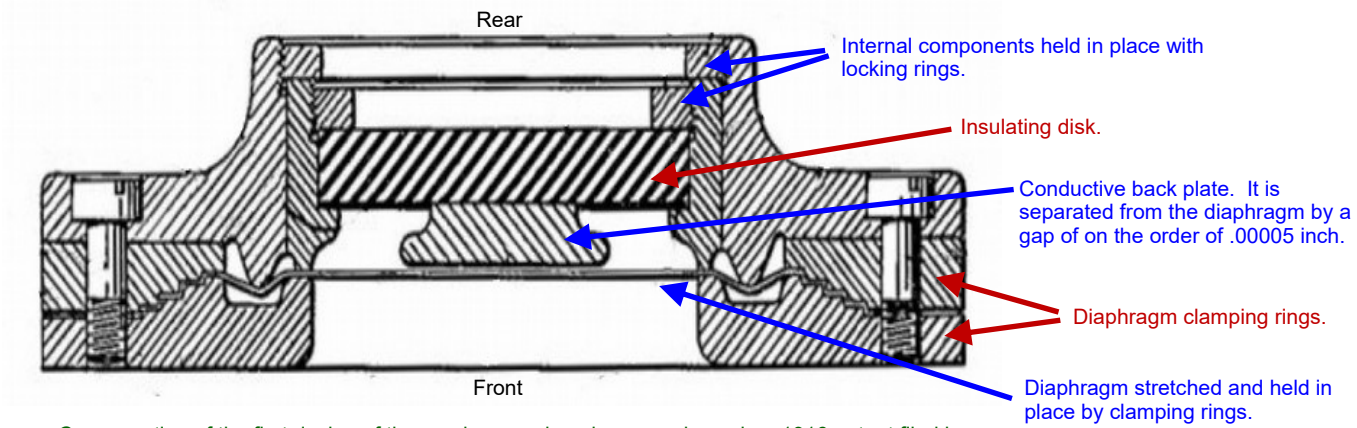
The RCA 4-A-1 condenser microphone dates from the early 1930's. CHRS now has one in its collection. The microphone has been restored to its original operational specification.



The RCA 4-A-1 in the CHRS collection. The lower photo is its ID plate.

The microphone is a large box. The back of the microphone that faces the audience shows the NBC logo over a USA map and an electrified microphone logo. The NBC logo is displayed diagonally on each side.

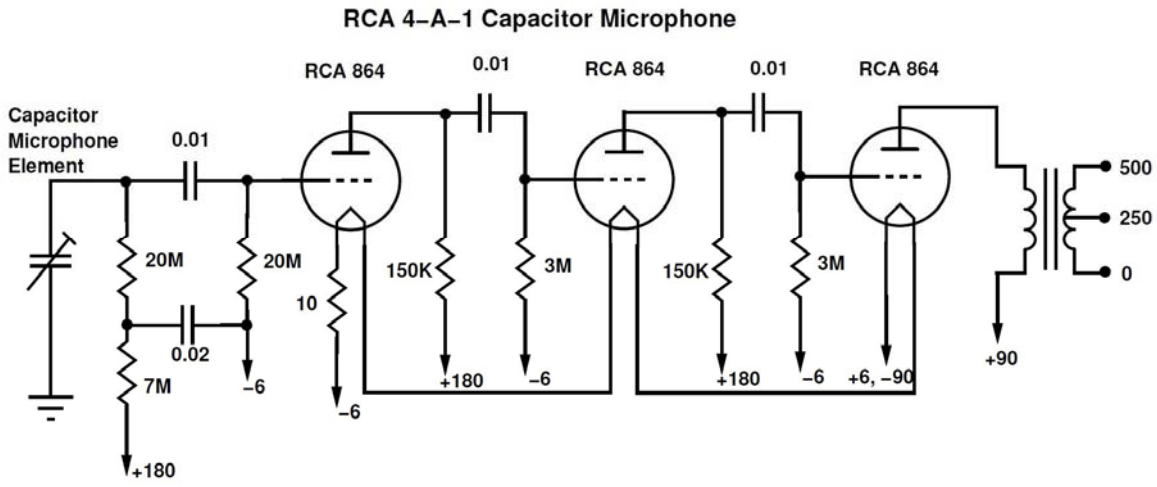
The basic operation of a condenser microphone is simple, as is its construction. A diaphragm is placed near a conducting backplate electrode which carries an electrical charge. As the diaphragm is moved by a sound wave, its capacitance to the backplate electrode varies. As the charge on the diaphragm remains constant, the varying capacitance causes the voltage between the diaphragm and the backplate to vary. This variable voltage is amplified and reproduces the sound waveform to the microphone.




Cross-section of the first design of the condenser microphone as shown in a 1916 patent filed by Edward C. Wente of the Western Electric Corporation.

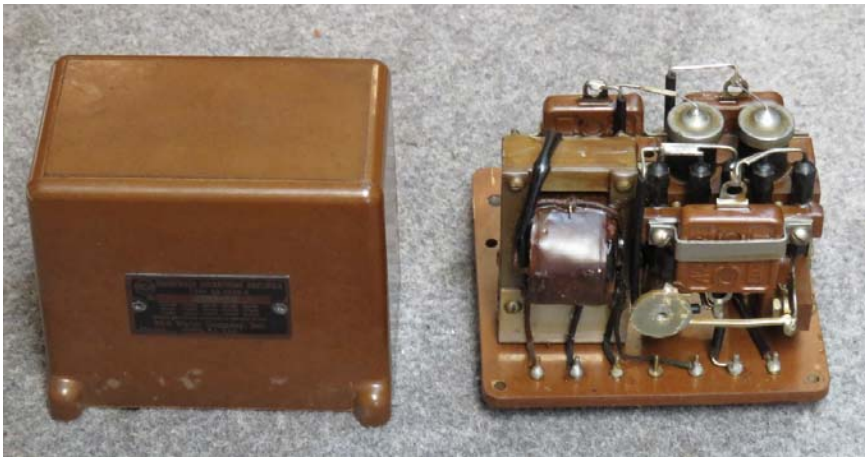

Inside the microphone body, a three-tube amplifier converts the small signal from the condenser element to a stronger signal at the output. The amplifier is surrounded by foam insulation to isolate it from vibration. The amplifier uses three special low-microphonic RCA 864 tubes. These tubes use a 1.1 volt 0.25 ampere filament. The filaments are wired in series.

Two more amplifier stages follow; the last one is transformer-coupled to drive a low-impedance output line. Only the 500 ohm tap on the output transformer is wired to the output connector.



A shielded multiconductor cable supplies operating voltages to the amplifier and passes the audio signal out to the studio mixer.

The condenser cartridge is removable from the case using a bayonet twist mount, so it can be replaced if defective.



Circuitry inside the Bakelite case.

Condenser cartridge removed.

When first tested, the amplifier was operational, but the condenser cartridge appeared to be shorted out. This was not surprising, as the spacing between the diaphragm and the backplane is only about 0.001 inch.


Front and rear views of the cartridge.

Unscrewing the front screen, the front of the diaphragm appeared to be eroded or contaminated. This could be the result of years of use by enthusiastic voice actors. Attempts to clear the short-circuit failed, so something was also wrong on the back side of the diaphragm.

The capsule comprises several levels of threaded rings that can be unscrewed exposing the diaphragm itself. The diaphragm is held in place by a pinch joint between pressure rings and a land near the electrically-isolated backplate.

Then upon removal of the diaphragm, the problem was immediately apparent. Over the years, the diaphragm had corroded to the point of breakage. The back side of the diaphragm also showed the effects of severe corrosion, as well as the space behind the diaphragm. This picture shows the rear of the corroded diaphragm, including a break and hole.

Front screen (left) and cartridge mounting ring (right).

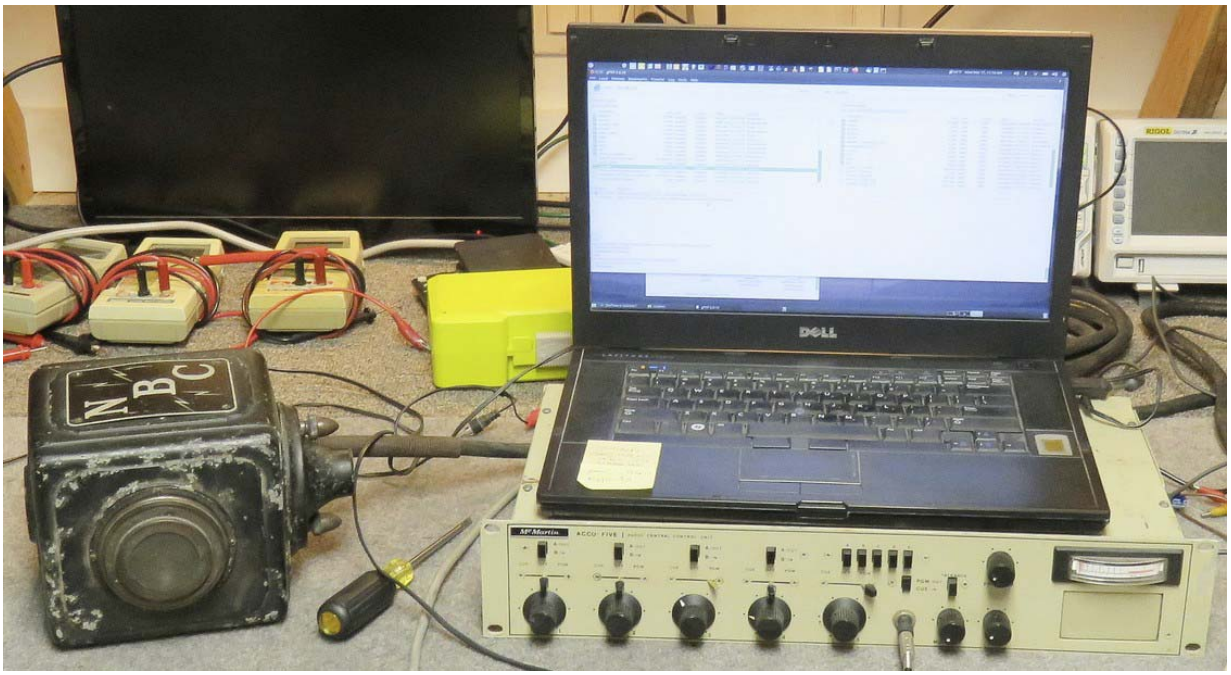
Corroded diaphragm with a hole.

The diaphragm is made of tin or aluminum foil, and is spaced over the backplate by a series of screw-in rings that center and stretch it.

A new diaphragm was cut out of aluminum foil, flattened to eliminate any creases, and placed into the condenser cartridge. The microphone worked immediately with clear and clean audio!

The multi-conductor cable ends were trimmed to eliminate a poor section, and a new connector was attached at the far end.

Cable ends trimmed and repaired.




Initial testing revealed the microphone was once again working.

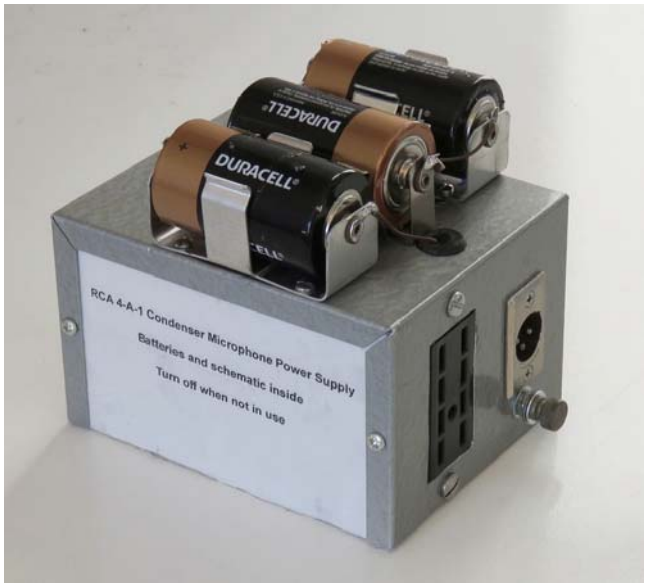
Since the microphone was now operational, a power supply was designed and built.

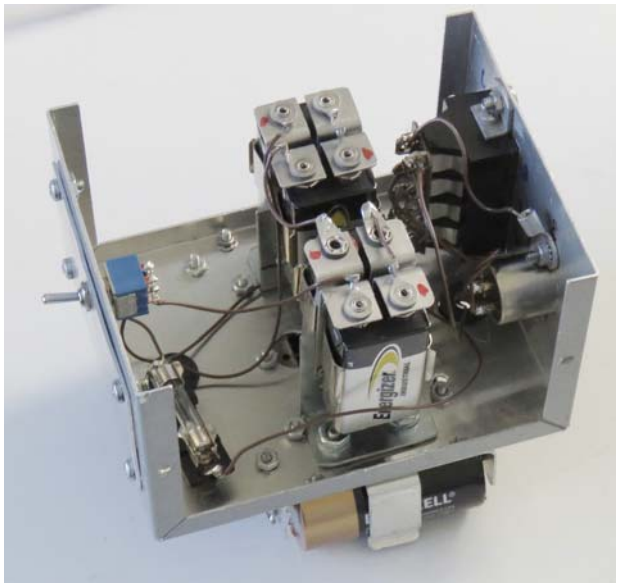
The power supply provides the filament current, the plate voltage for the three amplifier stages, and the polarizing voltage for the condenser cartridge.

Data from notation within the microphone itself called for 6 volts to light the series filament string, 90 volts for the amplifier stages, and 180 volts to polarize the cartridge. During tests, both the amplifier and the polarizing voltages were held to about 30 volts. This provided a strong output signal and reduced the possibility of damage to the cartridge or amplifier components.

The first attempt at power supply construction operated from a 120 VAC source was disappointing, as it was constructed as too compact a unit. The DC voltages supplied to the microphone must have a very small ripple component, as there is no additional filtering in the microphone itself and microvolt AC levels are present at the first amplifier input. Common-mode voltages were induced in the power supply chassis by the unshielded power transformer.

Thus, a battery-based power supply was instead constructed to eliminate hum-generating artifacts.



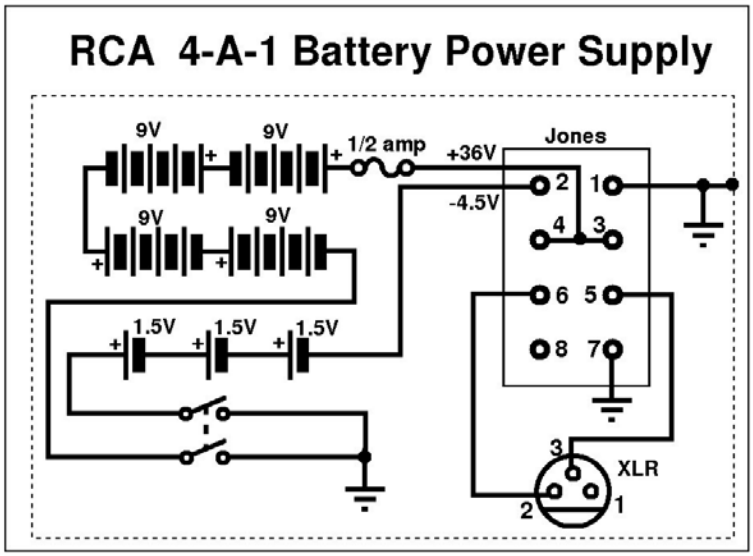



Battery power supply made to power the microphone.

The voltage for the three 1.1 volt filaments in series is provided by three D-cells, along with a small series resistance, and the plate and polarizing voltages by four 9-volt cells in series providing 36 volts. Since the microphone will undergo little use, the D batteries should last at least 24 hours of continuous use; the 9 volt batteries should last years.

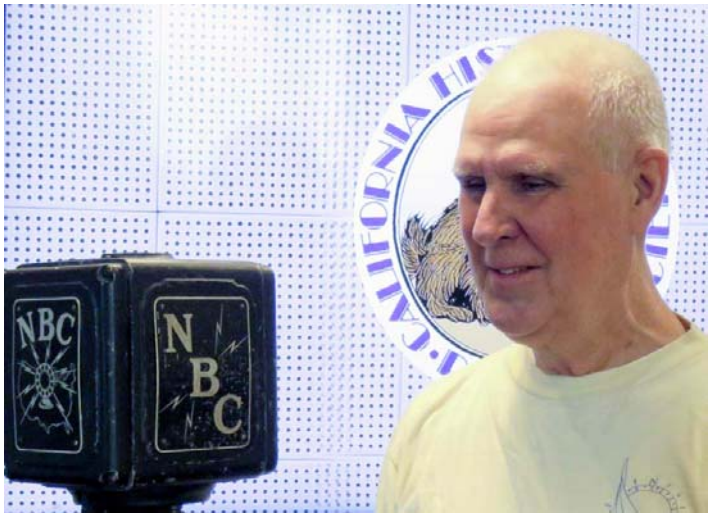
A polarized Jones connector connects to the microphone cable, and the audio comes through a male XLR connector. The output voltage is comparable to any low-impedance microphone.

The microphone can be run through the Gates board in the CHRS studio and heard on the monitor speakers. It produces a clear-sounding audio, surprising for the age of the microphone, approaching ninety years. It joins the collection of other high-value CHRS microphones, including an RCA model 77-DX, the Shure 55 and others.




## The Author

John, W6BM, at his advanced age, still has reasonably good hearing and eyesight, so is glad to be working these days on microphones and television cameras, both vital to program origination and communication. He is still doing physics research and consultation in the field of particle accelerators.




The author viewing the finished microphone on display at CHRS.

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## How It All Began

By Paul Joseph Bourbin

Heinrich Hertz.

The first artificial transmission of radio waves, as opposed to natural phenomena, is attributed to Henrich Hertz (1857 – 1894) in experiments he did from 1886 to1889. However, he did not come about this discovery from thin air. Hertz was inspired to do his experiments by those who preceded him. In 1831, Michael Faraday (1791 – 1867), demonstrated electromagnetic induction. He wrapped two coils of wire on the opposite sides of an iron ring. When he ran electric current, provided by a battery, an electric current was induced into the other coil as shown by a Galvanometer. This was based on the study of Orsted's discovery of electromagnetism. Faraday subsequently found that a magnet moved through a loop of wire caused an electric current to flow in the wire. Also, the same effect occurred when the loop of wire was moved around the stationary magnet. This showed that changing a magnetic field created an electric field and showed that they were the same phenomena. Unfortunately, Faraday's mathematical knowledge was limited to algebra, so he could not explain his discoveries mathematically. James Clerk Maxwell (1831 – 1879) used the discoveries of Faraday to help form his four Maxwell Equations which showed mathematically that fluctuating electrical and magnetic fields propagate (radiate) at the speed of light. He called them electromagnetic waves. He also showed that light is part of the electromagnetic spectrum going from radio waves to gamma rays.

Scientific method requires that, first a phenomenon be observed, as was done by Faraday in his experiments with magnets and wire. From this observation, a hypothesis must be made. Maxwell's fulfilled this with his equations based upon Faraday's observations. What remains is that the hypothesis has to be tested or proved. Maxwell's equations, while they showed that electromagnetic phenomena and light were the same, and predicted the existence of radio waves, they predicted much more. They are the basis for relativity and quantum mechanics. However, his equations had to be proved.

Hertz' mentor, Helmholtz, thought that Hertz would be the person to test Maxwell's equations. Hertz started his experiments in 1886 when he noticed that a charged Leyden Jar touched to a Reiss' Spiral (a flat, spiral wound coil with a spark gap) would produce a spark in another, close by Reiss Spiral. Seeing this, Hertz thought of a way to prove Maxwell's theory that electromagnetic waves could travel through space.

The apparatus he constructed consisted of a transmitter and a receiver. The transmitter used a Ruhmkorff coil. A Ruhmkorff coil consists of two coils, the primary, which is made with relatively few turns and a secondary consisting of many times the number of turns contained in the primary, wound around an iron core. There is also an interrupter. The interrupter consists of two points, one fixed and the other connected to a piece of spring steel. The primary coil is connected to a battery and a switch. When the switch is thrown, current from the battery flows through the primary coil turning the iron core into an electromagnet. The magnetic force eventually overcomes the resistance of the spring and pulls the points apart thus breaking the circuit. The movable point then springs back and closes the circuit allowing current to again flow through the primary coil. The vibrating point makes and breaks the circuit from fifty to a few hundred times a second.

**Diagram of Hertz transmitter and receiver**

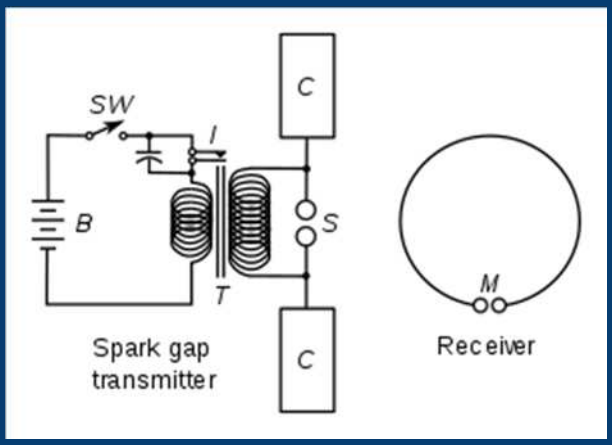
B=Battery, SW=Switch (or Key), I&T= Ruhmkorff Coil,

I=Interrupter, T=Iron Core Transformer, S=Spark Gap,

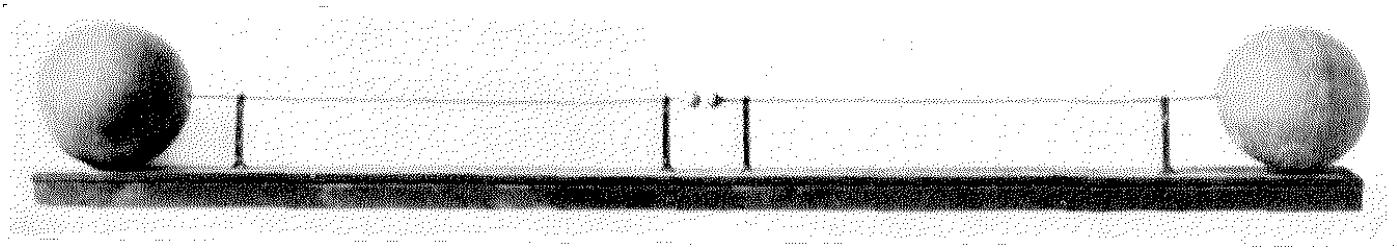
C=Antenna with capacitance balls or plates,

M=Receiver with micro gap.

From Wikipedia by DMGualtieri




When the flow of electricity stops in the primary coil, the magnetic field collapses and because of the iron core the energy is transferred to the secondary coil through electromagnetic induction. Because there are a low number of turns in the primary coil and thousands in the secondary coil, the voltage in the secondary coil is much higher. Attached to each end of the spark gap was an antenna, each about a meter long. At the end of each antenna was a capacitance ball or plate. This voltage charges one of the capacitance balls until the charge is high enough to overcome the air resistance of the spark gap. This causes a spark which charges the other capacitance ball which then discharges through the gap reversing the flow of current through the secondary coil. The discharging of the capacitances, causing oscillations through the gap, produced standing waves which were radiated by the antenna as electromagnetic waves. Hertz found that he could crudely tune his transmitter by changing the distance between the capacitance balls to vary the transmitter's rate of oscillations and hence its frequency. The frequency of his transmitters was from about 50 to 450 MHz.



Hertz transmitter spark gap, antenna and capacitance balls.

Once started, the oscillations will continue, decreasing in strength, until the energy is too low to jump across the gap. This produces damped waves, which form a broad frequency band.

The circuit, with the capacitance and spark gap, determines the spark rate. The spark rate is the number of times a second a spark jumps the gap producing damped wave trains, later detected through headphones as a buzz. This is usually from 50 to 1000 cycles per second.

This was not a problem when Hertz was doing his experiments and in the very early years of wireless telegraphy experimentation. However, when wireless telegraphy was starting to be used in practical ways, it became a very serious problem. Interference between stations became very intense. Improvements were made to spark transmitters, beyond the scope of this article, but there was never an acceptable solution. As other forms of radio transmission, with much narrower bandwidth, were developed, spark transmitters quickly became obsolete and unwanted.

Hertz' receiver was quite simple. It consisted of a loop of copper wire with brass balls at each end of the wire which was bent so as to have a microscopic gap between them. When the transmitter was switched on in a darkened room, Hertz saw a spark jump across the gap in the receiver showing that electromagnetic waves, indeed, travelled through space.

From 1886 through 1889, Hertz continued his experiments. He showed that electromagnetic waves could be refracted through a prism made of pitch in a similar way to light refracted by a glass prism. By using parabolic dipole antennae on both his transmitter and receiver, he demonstrated that electromagnetic waves were polarized by rotating the receiver's antenna. He found the received signal to be strongest when the antennae were parallel. He built a filter by attaching a number of parallel wires to a frame. The electromagnetic waves would pass through the filter when the wires were perpendicular to the dipoles and not when the filter was rotated so that the wires were parallel. The frequency of his parabolic transmitter was about 450 MHz. Hertz built a zinc reflector to enable him to plot the existence and speed of standing waves. He determined that electromagnetic waves travel at a constant speed which was the speed of light.

The results of Hertz's experiments successfully proved Maxwell's equations and showed that light and radio waves are both electromagnetic waves, just at different frequencies. Hertz was a pure scientist. His only goal in doing his experiments was to test Maxwell's equations. When asked, Hertz said that he could see no useful purpose for radio waves, just that they exist. Practical uses would be left to others.



## Author

Paul always had a nascent interest in old things, including radios. What started his interest was when a couple of family members gave him their castoff radios. Over the years, his collection began with a few radios he acquired at garage sales. One day, when he decided to get one of them to play, he ended up at member John Wentzel's Aladdin Radio shop. John helped him fix the radios and suggested that he come to a CHRS swap-meet and join the Society. Soon after joining, the Society's survival went into life support. Paul became president and board chairman and put the Society on firm footing. After five and a half years, he passed the gavel to others who have built the Society to what it is today.

His collection consists of all types of radios, equipment related to radios, tubes, and radio books, manuals, and periodicals from spark to transistor. He is particularly fond of radios from the Bay Area, especially San Francisco. He also collects antique phonographs (his first love), tube Hi-Fi gear, clocks, sewing machines, light bulbs and anything else that piques his interest. A true polymath.

Paul has written for Antique Radio Classified, The Old Timer's Bulletin, Radio Age and, of course, the CHRS Journal. He also worked for KMPX radio. He has been honored with the Doc Herrold Award and is a CHRS life member.

Now that he is retired, he plans to do more writing on subjects of radio interest. ◊

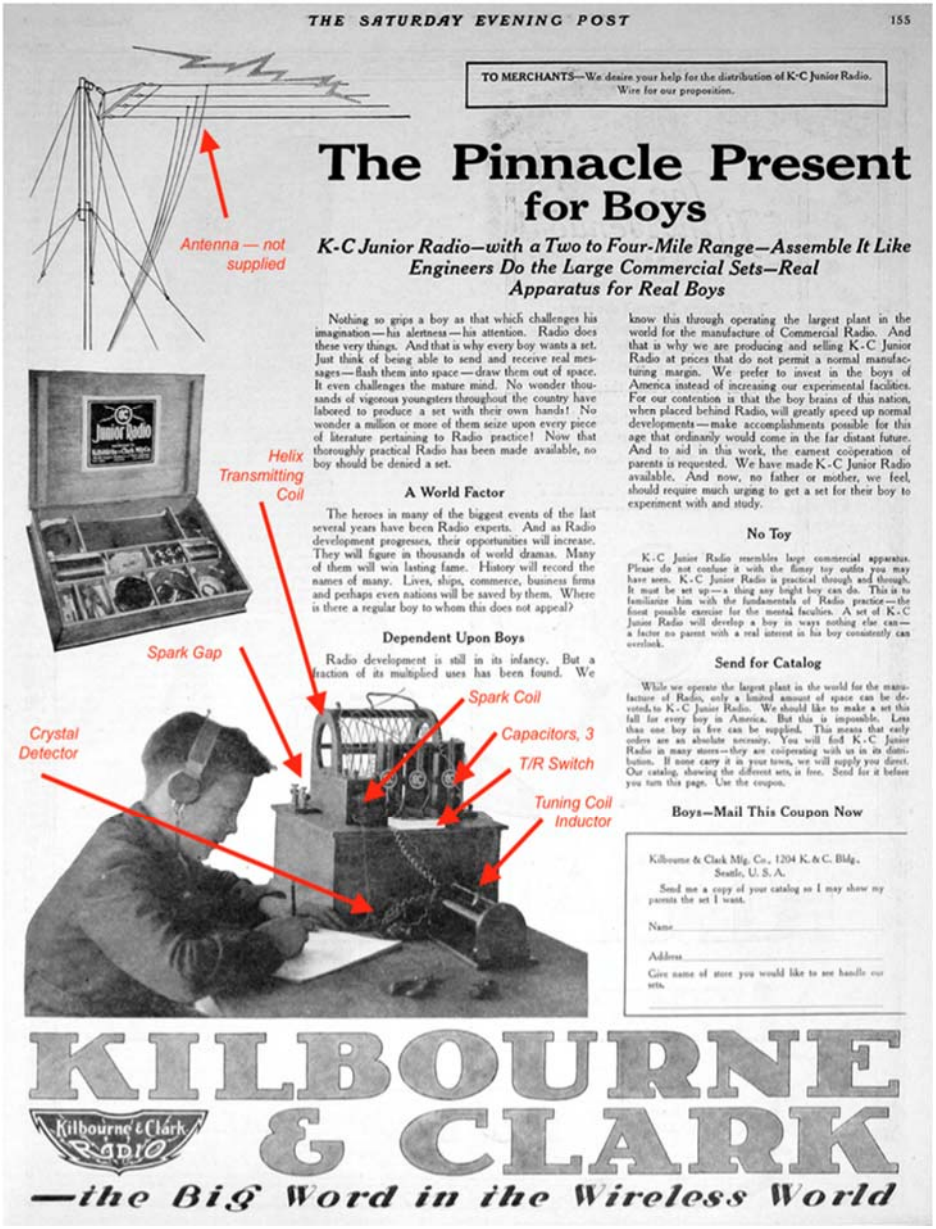
# Suddenly, It's 1916 - Replicating a Spark Transmitter

By Bart Lee, K6VK, CHRS, AWA Fellow

Several years ago, Richard Watts brought in an empty wood box with an interesting label on it (right). "Can you do anything with this?", he asked. And that's how the re-creation of a century-old communications technology started.

The box had held a radio kit for youngsters that included a crystal receiver and a spark transmitter offered by Kilbourne & Clark. They sold enormous amounts of wireless gear up through World War One, and by 1922 Kilbourne & Clark was out of business. Below is an advertisement of the kit from a Nov 29, 1919 edition of the Saturday Evening Post.

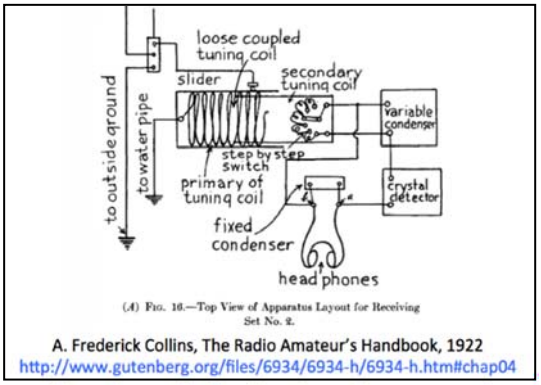

The Kilbourne & Clark Radio Kit #6 box top, with its original label and gently restored finish.



I'd been saving bits and pieces of spark technology for many years. Richard's Kilbourne & Clark box catalyzed a project: use it to make a working spark transmitter and receiver. So I did. All the steps in these restorations and recreations have been documented in detail on CHRS/facebook and on the CHRS website.

I had already restored and documented a CHRS-surplus loose coupler (below). I had acquired this from CHRS in 2012 for $50. This must have been a kit as well as it had not been built correctly; so it was corrected during restoration. It is two interacting inductances. The antenna and ground connect to the big coil with the slider; the inner coil slides in and out with more or less of it switched in.

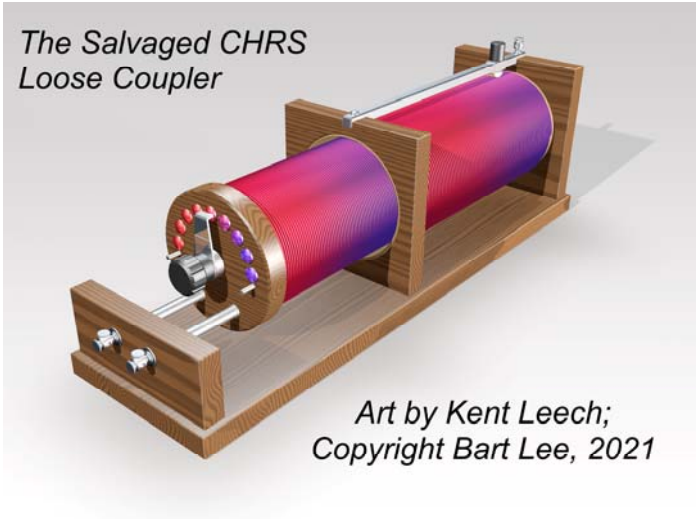
Restoration of the Very Loose Coupler.




Schematic diagram circa 1910.

Rebuilt, it worked well. Was this coupler designed for 200 meters and up (i.e., 1500 KHz and down, the old time marine, broadcast, and pre-1912 ham wavelengths)?

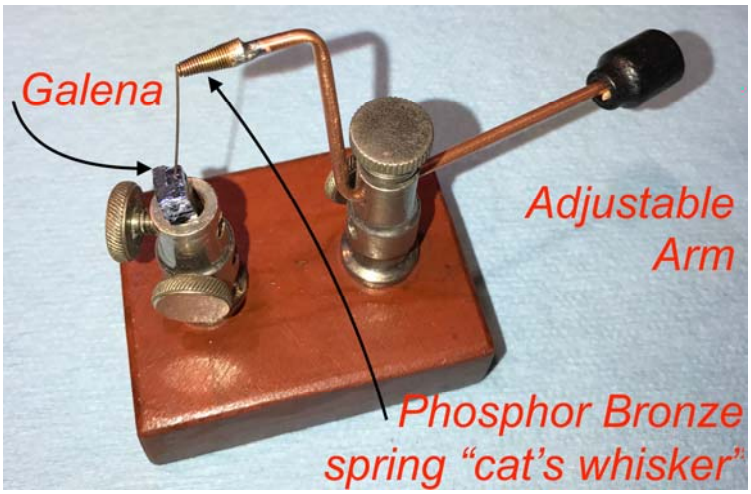
Loose Coupler working with inner coil connected to components shown and the large coil connected to the antenna.




Thus a period receiving inductance was at hand. Fellow CHRS member Kent Leech made a color rendering of the loose coupler (red for lower frequencies, blue for higher) shown left.

Also among the spark-era parts was a Wm. J. Murdock Co. variable condenser. This suffered from inner corrosion and it too had to be completely rehabilitated (below left). The crystal detector made reception possible. Many a later detector could be had, but it was appropriate to make a period crystal detector using a galena crystal. So I did (below right).

Murdock Variable Condenser (i.e. capacitor).




Crystal Detector.

After tuning and detection, rough audio goes to a pair of headphones. Old wireless men preferred Murdock 'phones (below left). To insure good sound, they shunted a small capacitor across the 'phones (below right).

High impedance headphones.

Capacitor shunt for the headphones..

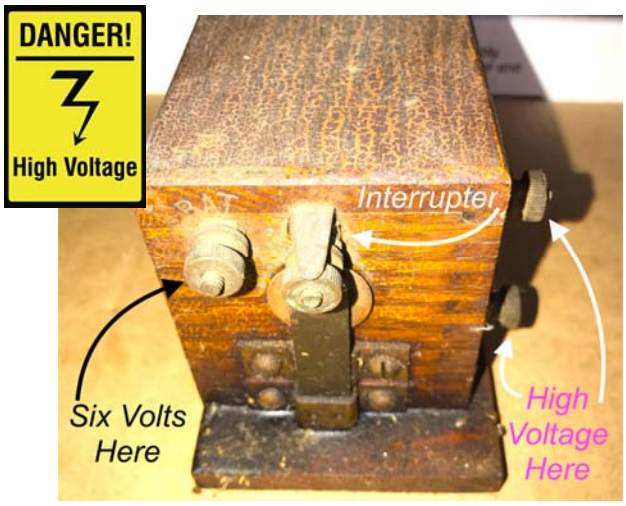
The net result: a working, World War One era crystal receiver well suited to the spark signals of the day.

The kit box provided the parts (long gone) to make a companion spark transmitter. But other old parts came to the rescue…

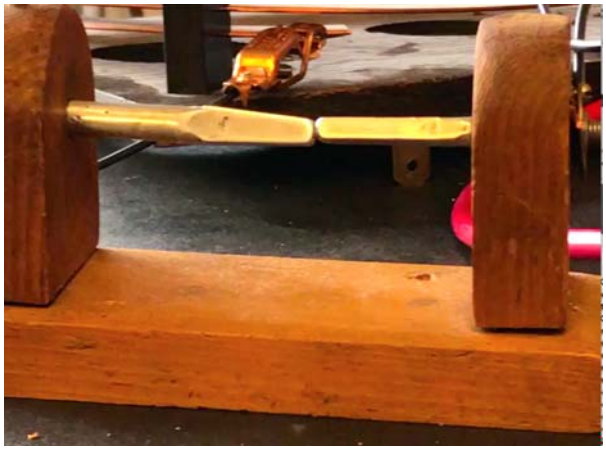
So I made a spark transmitter (illegal since the 1930s).

The key element is a source of high voltage. In this case an early automotive ignition coil filled the bill, made by the Detroit Coil Company. (A note on its base said that it tested "OK" in 1932.) The high voltage from the spark coil can create a spark in a spark-gap.

Some years ago Paul Bourbin let a zinc spark gap escape into the flea market. The spark-gap is, of course, but one element of the transmitter (below right).



An early automotive (Model T era) Ignition coil.


Handmade Zinc Spark Gap.

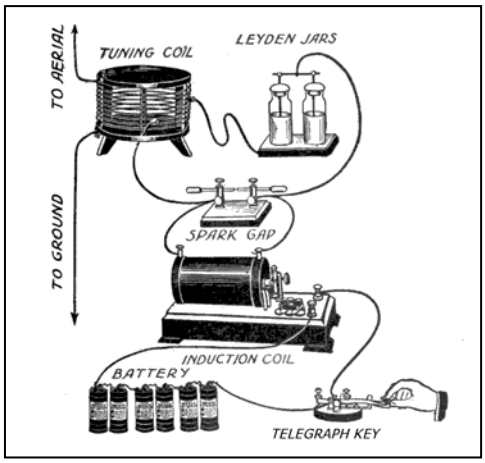


Diagram of a Spark Transmitter circa 1905.

Leyden Jars, the Marconi Lizard Station, UK, 1910.

A way to sustain the spark is needed, as is a way to get its energy into an antenna. The Leyden Jars in the diagram (above left) are a capacitor, storing energy from the induction coil. Marconi used them from the beginning (above right).

Leyden Jars are hard to come by these days, so it was necessary to make some. John Staples had made one to test, so that became the prototype. He wrote:

Using a peanut butter jar, I put aluminum foil inside and outside and measured the capacitance at 135 pF with the inside foil as close to the glass as reasonable, but not exactly. Filling the jar with salt water increased the capacitance to 470 pF, with a dissipation factor of 0.025. This means that the ESR measured at 1 kHz is about 8.5K, not a very good capacitor.

More than a century ago, Hugo Gernsback wrote in the Electro-Importing Co. catalog:

> "All our jars can be charged with even our 1/2-inch coil and the discharging crash of even our 1-pint jar can be heard for blocks. ***It is powerful enough to kill a cat with a single discharge.***" [emphasis added]

All in all, I made four with inner and outer aluminum foil, connected in parallel to maximize capacitance. I did not fill them with electrolyte at this testing stage. They measured at a little over 900 picofrads (pf) or a little under one micro-micro-farad (mmf) or 0.001 mf.

Homemade Leyden Jars.

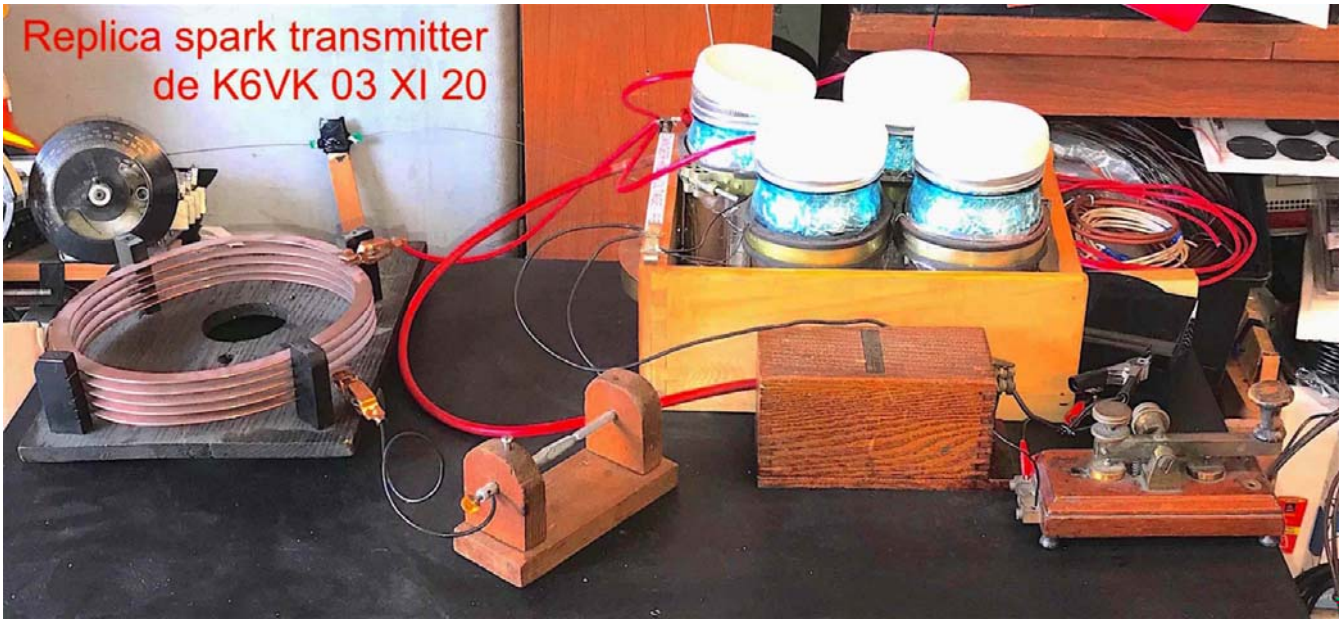
They measured 913pf.

As is illustrated in the diagram, an antenna inductance is appropriate to couple the spark system to an aerial. The band of frequencies that the spark transmitter will emit is a function of this antenna inductance and the aerial's capacitance to ground, working as a slot-filter.

As it happened, a Murdock spiral-wound pancake inductance was sitting in the parts box, patiently awaiting its reconstruction and its return to wireless service.


Pancake coil.

So then with an appropriate antique key, the system could be wired up and fired up…




Replica Spark Transmitter.

And it works. I made a coupling antenna coil to mate with the old Murdock coil. Across it, I put a neon bulb. And sure enough, key-down, it lights up.


The system set-up for testing used a kluged-together secondary antenna inductor. Copper wire wound around a big plastic jar with a NE-2 indicator bulb on top seemed like a good first step.

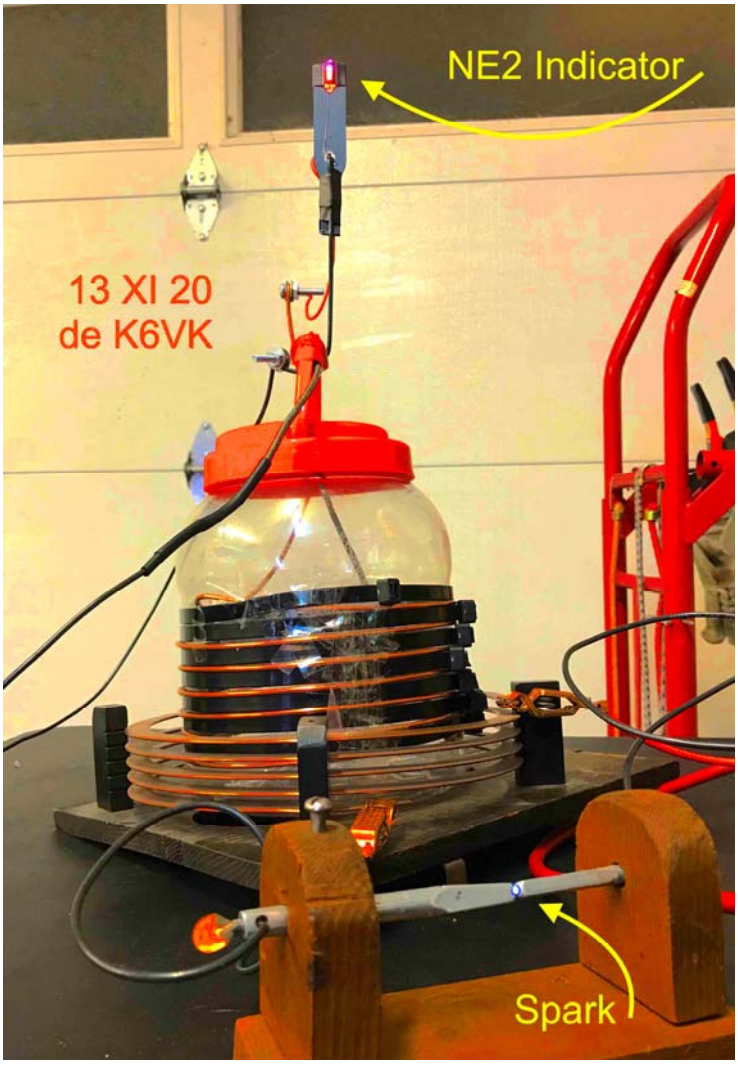
The NE-2 bulb lighting up with transferred radio frequency energy shows "proof-of-concept."

But a spark transmitter needed a reliable way to couple its energy to an antenna. Various sorts of antenna inductors did this. The Kilbourne and Clark kit used a spiral helix coil. The Murdock company offered a better (and professional) system. It made its coils of flat spiral copper and then mated two of them, at adjustable angles.

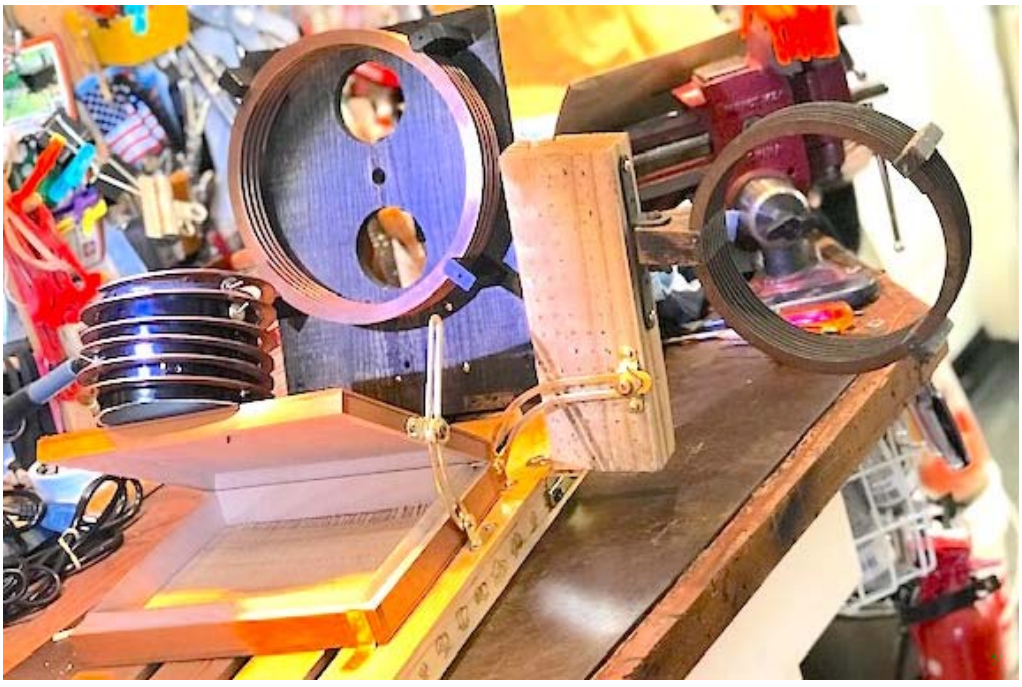
That way the degree of coupling could be managed, in order to get a peak of energy at one band of frequencies, measured then by minimum "decrement." This avoided the "double hump" of too close coupling, which spread out the energy too much over a larger band of frequencies.

I already had one old Murdock coil. I put the word out on the Spark Collectors reflector. A Canadian collector sent me two, for free, just to advance the project. Thank you, Lou Vermond, VE3AWA. This provided an opportunity to test many configurations in coupling coils.

The constructed test bed (below) permitted adjustment of the coupling angles of all three coils, and also made it possible to decouple the middle coil from the system entirely.

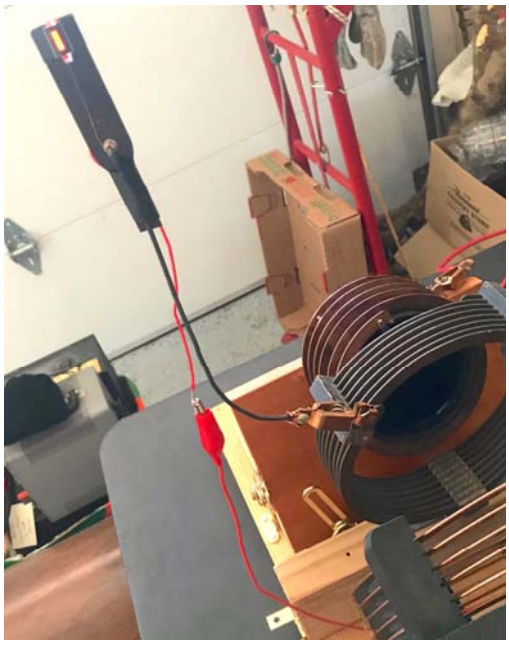


Lighting of a neon indicator.


Test bed for coupling adjustment.

Next came a simple test: could RF energy be coupled through the new coil set up?

Yes, indeed:



Testing the transmitter.

Neon bulb is lit.

Again the NE-2 bulb lights up showing transfer of RF energy from the spark to the antenna coils.

So a spark transmitter and receiver, *circa* 1916 to 1921, has been successfully recreated. Although this is hardly rocket-science, it is 21st Century kluge engineering of the first water.

My next project is to create a time machine so I can go back a century and use this spark set-up legally (but only on "two hundred meters and down" of course).

73 de Bart, K6VK (29 VI 21, v1) ##

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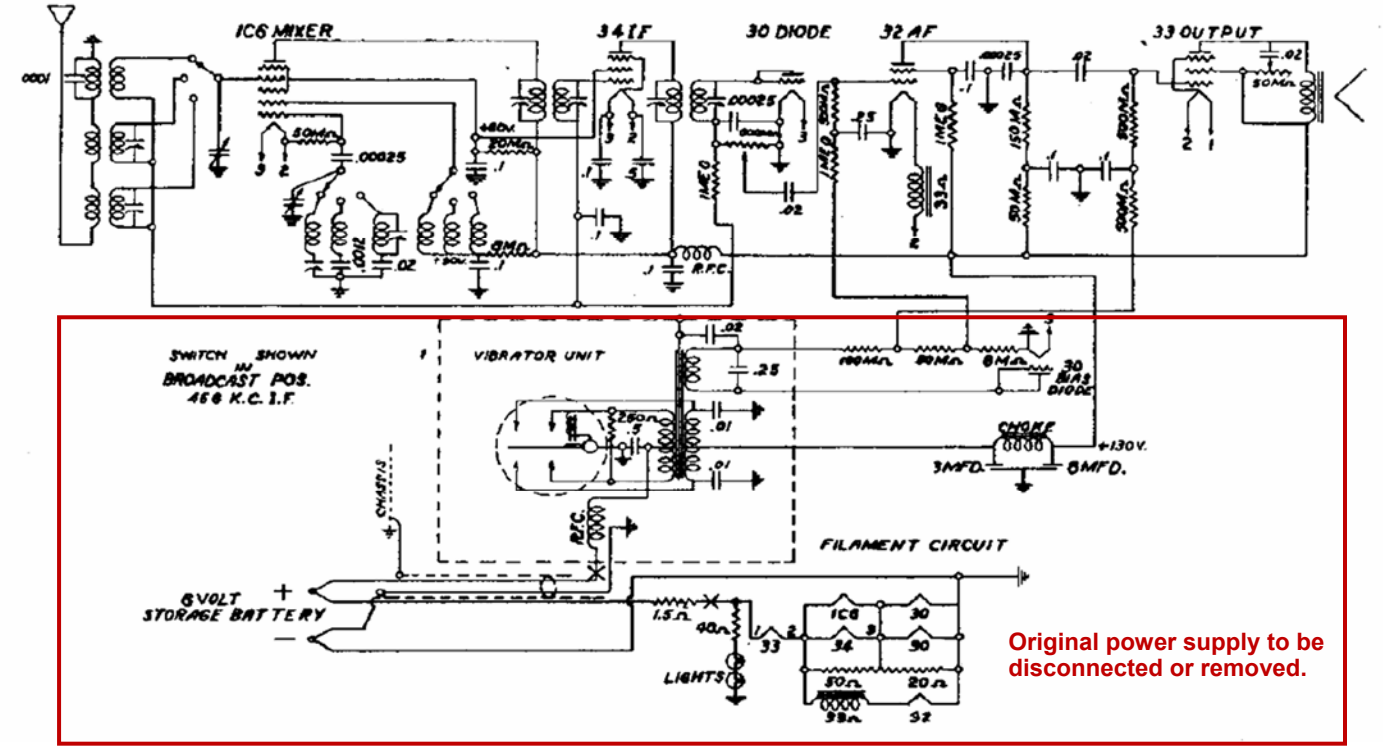
# Farm Radio Conversion to AC Operation

By Amnon Fisher

Continental Radio model Z4.

Continental model Z4, sold under the Monarch brand name, circa 1936 was originally designed to operate by a 6.3V car battery. Since electrification was slow to be implemented in rural areas during the 1930s, battery operated radios were common and often referred to as farm radios. In this radio, the DC from the car battery drives a vibrator which chopped the DC voltage to produce pulsated DC into a transformer which in turn produced the various AC voltages required by the set. In this article I will discuss how I converted the radio from DC to AC operation.

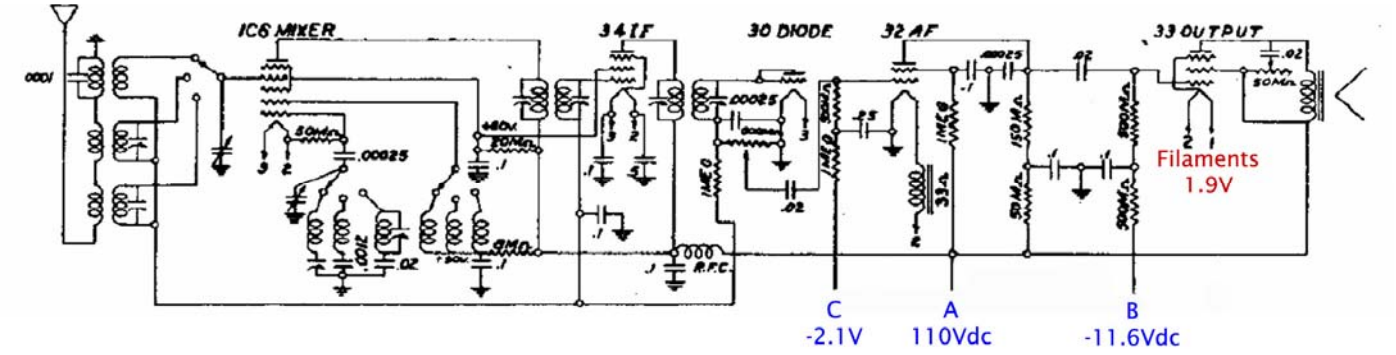
The key to the conversion was a 6.3v filament transformer with 115/230v input. I used the Triad Magnetics model F-314X with 1.2A output current, but similar transformers are available from Hammond Mfg. model 262D6 or Tamura 3FD-410. The choice was based on the transformer's form factor and price ($8 + shipping). The main consideration was having two primary coils, one used as the 115V AC power input, while the other was used to generate floating B+ and bias voltages. A simple calculation based on current ratio between the 115V input and the 6.3V output of this transformer, and the 7.6VA maximum power rating reveals that the B+ winding is capable of driving 50mA, sufficient for this set.



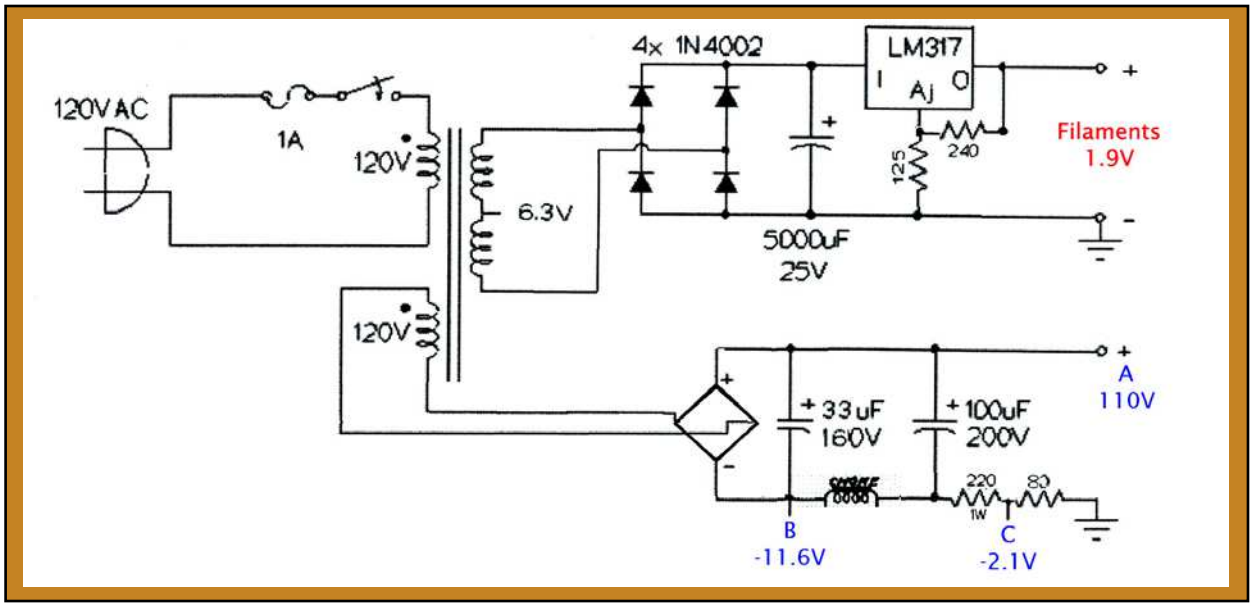

Continental Radio model Z4 original schematic.

First things first, the entire power supply section of the set had to be removed from the chassis. Fortunately, having purchased this set from Herb Brams, a member of our organization, he has done that work sometime in the past. All the tubes' cathodes are directly heated and operated at 2V, which require the filaments to be powered by a ripple-free DC supply. Toward this end, I used four diodes in a bridge, a large 5000uF filter capacitor and an LM317 regulator. The resistors' feedback values were selected to generate 1.9V, just below the nominal rating of these tubes in order to keep these old tubes alive for a few more years. [I used the formula provided in the data sheet Vo=1.25(1+R1/R2]. The current requirement was calculated by adding the nominal filament currents of all five tubes in parallel, totaling 0.62A. The largest consumer of current was, as expected, the 33 output tube, hence it was wired first in the string. I also had to make sure that there is a sufficient voltage drop of a minimum 2V across the regulator.

As for the B+ and the bias voltages for the output and AF amplifier tubes, I first determined the B+ current requirement by adding all the plate currents totaling 32mA, which is well within the transformer's rating as shown above. The supply filter consisted of 33uF and 100uF capacitors and a 3Henry choke. In order not to "waste" any voltage drop over the choke, I placed it in the negative path of the supply. With two resistors in series, I figured I will be able to generate the negative 15V for the 33 output tube and the negative 3V for the 32 AF amplifier tubes.



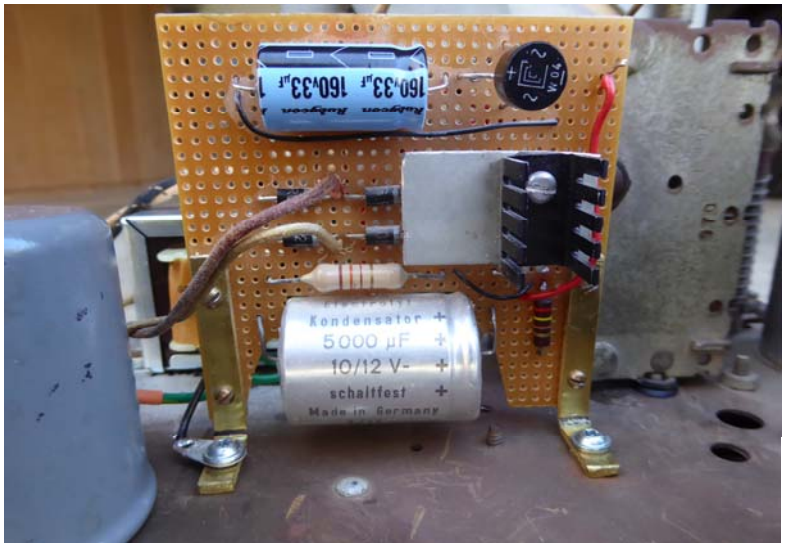

Continental Radio model Z4 with original power supply disconnected.




Replacement power supply circuit.

Calculations aside, these old tubes did not function according to their 85 years old specifications. The total plate current was only 26mA, consequently the voltage drops across the bias resistors were somewhat lower, but acceptable. In summary, the B+ voltage generated was 110V instead of the 130V of the original set, -11.3V instead of -15V and -2.1V instead of -3V.

Construction was free of space constraints having the vibrator, the step-up transformer and the bias rectifier tube removed by the previous owner. I built it all on a vertical board and placed the regulator on a spacer to allow the air to flow. I had to add a small aluminum slab to the heat sink in order to keep the temperature down to equal the temperature of a hot cup of tea. See pictures below. The radio was recapped, aligned, and some wires were added to connect the filaments in parallel. It works perfectly and it also looks really good.




Construction of the replacement power supply circuit.

Placement in the radio.

## The Author

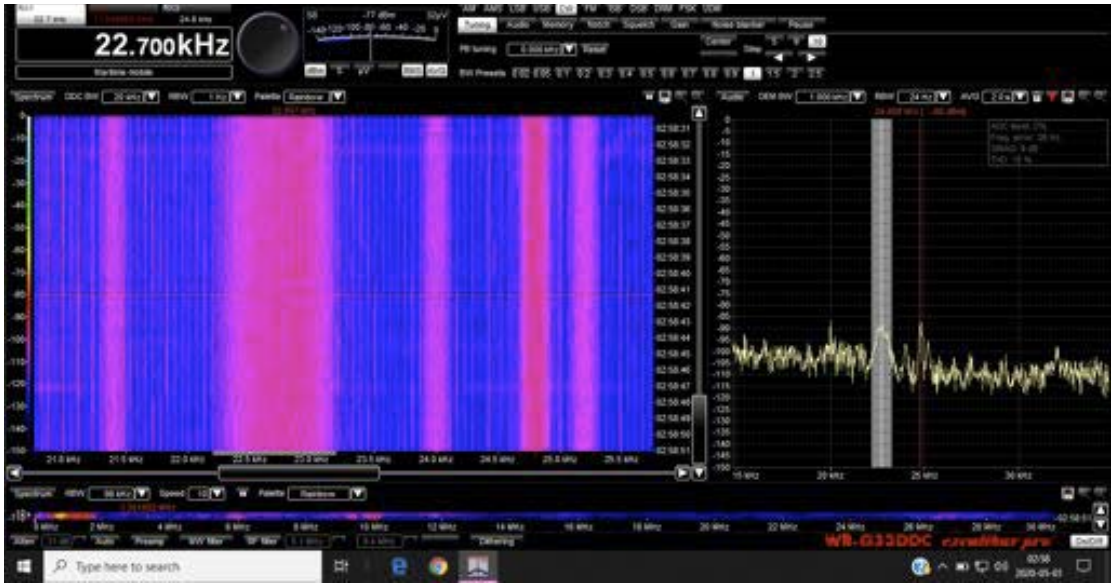
Amnon Fisher is a long time member of CHRS. He retired from the semiconductor industry a number of years ago. Since, he has accomplished an MA degree in History from Stanford university (16th century Spain). His radio restoration work is focused on prewar sets, and he has a modest collection. All restored radios beyond the space allocated to him by his wife are given away as gifts. ◊

# Mystery VLF Signal Identified

By Bart Lee, K6VK, CHRS Fellow, AWA Fellow

A century ago, RCA ran Alexanderson Alternator transmitters at Bolinas, California. RCA called it "Bolinas High Power" with the callsign KET. RCA's alternator transmitters generally operated between 14 KHz and 25 KHz. KET ran at 22.9 KHz [1] in what we now call the VLF (Very Low Frequency) range. SAQ in Sweden used (and still does) 17.2 KHz. Marconi used 88 KHz in its transatlantic circuit. Radio has thus worked at "longwave" from the beginning. Some CHRS members have found exploring this "legacy" band productive with both new and old gear; we are the CHRS VLF Interest Group, including John Staples, John Stuart and Gilles Vrignaud.

A new (to me, in 2019) BIG signal appeared in the longwave VLF band (Very Low Frequencies, 3 KHz to 30 KHz). At about 22.7 KHz and with an 800 Hz bandwidth, it does not come from any of the operating U.S. Navy VLF transmitters (four of which appear below) but rather nests between them. An SDR full-screen capture of the WinRadio G33 shows the signal:




Very Large Folded Loop antenna, early evening local time, May 1, 2020 -- de K6VK.

The Navy has for many years standardized its submarine communications at 200 Hz bandwidth, MFSK (Multiple Frequency Shift Keying, five carrier frequencies sometimes seen). There is no listed or observed U.S. Navy VLF signal at more that 200 Hz bandwidth [2], *except* the Navy airborne TACAMO system at the observed 800 Hz.

[KHz:]

"00022.6:unid:US NAVY TACAMO mobile worldwide:

F1B-50Hz/190Hz/MSK 400Hz/800Hz BW

… TACAMO is an acronym for; TAke Charge And Move Out" [3]

The Navy has operated TACAMO for several decades, since 1962.

The wiki says:

> "TACAMO (Take Charge And Move Out) is a United States military system of survivable communications links designed to be used in nuclear warfare to maintain communications between the decision-makers (the

National Command Authority) and the triad of strategic nuclear weapon delivery systems. Its primary mission is serving as a signals relay, where it receives orders from a command plane such as Operation Looking Glass, and verifies and retransmits their Emergency Action Messages (EAMs) to US strategic forces. As it is a dedicated communications post, it features the ability to communicate on virtually every radio frequency band from very low frequency (VLF) up through super high frequency (SHF) using a variety of modulations, encryptions and networks, minimizing the likelihood an emergency message will be jammed by the enemy." [4]

The wiki adds: "a west coast alert base at Travis AFB, California" near Sacramento, hosts some of the operating aircraft. So, too, other sources. [5]

*Popular Mechanics* [6] recently ran an article titled:

> ""This Unarmed Plane Is the Deadliest in the U.S Arsenal [-] The E-6 Mercury doesn't carry any weapons, but it could end civilization as we know it."

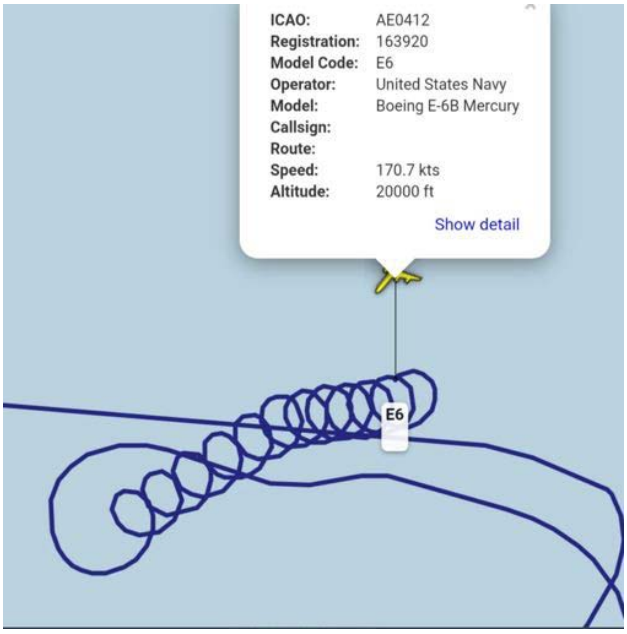
A Russian website [6] conveniently collects the TACAMO frequencies:

> ["Addition from participant Zesty67":]

| | | |
|---|---|---|
| 17.9 KHz TACAMO | 25.3 KHz TACAMO | 27.6 KHz TACAMO |
| 18.0 KHz TACAMO | 25.6 KHz TACAMO | 27.7 KHz TACAMO |
| 18.6 KHz TACAMO | 26.2 KHz TACAMO | 27.9 KHz TACAMO |
| 19.3 KHz TACAMO | 26.9 KHz TACAMO | 29.3 KHz TACAMO |
| 22.6 KHz TACAMO | 27.0 KHz TACAMO | 29.4 KHz TACAMO |
| 23.1 KHz TACAMO | 27.2 KHz TACAMO | 29.6 KHz TACAMO |
| 25.2 KHz TACAMO | 27.5 KHz TACAMO | |

Other sources also list 27 KHz. [8]

Each TACAMO aircraft, in this case an E6 ("Mercury" - a modified Boeing 707), as observed in December 2019, flies a unique spiral pattern above the sea, with a 200 kilowatt VLF transmitter.




Data and diagram by "Evergreen Intel @vcdgf555" December 13, 2019 on Twitter. As plane-spotting goes, this is as good as it gets.

This aeronautical event was reported in *The War Zone* [9] titled:

> "Here's Why An E-6B Doomsday Plane Was Flying Tight Circles Off The Jersey Shore Today [-] Part of the E-6B's critical mission is to fly aerobatic-like maneuvers that allows them to send messages to ballistic missile submarines hiding below."

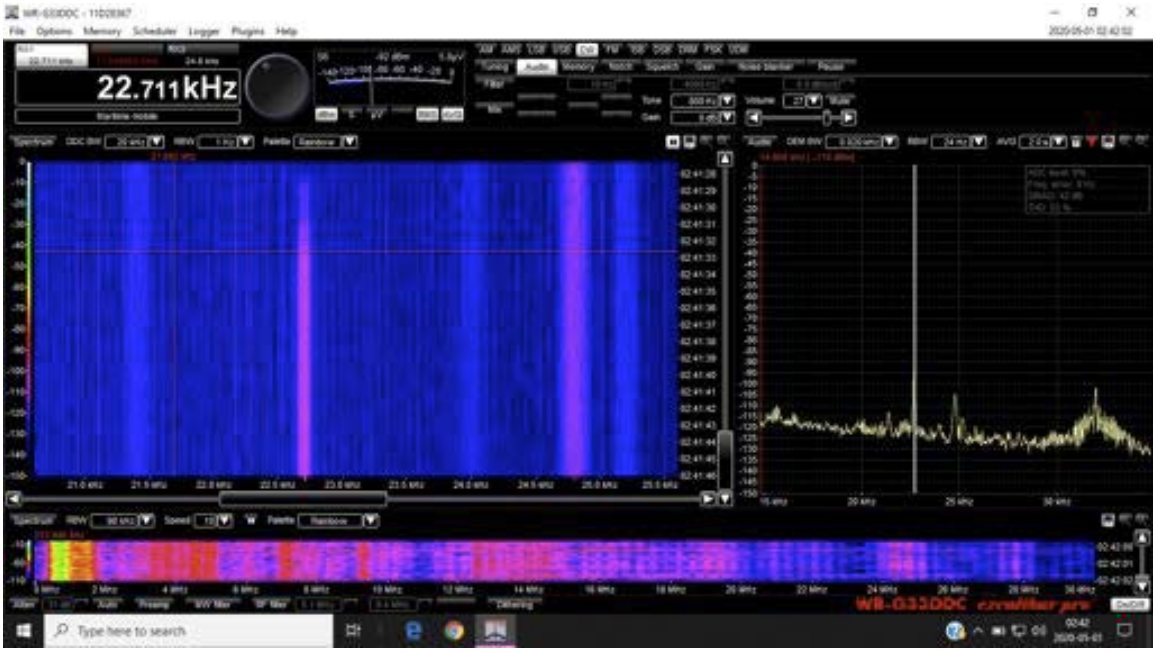
The article reports:

> "The E-6B's primary VLF antenna is just over five miles long. It also has a shorter one that is deployed via a trapdoor arrangement in its tail.

The VLF antennas are stabilized with a drogue on its trailing end. The idea is to get the antennas as close to vertical as possible for maximum transmission effectiveness. This is done by putting the aircraft into a very steep and tight banking turn at slow speed and above 20,000 feet, not far above the aircraft's stall speed. These turns are repeated, oftentimes for hours at a time, as messages are sent."

Given the strength of the signals received here in the San Francisco Bay Area, the transmitter likely flew just off the west coast. The observed signals often (but not always) seem to end about 03:00 UTC.

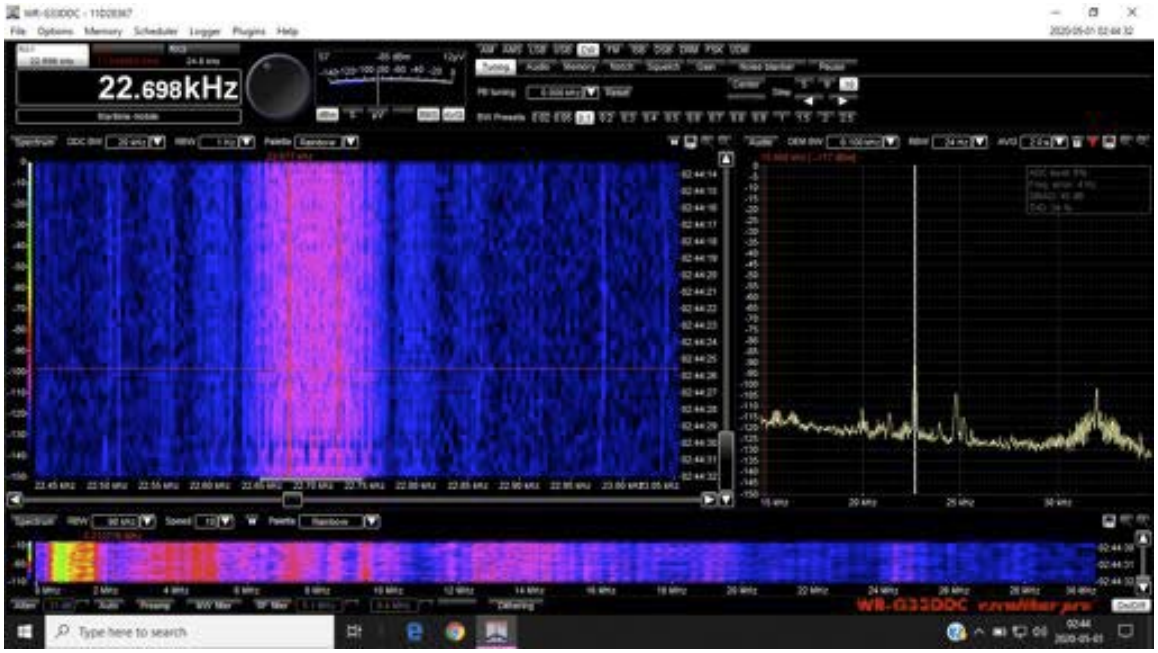
Sometimes a much narrower signal appears; in this case several minutes before the wide signal. This signal is stronger than NLK in Washington state ("Jim Creek") at 24.8 KHz, bandwidth 200 Hz. This signal's bandwidth may be 100+ Hz.




For comparison, the nearby Navy stations at 200 Hz are:

| Station | Frequency KHz | Location |
|---|---|---|
| NPM | 21.4 | Lualualei, Hawaii |
| NAA | 24.0 | Cutler, Maine |
| NLK | 24.8 | Seattle, Washington |
| NML | 25.2 | LaMoure, North Dakota |

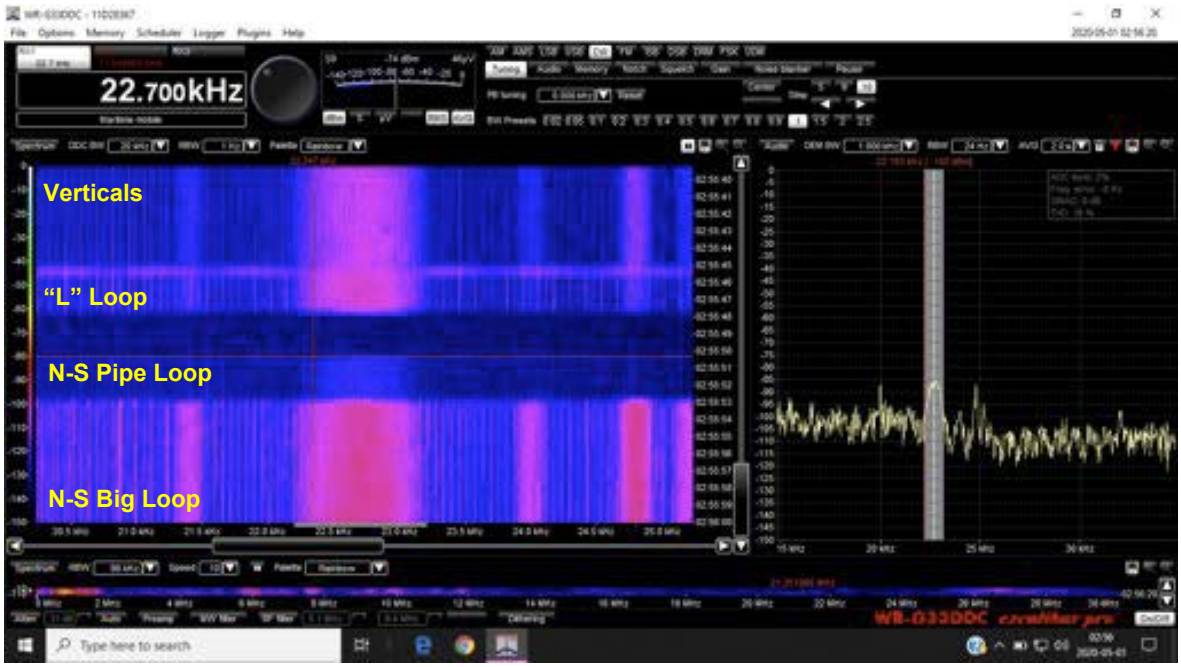
Sometimes it appears with perhaps two internal carrier frequencies (see 02:44:31). The signal may exceed 100 Hz bandwidth. TACAMO has been listed at sometimes at 50 Hz and 190 Hz bandwidths in F1B modulation. F1B is frequency modulation, one channel, radioteletype or digital. Perhaps this trace shows two such signals in parallel.




Shortly after this capture, the signal ended and then came up at 800 Hz bandwidth. Available antennas provide some directionality. The paired verticals at 43' +- are omni-directional. They appear at the top of the next capture.

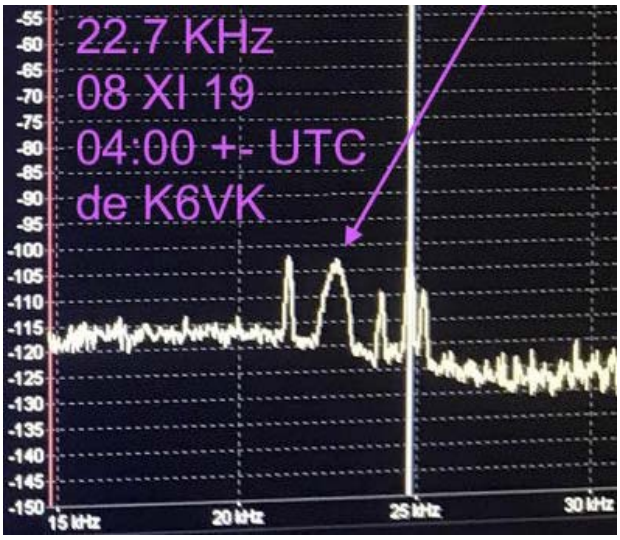
The next level down is a large, single wire loop about an average 10' high and 240+' long, in an "L", first North/South then East/West. It returns the strongest signals from the West. In this case, the signal is stronger than that received by the verticals. The North and East stations are weaker than on the verticals. Hawaii NPM is about the same strength. The third level down is the single turn copper pipe large loop. It receives best North/South. Only the 22.7 KHz signal appears. The lower band is a multi-turn Very Large Folded Loop. It sees the 22.7 KHz signal as strongest (at 46 microvolts and -74 dBm) and NLK Jim Creek is comparable (and due North).

One can infer from this rough data that this signal comes roughly from the North.




22.7 KHz 02:56 UTC 4 ants - verts then NE (=EW) then kinky (NS but intermittent) then VLFL NS = 46 micv Capture @ K6VK

This signal was first observed at K6VK in November 2019. Its strength was comparable to NPM in Hawaii. Perhaps the aircraft then flew in that area. The aircraft usually fly at least 20,000 feet altitude and NPM is not much above sea level.




08 XI 19 22.7 KHz RF 04-00+ UTC @ K6VK.

The Navy has hardened the TACAMO aircraft against nuclear blast and atomic-bomb created electromagnetic radiation (EMP). In the event of a war, a TACAMO aircraft would be a very safe place to be – for a while.

From *The War Zone* -- a TACAMO aircraft.

Correspondence is invited: bart.lee.k6vk@gmail.com.

## Footnotes

1 http://www.radiomarine.org/gallery/show?keyword=BHP&panel=pab1_10; see also https://en.wikipedia.org/wiki/Alexanderson_alternator
2 The Canadian NATO VLF Vancouver station callsign CKN at 76 kHz [=KHz] seems to use a bandwidth of perhaps 400 Hz; sometimes what appears to be much wider (data?) bursts appear just above this frequency.
3 UDXF – UTILITY Dxers FORUM – ELF and VLF Guide Version 1.0 - updated 15 November 2001 WUN - Very Low Frequency Guide - DC to 30 kHz http://www.udxf.nl/ELF-VLF-GUIDE-v1.0.pdf
4 https://en.wikipedia.org/wiki/TACAMO
5 https://fas.org/nuke/guide/usa/c3i/e-6.htm
6 In *Popular Mechanics*, By Kyle Mizokami, April 26, 2017.
7 http://nato.radioscanner.ru/frequencies/article107/
8 *E.g.*, http://x264.nl/dump/VLF-Frequencies.txt
9 Tyler Rogoway, *The War Zone*, December 13, 2019: https://www.thedrive.com/the-war-zone/31477/heres-why-an-e-6b-doomsday-planewas-flying-tight-circles-off-the-jersey-shore-today ◊

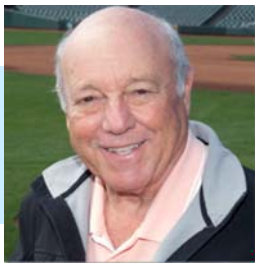
From The Birthplace BAY AREA RADIO HALL OF FAME ...Of Broadcasting!™

BAY AREA RADIO MUSEUM

# 2021 Inductees

The latest inductees into the Bay Area Radio Hall of Fame (BARHOF) were announced July 20 by Ben Fong-Torres and Kim Wonderley. They were then inducted in to the Hall of Fame at a luncheon on September 24th hosted by the Broadcast Legends and CHRS.

**NEWS: Holly Quan** has been the cornerstone of excellence at KCBS as both reporter and anchor. As a teenager, she became involved in Youth News, an Oakland-based news radio magazine. Upon graduating San Francisco State, she began her career at KQED. She joined KCBS in 1997. Holly has collected numerous awards, and recently added AP's prestigious Reporter of the Year honor.



**SPORTS: Marty Lurie** has been hosting pre-game shows since 1997, beginning with an Oakland A's affiliate in Concord, then with the A's themselves, and finally with the Giants. He was an attorney for 25 years until a burnout turned him to his childhood love of baseball. That love still burns, and has led him to the Hall of Fame.

**TALK HOST: Peter B. Collins** was born in Cincinnati. He built a closed-circuit station with buddies on his high school campus. He attended Northwestern, then became a late night talk host on Chicago's WLS-FM. He landed in the Bay Area at KOME in 1976. After a stint at KGO, Peter joined KRQR, The Rocker, hosting the morning show through the 80's. Returning to talk radio, Peter was the lone liberal in the wilderness at KNBR and later KSFO. Peter continues today, on his subscription-driven

**Program Host is a three-way tie:**

**PROGRAM HOST: Lamont & Tonelli** are being welcomed into the Hall of Fame after almost 32 years together – first in San Jose, on KSJO, until a contract dispute in 2002 led them to mornings on The Bone, a/k/a KSAN. Lamont Hollywood came from radio in Canada, while Paul Tonelli was raised on Bay Area personalities like Don Sherwood and Russ the Moose Syracuse. Call letters and frequencies come and go, but Lamont & Tonelli remain

**PROGRAM HOST: Jack Kulp**. Twenty-something years ago, the slogan at KOIT was 'lite rock, less talk.' But morning anchor Jack Kulp got the last word. He'd been on mornings since 2005 after handling the afternoon shift, and the show was earning high ratings. But new management pulled a switch in 2015 for a younger team. No problem. Jack moved over to The Breeze, also new, and breezed to the top of the ratings. Jack also has lent his friendly pipes to KDBK and, back in the '80s, to K101.

**PROGRAM HOST: Paul 'Lobster' Wells,** despite his college radio nickname, has proven to be a most versatile broadcaster since joining KSJO in San Jose in 1974. He worked two other stations in the South Bay, got to KSAN just as it was dying in the early '80s, became morning anchor on The Rocker, and continues to host and produce shows, on KVRV, the River in Santa Rosa. He also operates Flow Communications, a production company.

**ENGINEERING: Erick Steinbeck** who, beginning in 1977, worked 11 years for ABC radio and television, including serving as chief engineer at KGO AM and FM. From 1988 to 1991, he was in management, as Vice President and GM with KDFC. He then returned to engineering and spent ten years with Susquehanna and Cumulus as Director of Technical operations,, covering KFOG, KNBR, "The Ticket" and KSAN. He continues to do part-time consulting for radio stations.

**MANAGEMENT:** Bill Lueth presides over KDFC, the long-time classical station. He began as an announcer at KKHI, then moved to KDFC in 1997, and would become its operations and program director, leading it through numerous changes in ownership and a transition to public radio. Through it all, KDFC has maintained its position as one of the best classical stations in the country, thanks to the staff and to its resident, Bill Lueth.

**SPECIALTY: Dana Jang**'s specialty was to remain mainly behind the scenes at whatever radio station he was working. As his brother, the musician Jon Jang wrote: "For nearly a half a century, Dana has been a radio programmer and director at KOME, KSJO, KBAY and he founded KKUP. In a field dominated by white radio programmers during the 1970s, Dana Jang broke the color barrier." Dana got into broadcasting at Foothill College in 1971, and never looked back.

**PIONEER: Denny Terry** is a DJ and former phone phreak. Dennis, born Dennis Teresi, is identified in the documentary, The Secret History of Hacking, as an expert in social engineering. Phone phreaks, it is said, could manipulate call routing to make calls for free. Since 1976, Dennis has hosted an oldies show on KSJS in San Jose where, at one time, he also operated a pirate radio station.

**LEGEND: Tom Campbell** comes from the Top of the Hill, Daly City. It's Tall Tom Campbell, who made a name for himself on KYA in the mid-through-the-late 1960s. His promotional stunts included listing his number in the phone book, lending listeners anything from albums to his car, and, after receiving public criticism, threatening to quit and move to New York, pending votes from his listeners. He did leave KYA in 1970, working at KLOK and KNEW before trying his hand at television, where he continues to work today.

**LEGENDARY STATION: KOME 98.5 San Jose**. Selected by the Bay Area Radio Museum's board, the award goes to KOME, 98.5 FM in San Jose, known for years as "The KOME Spot." Hey, rock and roll! And that's what KOME epitomized. From 1971 to 1982, it rocked with DJs like Gene Mitchell, Dana Jang, Jona Denz, Uncle Frank, Mikel Hunter, Jeff Blazy, Peter B. Collins, Dennis Erectus and Laurie Roberts. KOME was inducted into the Rock Radio Hall of Fame in 2014.


◊

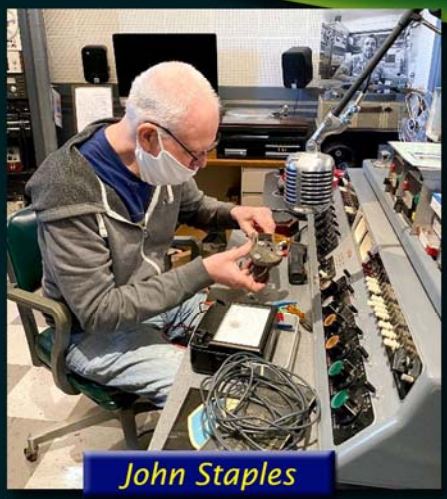
Hil Hampton & Gilles Vrignaud

Hiedi Kikawada

Jon Barrilleaux

Denny Monticelli & Keith Scott

# Volunteers continue to make a lot happen . . . socially distanced of course.

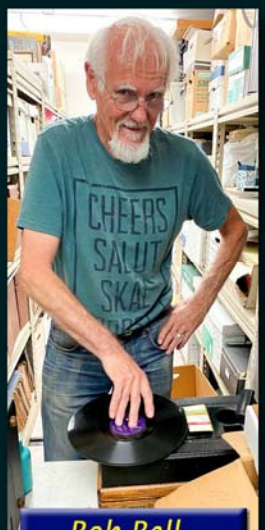


John Staples

John Stuart

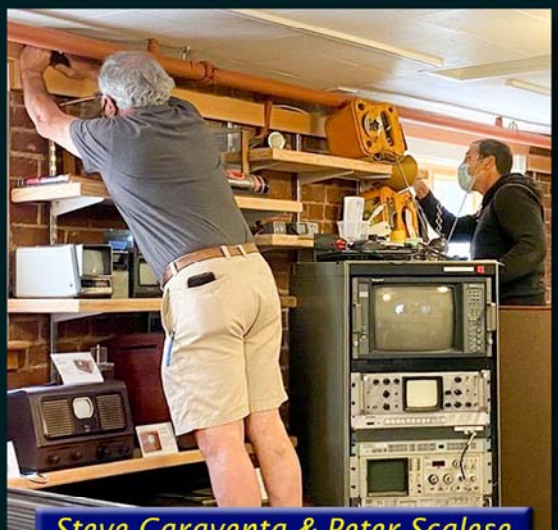
Jim Fink

Dave Billeci




Bob Bell

Dan DeRensis



Steve Garaventa & Peter Scalese