

# ANTIQUÉ WIRELESS ASSOCIATION REVIEW

## MASTER INDEX

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**THE EXTRAORDINARY TRIPLETT 630 VOM SERIES**

by Charles Kirsten.....1

**ABSTRACT:** Beginning in the early 1900s, analog moving coil meters saw great development during and after World War Two, reaching their peak in the late twentieth century. Triplett Instruments was one of the meter manufacturers who not only profited from the demand for good meters, but introduced quality construction combined with design innovations above the norm. Beyond producing a quality Volt Ohm Milliammeter (Model 630) that has enjoyed uninterrupted sales for over sixty-five years, Triplett offered several instruments with a price/performance ratio which has not been exceeded, or even equaled by recent analog meters.

**RADIO PIONEER DR. DAVID G. MCCA**

by Lloyd Jury and Brian Belanger.....29

**ABSTRACT:** Few radio historians would recognize the name David Galen McCaa. Yet Pennsylvania newspapers described McCaa as "the inventor of the wireless telephone," and "the foremost inventor of his time in everything concerning wireless telephony of which he undoubtedly, was the originator." Research in local historical records, and interviews with family members, has made it possible to reconstruct McCaa's life and his contributions to radio technology. This article emphasizes his radio work during the period between 1910 and 1930. Had World War I not broken out, McCaa might have become a manufacturer of wireless telephony equipment. During the war he worked briefly for the National Bureau of Standards and also had ties to the California-based Federal Telegraph Company.

**CQ "SMALL FORMAT" AMATEUR RADIO BOOKS,  
1947-1984: AN ANNOTATED BIBLIOGRAPHY**

by Neil Friedman.....49

**ABSTRACT:** Books published by CQ magazine have enthused and educated Hams about the many aspects of Amateur Radio for the past sixty years. Authors have included some of the best-known experts in their fields. In this annotated bibliography, Neil D. Friedman catalogs and describes the 28 "small format" (about 6" by 9") books published by CQ between 1947 and 1984. These influential works may still be found at hamfest flea markets and online.

**TELEVISION HISTORIAN: AN APPRECIATION OF  
GEORGE SHIERS (1908-83)**

by Christopher Sterling.....61

**ABSTRACT:** Though readers may not recognize his name, historical researcher and author George Shiers' valuable influence lasts to this day, more than two decades after his death. Employed in the English and (after World War II) American electrical industries in the 1940s and 1950s, he became a freelance researcher and college teacher, moving to California. An authority on electronic drafting (his book on the subject was long the standard text), he taught courses in technical writing. At the same time, he developed a valuable book collection on the history of electronics. His magnum opus, the

definitive bibliography of early television development, remains a basic multilingual reference source used by anyone writing about television's technical history. His historical articles and reference books, written over a period of two decades, and especially the memorial trust he and his wife established, continue to support research efforts that add to our knowledge of radio and television development.

**E.H. SCOTT SERIAL NUMBERS: AN UPDATED ANALYSIS**

by Kent King and Norman Braithwaite.....73

**ABSTRACT:** E. H. Scott produced a highly collectible line of radio sets during the 1930s and 1940s. Scott sets had unique serial numbers, which changed in format and value through the years. Efforts to collect and analyze serial numbers began over 30 years ago. The Internet has permitted much wider communications among collectors and has allowed the authors to collect well over 1000 serial numbers. This volume of accurate data has permitted a more thorough analysis, including estimates of numbers of sets produced. This article describes the serial number systems used by Scott and the resulting patterns in set production from 1932 to 1947. Understanding the serial number assignments allows owners to determine models of unknown sets and even estimated production dates of some models.

**TECHNIQUES OF RADIO INTELLIGENCE IN THE SECOND WORLD WAR**

by Gary Cain.....85

**ABSTRACT:** Radio Intelligence is the analysis of the enemy's radio signals to determine his capabilities, intentions, disposition and order of battle. It consists of **Cryptography, Direction Finding, Traffic Analysis, and Radio Fingerprinting**. The technique of radio intelligence was born in the First World War, the world's first scientific- industrial war. By the end of the war in 1918 the use of wireless was so deeply entrenched that its use in future military operations was assured.

**FESSENDEN'S CHRISTMAS EVE BROADCAST:  
RECONSIDERING AN HISTORIC EVENT**

by Donna Halper and Christopher Sterling.....119

**ABSTRACT:** Everyone "knows" that Reginald Fessenden conducted the first broadcast of voice and music on Christmas Eve of 1906 . . . or did he? The authors, finding no reference whatever to that event until more than two decades later, explored both the archival and published records of the period and find the iconic event only becomes well known after the inventor's biography, written by his widow, appeared in 1940. A careful search of the available Fessenden documents in two key archives reveals but a single mention of the event and that in a copy of a 1932 letter. While there is little doubt of Fessenden's earlier transmissions (1900- 1906) of voice and music, many of which were witnessed, they have (perhaps ironically) become lost to most historians. This article reviews the published and archival record, and then suggests some reasons for this strange anomaly, including the need to keep such a "frivolous" event from the ears of his financial backers who were seeking success with other lines of wireless business. The telegraph was the primary communication device of the 19th Century and continued to play an important role throughout the 20<sup>th</sup> Century. As concepts for teaching Morse code evolved throughout this period,

entrepreneurs and manufacturers incorporated new technologies and offered an increasing variety of training instruments. This article presents a review of American teaching devices used for Morse code training after 1850. The devices discussed include: training keys, disk and drum devices, paper tape machines, audio visual trainers, oscillators, and phonograph and tape recordings. For over 150 years, these devices provided the means to teach and practice Morse code. They offered a way to replicate the code and provided variation in code speeds and timing for individual and group practice. Use of these devices enabled thousands of telegraphers and wireless operators to work towards achieving greater proficiency levels and standards of performance.

**MORSE CODE TRAINING DEVICES**

by David and Julia Bart.....139

**ABSTRACT:** The telegraph was the primary communication device of the 19th Century and continued to play an important role throughout the 20th Century. As concepts for teaching Morse code evolved throughout this period, entrepreneurs and manufacturers incorporated new technologies and offered an increasing variety of training instruments.

This article presents a review of American teaching devices used for Morse code training after 1850. The devices discussed include: training keys, disk and drum devices, paper tape machines, audio visual trainers, oscillators, and phonograph and tape recordings. For over 150 years, these devices provided the means to teach and practice Morse code. They offered a way to replicate the code and provided variation in code speeds and timing for individual and group practice. Use of these devices enabled thousands of telegraphers and wireless operators to work towards achieving greater proficiency levels and standards of performance.

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**ONE HUNDRED YEARS OF ELECTRONIC COMMUNICATIONS**

by Ludwell A. Sibley..... 1

**ABSTRACT:** The essential elements of electronic communications (mainly the LRS Relay and de Forest audion) arrived on the scene in mid- and late 1906. They developed into practical form during the next five or ten years. Over the rest of the Twentieth Century, the vacuum tube (né audion) and transistor slowly displaced a wide variety of mechanical devices for signal generation, signal amplification, and computation. This article provides a perspective of the arrival and triumph of electronic communication and related arts.

**HENRY J. NOLTE AND GENERAL ELECTRIC'S HIGH POWER, METAL ENVELOPE TUBES**

by John M. Anderson..... 19

**ABSTRACT:**After World War One it became apparent that a better means of cooling the plate of transmitting tubes above about one kW was necessary. Direct water cooling was the logical choice, and Henry J. Nolte, a technician in the General Electric Research Laboratory was given the task in 1918. A tortuous period of development followed until the successful UV-207 evolved about 1925. This tube, more than any other factor, led to replacement of Alexanderson alternators by tube transmitters. Knowledge

gained from the development led to the thyatron, ignitron and ultimately, in 1935, to the highly successful octal based metal receiving tube, introduced by RCA and GE. Henry Nolte was granted more than 20 patents and received the Coffin Award (GE), before his retirement in 1958.

**MARCONI VS. DE FOREST AUDION INFRINGEMENT LITIGATION REVISITED**  
by Eric P. Wenaas..... 31

**ABSTRACT:** The infringement litigation by American Marconi over the De Forest audion was one of the most protracted legal disputes in U.S. history, resulting in five different lawsuits which spanned a 29 year period. The history of this dispute is recounted. Of particular interest are the numerous experiments that the Marconi side presented to the court during the course of the first trial to support their contention that the audion infringed on the Fleming valve when used as a detector, amplifier and oscillator. Comparisons of the detection efficiency of numerous audion detector configurations with both the Fleming valve and a crystal detector presented to the court are recounted. Also, the methods by which American Marconi demonstrated to the court that the two-electrode Fleming valve was able to amplify and oscillate are explained. Finally, the surprise ending at the U.S. Supreme Court in 1943 is recounted.

**FIRST WORLD WAR AIRCRAFT RADIO**  
by Larry Babcock..... 75

**ABSTRACT:** This article began with a collection of aircraft radio artifact from the First World War. This collection was exhibited at the Annual Convention of the AWA in 2006, and subsequently at the Curtiss Aircraft Museum in 2007. To better place the artifacts in context, stories were drawn from contemporary publications. Powered flight and wireless were invented close to each other in time. It is not surprising that the two technologies would soon overlap. One difficulty at first was that wireless receivers did not have sufficient volume to overcome aircraft noise, and alternative means of communicating from ground to aircraft needed to be devised.

**THE 1902 WIRELESS CONNECTION - SANTA CATALINA ISLAND TO SAN PEDRO, CALIFORNIA**  
by Norwood Teague and Joe A. Knight..... 97

**ABSTRACT:** One of the commercial ventures in early wireless was the Pacific Wireless Telephone and Telegraph Company. It used a system based on the available inventions in the literature at the start of the 20th century, including a system patented by Prof. Dolbear emphasizing ground waves. In its regular wireless connection established between Avalon on Santa Catalina Island and White Point on the mainland, it had a setting that combined an intervening stretch of ocean and high cliffs at each end. In this situation it managed to provide a regular service with rudimentary equipment and little understanding of wireless. It thus managed to offer the world's first regular, commercial wireless telegraph link.

**THE EARLY HISTORY OF THE ELECTRIC LOUDSPEAKER**  
by John D. Jenkins..... 125



**ABSTRACT:**Not the result of a happy accident or flash of brilliance, modern loudspeakers and headphones are the result of the contributions of literally hundreds of individuals, going all the way back to 1837. Much of their early development can be traced to the telephone, the result of a continual quest for louder, higher quality sound reproduction. Along the way, a quirky and often bizarre assortment of inventions were offered up as potential solutions. More often than not, invention is the result of a process, not a single event. While history tends to record the events, it is the process that truly tells the story, and it is the story that gives us insight into the minds of the men and women whose cumulative efforts result in achievement - certainly that is the case with the invention of the loudspeaker and headphone.

**EMIL J. SIMON: A BUSY LIFE INDEED**

by Russ Kleinmann, Karen Blisard, A.J. Link & Warren Berbit ...145

**ABSTRACT:** "Emil J. Simon" is not a name most people recognize, although he was a very controversial and colorful character. The story of his early life was routinely smeared across the headlines of newspapers, including his short stint in prison in Europe. After attending Columbia University, Simon worked for Lee De Forest and then started his own company. He successfully organized a huge network of contractors to construct radio transmitters and receivers during World War I, and then lost a fortune trying to fight big business in the 1920's. Unlike other radio engineers of the day, Simon does not have a long list of patents to his name. Rather, he was a business entrepreneur who could get the job done.

**A PORTAL INTO RADIO'S PAST: FRANCIS A. HART AND HIS RADIO LOG**

by James E. O'Neal..... 169

**ABSTRACT:** While trying to substantiate Reginald A. Fessenden's claim to having made the world's first radio broadcast in December, 1906, the author discovered a radio log from that period. The little-known document, referred to as the "Hart log," was placed in the Smithsonian Institution's custody nearly 40 years ago. The log is unique in that it was kept for a period of more than three years and offers a great amount of insight into communications during the first decade of radio's widespread commercial use. A surprising amount of information about the log and its author, Francis A. Hart, has now been located. Hart was one of the first generation of young people to embrace radio, first as a hobby and later as a profession. Not only does Hart's log provide a unique window into the radio world of 100 years ago; it also sheds light on the youth of Hart's generation.

**EXPLORING THE ORIGINS OF THE LOUD SPEAKER**

by David and Julia Bart..... 191

**ABSTRACT:**The invention and subsequent mass production of the loud speaker after World War One made radio commercially viable for the general public. The loud speaker offered a dramatic improvement over existing head phone technologies by providing a sound reproduction device capable of projecting the radio broadcast to an audience. Conceptual origins for electronic sound reproduction trace their roots to early telegraph applications. As new methods for sound reproduction emerged, entrepreneurs and manufacturers incorporated more sophisticated approaches; first developing telephone receivers, then horn reproducers and finally direct radiator cone speakers. This article reviews the primary inventions and patents underlying the growth of loud speaker technology. The discussion encompasses the years 1837 to approximately 1960.

**THE SUPREME MODEL 45 TUBE TESTER AND THE 1933 TUBE PIN STANDARD**

by Charles C. Kirsten..... 213

**ABSTRACT:**This is the story of an ingenuous vintage Model 45 tube tester design by Supreme Instruments, and how it was rendered obsolete within a year of the time it was marketed, when the vacuum tube pin numbering standard of 1933, the tester's design basis, was replaced by a new numbering standard. The new code was part of RCA's 1934 tube chart including base drawings of the new pin numbering standard published in a two page spread in both the Sept, 1934 issue of *Radio*, and in the Oct 27, 1934 issue of *Radio World*. Other instruments (radio analyzers by Supreme, Weston, and Hickok), were also disabled by this change in radio national standards, and were equally innovative products. The filament/heater pin assignments were hard wired into the Supreme Model 45 tester such that they were not readily reassigned when the new code was introduced.

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**THE MARCONI BEACON EXPERIMENT OF 2006-07**

by Bartholomew Lee, Joe Craig, Keith Matthew.....1

**ABSTRACT:**The success of the 2006-'07 Marconi Beacon Experiment shows the skill and tenacity of amateur historians and amateur radio operators on both sides of the Atlantic. The International Telecommunications Union defines amateur radio: "A radio communication service for the purpose of self-training, intercommunication and *technical investigations* carried out by amateurs that is, by duly authorized persons interested in radio technique solely with a personal aim and without pecuniary interest." This technical investigation not only shed welcome and favorable light on Marconi's claims of transatlantic signals in 1901, it also resulted in revisions to one of today's most sophisticated radio propagation models to account for its success. Moreover, the critical role of engineer John Ambrose Fleming and his high power pulse transmitter in Marconi's success now comes to the fore.

**A MOUNTAIN OF WATER**

by Crawford MacKeand.....23

**ABSTRACT:** In 1901 Marconi claimed to have received wireless telegraph signals from Poldhu in England at St. John's in Newfoundland, but the very possibility has been much disputed. We show that he may well have heard the integrated effect of high frequency signal components propagated as a sky-wave across the Atlantic Ocean in a band several MHz wide just below the maximum usable frequency. Combined calculation and experiment has suggested an average signal-to-noise ratio (SNR) of -32 dB, HF fading and noise variation together bringing the SNR to -20 dB or better for around 1% of any hour. Further experiment has shown that a non-CW signal like that of the Poldhu transmitter could have been recognized at a ratio of received signal power to received noise power as low as -20 to -24 dB.

**COMMENTARY**..... 41

**EXPERIMENTS WITH MOCK-UPS OF THE ITALIAN NAVY COHERER**

by Eric P. Wenaas, John D. Bryers.....45

**ABSTRACT:** Experiments were performed with mockups of the Italian Navy Coherer with headphones as a sensing device to characterize the detection modes and sensitivity thresholds to short-pulse excitations characteristic of those radiated by the transmitter at Poldhu in Marconi's 1901 transatlantic experiment. It was determined that the short-pulse sensitivity threshold of the mercury coherer operating in the rectification mode—and the modern 1N34A detector as well—is much higher than previously inferred from cw measurements. As a result, it is even more unlikely that Marconi could have heard the "S" signals from Poldhu on headphones with the Italian Navy Coherer in the rectification mode than previously believed. Two new modes of operation of the mercury coherer were discovered, both of which are much more sensitive than the rectification mode for short pulses.

**EXPERIMENTS WITH THE MERCURY SELF-RESTORING DETECTOR**

by Lane S. Upton.....69

**ABSTRACT:** Over the years there has been considerable debate about the mercury detector used by Marconi in his 1901 transatlantic radio experiment. This detector has been referred to as a "self-restoring coherer", but my work with these units has shown that the mercury detector acts as a diode detector, not a coherer. One detector was designed and constructed in accordance with the principles outlined in Marconi's patent, and its characteristics were investigated. Based on experiences with the first detector, and consultation with a chemistry professor regarding the properties of mercury, a second detector was constructed and its characteristics also analyzed. A small spark transmitter was then built to see if this type of signal into the detector would have any effects. There were no changes in the results. The detector was also analyzed using a very fast rise pulse input, with no different results. From these investigations, it is my conclusion that it would have been very difficult, if not impossible, for Marconi to have heard the Poldhu signals with such a device.

**WHO WAS THE REAL INVENTOR OF MARCONI'S WIRELESS DETECTOR?**

by Eric P. Wenaas.....81

**ABSTRACT:**Marconi attributed the success of his 1901 transatlantic experiment to the Italian Navy Coherer, a novel detector gifted to him by Lt. Luigi Solari of the Italian Navy. A controversy over the real identity of the inventor has been reopened recently with claims that it was Jagadish Chandra Bose. Based on those claims, it has been asserted that "the invention of radio should not be attributed to Guglielmo Marconi alone, but Guglielmo Marconi and Jagadish Chandra Bose." There are a number of problems with the arguments offered in favor of Bose as the inventor, and the purpose of this article is to present an opposing view. We make a strong case that Bose is actually the least likely of several possible candidates for which a valid claim of precedence can be made for the invention of this device.

**PHIL WEINGARTEN'S FABULOUS FAKES**

by Tom Perera.....103

**ABSTRACT:**Buying, selling and trading early wireless equipment has always been a favorite activity of AWA members. Phil Weingarten participated in these activities, but sometimes he did not make it clear that the items he was offering were not original. Indeed, he became very accomplished at constructing accurate replicas of historic telegraph keys, tubes, and radios that are hard to tell from the originals. Many of his replicas have found their way into collections throughout the world. Experienced collectors were often so excited at the prospect of adding rare items to their collections that they did not check their authenticity. This article highlights some of his most widely distributed fakes and should be helpful in allowing owners to identify them.

**SIR Wm. THOMSON, ON THE 150th. ANNIVERSARY OF THE ATLANTIC CABLE**

by David and Julia Bart.....121

**ABSTRACT:**Sir William Thomson is considered one of the greatest of the 19th century physicists. He emphasized the importance of empirically proven theory, the development of absolute standards of measurement, and the critical role of laboratory science. His unique applications of mathematical theory and his use of analogies drawn from the physics of heat allowed him to explain the flow of electricity. He provided the first theoretical and mathematical explanation of the operation of the electric telegraph and developed many of the critical innovations necessary for it to function in undersea cables. The successful operation of a trans-Atlantic cable, spanning some 2,500 miles, marked a high point of Victorian scientific and technological development and laid the foundation for the future worldwide network of electrical communications. This article explores his many contributions to telegraphy, electrical engineering and the Atlantic Cable.

**A HISTORY OF EMERSON**

by Brian Belanger.....165

**ABSTRACT:**The Emerson Radio & Phonograph Company is a neglected firm from the

standpoint of historical documentation. Even though Emerson was among the top ten radio manufacturers for nearly a quarter century, very little has been written about the company. This article seeks to remedy that neglect.

**THE HISTORY OF WURLITZER RADIO, 1924 - 1937**

by Larry Babcock.....191

**ABSTRACT:**The Wurlitzer family was in the business of making musical instruments in Germany. In 1853, Rudolph Wurlitzer emigrated to the U.S. and started a retail music business near Cincinnati. He got a contract to supply drums and bugles to Union forces during the Civil War. In 1880 he and his brother started making pianos. In 1908, Rudolph bought a manufacturing plant in North Tonawanda, NY, where they made pipe organs to accompany silent movies. Radio became their main product line from 1930 to 1936. They then found that jukeboxes were more profitable, and moved into that business. This is the story of the radio phase of the Wurlitzer family business, from 1924 to 1937.

**FROM IDDY UPTY TO CHARLIE MCCARTHY: RADIO GAMES AND THE RISE OF COMMERCIAL BROADCASTING**

by Graeme Bartram.....211

**ABSTRACT:**Games are the artefacts of our culture and as such help us to better understand and interpret the world we live in. Playing games supports the assimilation new ideas and new technologies into society. And so it was with the development of radio broadcasting. This paper traces the rise of commercial radio over the first twenty years of broadcasting through a process of 'cultural archaeology', using as evidence the radio games of the period. Based on an analysis of the changing characteristics and symbols embodied in each of the representative games it is argued that the rapid commercialization of radio can be clearly we are better able to understand how commercial broadcasting became socialized as the accepted and predominant use of the new medium so soon after its inception.

**THE UNITED STATES ENTERS INTERNATIONAL BROADCASTING: A TALE OF TWO UNUSUAL RADIO STATIONS**

by James O'Neal.....233

**ABSTRACT:**In the 1920s, unlike the development of radio broadcasting in other countries, the United States government chose not to establish a national or international broadcasting presence, preferring to leave such matters to private interests. This policy changed with the outbreak of World War II, as official Washington began to appreciate the power of international shortwave broadcasting as employed by enemy nations. In 1942 a crash program was initiated by the U.S. to counter the dissemination of propaganda by Germany and Japan. As part of this initiative, three large and powerful U.S. government- controlled shortwave radio stations were hurriedly constructed under extreme wartime conditions. After the war's end in 1945, they continued to promote freedom and American concepts. The last of these wartime stations was silenced in late October 2007 after 63 years of service. This paper follows the history of two of these stations.

**DORON BROTHERS ELECTRICAL COMPANY, HAMILTON, OHIO:**

**WIRELESS EQUIPMENT AND BROADCASTING, 1910-1930**

by Charles Stinger.....271

**ABSTRACT:** Who were the Doron Brothers? They were two young men from the Midwest, Shuler and Joseph Doron Jr. dedicated to experimenting, building, and selling wireless equipment by 1910. Having some of the Marconi patent rights the business expanded several times with sales to the Signal Corps and other commercial vendors. In March 1913, a flood disaster occurred in the area resulting in Shuler Doron being issued a Special Land Station license, 8ZU. Only fourteen of these amateur licenses were issued by 1915. The Dorons were veterans of WW-1 serving in the Signal Corps. Business continued after the war and station WRK was operated. Sadly, the death of the boys' father in 1922 started the downfall of the Doron Brothers wireless business.

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**THOMAS E. CLARK, DETROIT'S "WIRELESS WIZARD"**

by Russ Kleinman, Dick Clark and Karen Blisard ..... 1

**ABSTRACT:** Thomas E. Clark was the inventor who brought wireless to the Great Lakes region. Inspired by Nikola Tesla while at the World's Columbian Exhibition in Chicago in 1893, Clark patented his own coherer design and a system of wireless telegraphy. At the peak of his success, Clark operated a network of almost 20 shore stations and many spark wireless telegraph stations on ships on the Great Lakes. Competition and lack of regulation eventually led Clark to withdraw his operating system from the Great Lakes. He incorporated as TECLA in 1916 and resumed the manufacture of wireless equipment. Clark was the consulting engineer for the broadcast station that became WWJ radio in Detroit after World War I. TECLA diversified into other product lines during the 1930's. Although the company no longer manufactures radio equipment, it remains successful today machining parts and making pet, marine and fishing tackle products.

**MENTAL RADIO: WIRELESS AND TELEPATHY**

by Graeme Bartram.....63

**ABSTRACT:** A number of recent studies have been undertaken into the historical relationship between the development of radio, psychic research and telepathy<sup>1</sup>. However there has been little focus on a series of broadcast mass telepathy experiments that took place throughout the world in the 1920s and 1930s at the beginning of the broadcast era. This paper initially explores the nineteenth century thinking that underpinned the creation of a linkage between what are now considered disparate sciences and introduces some of the key scientific minds who drove those ideas. From this point we can trace how these ideas entered into popular culture in the early twentieth century and culminated in a series of broadcast telepathy tests which both enthralled and entertained early radio audiences. Whilst the validity of telepathy was never proven through these tests the power of broadcasting to promote and popularize the idea of telepathy with a mass audience is clearly evident.

**ORIGINS OF THE EDISON MEDAL ON ITS 100TH ANNIVERSARY**

by David and Julia Bart.....89

**ABSTRACT:** The Edison Medal is the principal medal of the Institute of Electrical and Electronics Engineers (IEEE). It is the most prestigious award given in the United States and Canada in the fields of electronics and electrical engineering. Many of the most important people responsible for developing radio, television and electronic communications received the medal for their groundbreaking contributions. Initiated by Samuel Insull and supported by J.P. Morgan and Andrew Carnegie, the medal was inaugurated with great fanfare. Nevertheless, the medal endured years of neglect, a redesign and controversy. In the end, the Edison Medal was treasured by its recipients and became a legacy of honor to those who made the modern electronic world. This article reveals the previously untold history of the Edison Medal's early years on the occasion of its 100th anniversary.

**PROFESSOR DAVID EDWARD HUGHES**

by Ivor Hughes.....111

**ABSTRACT:**Our society and technology is built on the pioneering work of the

Victorian scientists. Unfortunately, with the passage of time, only the popular names are remembered. If we peel away this top layer though, we can discover a host of scientists that not only made important discoveries but also led fascinating lives. One of these scientists was Professor David Edward Hughes FRS. His printing type telegraph instrument invented and used in America was also instrumental in the growth and success of the communications network of Europe. His work on suppression of electrical interference and discovery of the carbon microphone led to improved telephone communications and experiments with his induction balance led to the metal detector. His wireless experiments, for which he had invented a unique detector enabling him to receive a transmission over distance of 500 yards with his mobile receiver in 1879-1880, are a tribute to his ingenuity.

**HOW DUNWOODY'S CHUNK OF 'COAL' SAVED BOTH DE FOREST AND MARCONI**

by Bartholomew Lee.....135

**ABSTRACT:** The success of wireless telegraphy pioneers Marconi and de Forest owes much to the invention in 1906 of a simple, reliable detector of wireless signals by a then-retired Army General, Henry H.C. Dunwoody. He showed that carborundum could act as a stable and sensitive detector, permitting the wireless operators of the day to hear even transatlantic signals. The carborundum detector got de Forest out from under what would otherwise have been a company-killing injunction obtained by Fessenden, whose electrolytic detector patent de Forest infringed. It also facilitated the development of a noise cancelling circuit essential to Marconi's long wave transatlantic success as early as 1907 and up to the vacuum tube era. For a decade it was state-of-the-art, stabilizing the circuits and operations of wireless telegraphy and thus fostering new directions of innovation.

**FROM COHERERS TO CRYSTAL RECTIFIERS**

by Eric P. Wenaas.....147

**ABSTRACT:** The story of how coherers became the dominant method of detecting radio waves in early wireless telegraphy systems and then transitioned to the rectifying crystal detector is fascinating. The story has never been fully and accurately recounted. A number of questions are often asked: Who was the first to transmit and receive radio waves? What type of detector was used to receive these transmissions? Who first discovered the coherer and the first crystal detector, and when were they discovered? How many distinct modes of operation does a coherer have? Who gave the name "coherer" to Branly's iron-filing tube? What are the differences between a coherer, a self-restoring coherer, and a crystal detector? Who first discovered the principle of rectification for the crystal detector? Who was the first to receive a patent for a crystal detector? Which detector is more sensitive, a crystal or a good iron-filing coherer? The answers to these and other questions are likely to be of interest, if not a surprise, to most readers.

**THE DEVELOPMENT OF RADIO IN A SMALL SOUTHERN CITY**

by Allan G. Pellnat.....233

**ABSTRACT:** Two entrepreneurs, one the son of a Confederate Naval hero, the other a transplanted New England Yankee moved a small coastal city in an agricultural state from wireless telegraph to AM Broadcasting, FM and then television. This article describes the web of amateur radio operators,



school radio clubs and associated radio startup businesses that made radio the economic boom field of the twenties and thirties.

**THE GROSS RADIO COMPANY - A HISTORICAL BACKGROUND**

by Bruce J. Howes.....257

**ABSTRACT:**The 1930s were the halcyon days for the radio amateur. Nearly every red-blooded American man and boy eagerly read *QST* magazine. Aside from reading, or perhaps because of it, many of these newly minted radio bugs also sought out a company to supply their radio needs. A radio ham named Jerome Gross, known by his call sign of 2AUD, stepped forward. In the next 20 years Jerry was to live out his own real life Horatio Alger story, through a small business located in Manhattan, in an area later to be known as "Radio Row". The history of that business, known in its latter days as the Gross Radio Company, is recounted here. Unfortunately, time has erased much of the recorded history of Jerry Gross and Gross Radio, as it has with nearly all the equipment he produced. However, the history of Gross Radio has been reconstructed, largely via Gross's ad placements in *QST*, and other supporting references.

**MEISSNER REGENERATED**

by Michael J. Murphy.....275

**ABSTRACT:** Could Alexander Meissner, an Austrian engineer working for the Telefunken Company of Berlin at the turn of the 20<sup>th</sup> century, be the real *Vater der Regeneration*? On the American side of the pond at least, it seems that the various contributions of several players including Armstrong, Meissner, Languiuir, de Forest, Round, Franklin and even Tesla's assistant Fritz Lowenstein, have been weighed and regeneration litigation has long been settled. History has shown that de Forest got the legal nod while Armstrong got the heartfelt scientific and technical endorsements. Meissner however, never got the recognition that he might have in the litigation and subsequently in print because of the outbreak of World War I. His work deserves a fresh look in the context of the years between 1911 and 1914 when regeneration was discovered and applied in practical circuits using early valves.

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**"IF IT BE PERMISSIBLE TO PROPHECY WILDLY..."**

by Graeme Bartram.....1

**ABSTRACT:**For 120 years the name of Professor Richard Threlfall has remained a passing reference in the history of radio. In radio circles he is best remembered for his 1890 'prophecy' in which he speculated about the use of Hertzian waves in signaling. However this belies a distinguished academic, industrial and public record of achievement. This paper therefore commences with a review of Threlfall's significant contributions to the scientific and engineering communities during his lifetime. Against this background a close examination of the genesis of the 'prophecy' is undertaken to show the development of Richard Threlfall's thinking in the field and how he arrived at the conclusion he did about the possibilities inherent in the discovery of Hertzian waves.

**COMMUNICATIONS RELATED U.S. ARMY RECRUITING POSTERS**

by David and Julia Bart.....23

**ABSTRACT:** The upcoming book *The Art of War: An Illustrated History of American Military Communication Posters* describes the history of communications themes in American military posters. This article introduces the subject by focusing on U.S. Army and Air Force recruiting. The poster evolved as a printed medium during the same period as electronic communications came of age. First radio, then television, and now digital media have supplanted print world. Even today, the poster's basic form survives; albeit in a different context, on the internet. The poster was instrumental in appealing to the public, stimulating national unity and promoting military recruiting. Governments recognized that posters offered an essential means of communicating with the public in both World Wars I and II. The posters also demonstrate how government used media to teach the public about wartime policies.

**THE 1000Z STRATOSPHERE: ZENITH RADIO ENTERS THE BLACK DIAL ERA IN GRAND FORM, 1933-1937**

by Martin W. Blankinship.....49

**ABSTRACT:** To learn the history of the Zenith Radio Corporation, one must appreciate Commander Eugene F. McDonald. Both a genius and risk-taker, his influence brought about several inventions and innovations. One of them was the Big Black Magnavision Dial, which was first employed on a 25-tube console. This radio, the Stratosphere—due to its scarcity and luxurious styling—has become the Holy Grail for many collectors of vintage radio sets. While very few of the Stratosphere units were produced, they served very well as a promotional device in advertising all of Zenith's lower priced 1936 *black dial* models. Sales volume for the 1936 line increased by at least 2.5 times over the 1935 model sales volume. For the 1937 model line, sales doubled yet again. This paper tells the story of the Zenith Stratosphere, from inception through engineering, production, sales, and its legacy to the radio collecting community.

**THE EARLIEST HEATHKITS AND A DATABASE FOR 1947 - 1956**

by Erich Brueschke.....81

**ABSTRACT:** It is not possible to estimate the positive influence Heathkits had on generations of technical-minded individuals. Not only did Heath make devices available at much lower prices than commercially available units, the dimensions of understanding achieved through the assembly process they added were invaluable. Early on, employees were few; later there were hundreds or even thousands but with little recall of the past. This article is intended to add to that knowledge for historians and collectors. The first two years of kits, a time of rapid change, is treated in greater detail, and a database of the first ten years is provided in this article. Early changes, even if short lived, are of interest to historians and collectors. There were other kit makers, but only one Heathkit.

**SWAN ISLAND, ITS RADIO HISTORY, INCLUDING THE CIA**

**AND THE REVENGE OF UNITED FRUIT**

by Bartholomew Lee.....115

**ABSTRACT:** Swan Island in the Caribbean, once a pirate lair, can tell many related radio stories. It shows a century of communications technology in the real world of commerce, geo-politics, war and weather. United Fruit Company put Swan Island to work as its long wave spark wireless relay station for its sea-borne commerce in bananas and sugar. Swan Island thereafter provided an ideal site for researching the Caribbean hurricanes. In the Cold War, Latin American insurgencies surrounded Swan Island. In opposing them, the American Central Intelligence Agency, with remarkable connections to United Fruit, once again put Swan Island to work -- for "black ops" and propaganda. The CIA enjoyed Swan Island's advantages for nearly four decades of covert action. Now, Swan Island once again provides a sunny, peaceful lair for its big Iguanas, with an occasional visit from amateur radio operators.

**SCR-54/A (BC-14/A) RADIO RECEIVER SETS FOR ARTILLERY SPOTTING**

by Eric P. Wenaas.....141

**ABSTRACT:** The BC-14A boxes from the SCR-54A radio receiving sets manufactured by at least four different contractors are the most widely collected of all World War One radios. The colorful method by which these sets were used to communicate with aircraft for artillery spotting missions during World War One is summarized. Next, the evolution of the AR-4, SCR-54 and SCR 54A receiving sets based on the French A-1 receiver is documented. The evolution of the companion AR-5 vacuum-tube detector and SCR-55, DT-3 and DT-3A variants is also documented. Finally, a primer for identifying each of the seven known variants of the BC-14A is provided. The primer can be used by the discriminating collector not only to identify each variant, but also to identify surreptitious alterations thereof- something very common among these sets.

**EARLY SUBMARINE CABLE INSTRUMENTS AND APPARATUS**

by Bill Burns.....177

**ABSTRACT:** The rapid development of the electrical industry in Britain in the second half of the 19th century was closely tied to the introduction of submarine communications cables in 1850. Commercial and government interests quickly recognized the potential gains to be made from having virtually instantaneous communication with distant lands, and a vast investment was made in manufacturing and laying cables. This stimulated the production of pure copper, the felling of hundreds of thousands of trees in Malaysia to provide gutta percha insulation, the drawing of tens of thousands of miles of iron wire to armor the cables, the adaptation of land line instruments for cable use, and the invention of many new instruments and techniques for working the cables. This article examines how the technical requirements of the cable industry led to the development of some of the instruments and apparatus peculiar to ocean telegraphy.

**BRITISH WORLD WAR TWO ARMY ANTI-AIRCRAFT RADAR**

by Crawford MacKeand.....195

**ABSTRACT:** British Army anti-aircraft radar of World War II and years

immediately thereafter is described. The earliest mid-1930s developments are examined briefly as is the work leading to the cavity magnetron's introduction and consequent centimeter wave radars. Operational devices from 1940 to 1950 are described in some detail with line drawings, examples mainly being taken from the former Anti-Aircraft Command School of Technical Instruction at Lydd in

Kent, a unit of the Royal Electrical and Mechanical Engineers. Accurate Position Finders included British designed and manufactured meterwave. Gun Layers of 1940 to 1942 are considered, and 10 cm magnetron equipment from the last months of WW II, and also the American designed and supplied SCR-584s. Early-Warning units described include the famous Canadian Zippy system, and a remarkable D-Day unit assembled at short notice from available Army, Navy and Royal Air Force equipment.

#### **MIRROR SCREW TELEVISION: 25 YEARS OF EXPERIENCE**



Maintenance Company Ltd. from 1868 until his retirement in 1893, where he supervised the making and laying of millions of pounds worth of undersea cable all over the world. He was also a talented artist in watercolor and oils; his paintings of scenes made on board ship while laying cable are in museum and private collections. Although research continues, I'm pleased to be able to relate here much of the story of this cable pioneer.

**TOYOTA RADIO: 1946-49**

by Tadanobu Okabe ..... 41

ABSTRACT: Toyota is well known as a major Japanese automobile manufacturer. After World War Two, from 1946-49, they were required to manufacture radio sets to survive. We will describe how this happened, and we will illustrate our presentation with artifacts from our collection.

**CULTURE, TECHNOLOGY, BRITANNIA: THE BBC HANDBOOKS**

by David Wunsch ..... 55

ABSTRACT: The BBC Handbook was a remarkable annual publication of the British Broadcasting Corporation during its formative early decades-- its "golden age." The Handbook is of interest to collectors of books germane to radio history, to students of British broadcasting, to researchers of radio's technical past and to historians of the UK of the 20's, the depression, the war and postwar years. Handsomely designed, the volumes provide a description of how the BBC wished to present itself to the public and are remarkable not only for the technical sophistication assumed in its readers but for their record of the rich world of music, literature and theatre to which British wireless listeners were exposed. The Handbooks reflect the philosophy of the BBC founding director, Sir John Reith, a disciple of Mathew Arnold and his conception of culture.

**JOHN GRAEME BALSILLIE: AUSTRALIA'S FORGOTTEN WIRELESS PIONEER**

by Graeme Bartram ..... 75

ABSTRACT: John Graeme Balsillie was a central figure in the landmark patent case *Marconi v. British Radio Telegraph & Telephone Company*. Yet little has been written about his work in wireless telegraphy upon his return to Australia in September 1911. This paper therefore focuses on his role as the Commonwealth Radiotelegraphy Engineer responsible for the establishment of a network of coastal wireless telegraphy stations across Australia. On this journey Balsillie navigated a patent minefield, designed his own wireless telegraphy system, took on the might of both the Marconi and Telefunken companies and built nearly 20 wireless stations in the space of two short years. However his sudden departure from the role in 1915, followed by a series of failed ventures and his premature death in the United States several years later have long obscured a significant contribution to the development of wireless telegraphy.

**HOW THE 1923 RADIOLA SEASON REALLY CAME ABOUT**

by Eric Wenaas . . . . . 99

ABSTRACT: RCA's original Radiola lineup for 1923 was simple- GE was to manufacture all three new models including the Radiola II, III, and IV plus five carryover models from 1922, and Westinghouse was to manufacture eight carryover models. Something dramatic happened between July when RCA first approved the 1923 models and October when RCA approved a dramatically altered manufacturing plan. Westinghouse was assigned four new models, while GE was assigned an additional two models, Radiolas V and VI, and the Radiola III was dropped. In the end, the lineup consisted of three categories consisting of sets by GE matched with competing sets by Westinghouse. The original plan and the reasons for the changes have never been chronicled. The story was unraveled after two prototypes surfaced in 2009 providing insights to the changes in the plan and the reason for the elimination of Radiola III. The author describes how the 1923 season actually came about, and provides an image of what a prototype of the mysteriously deleted Radiola III might have looked like.

**DEVELOPMENT OF TELEVISION IN GERMANY UNTIL 1939**

by Franz Pichler ..... 125

ABSTRACT: The paper discusses the engineering development of television in Germany until 1939. Before 1936 efforts were concentrated towards "mechanical television", the realization of a television system by optical and electro-mechanical means. The Olympic Games of 1936 in Berlin offered an opportunity to present newly developed television systems. The covering of the Olympic Games by television was used to promote the existing political regime internationally. The year 1936 also marks the start of "electronic television" in Germany. Television receivers became fully electronic and television cameras started to become electronic. It was expected that soon in Germany a nation-wide television network would be provided. However the political climate changed and military projects were favoured. The beginning of World War Two in 1939 finally stopped all television projects in Germany.

**EDDYSTONE RADIO AND THEIR MID-1930'S ALL WORLD TWO**

By Gerry O'Hara, Graeme Wormald and Ian McQueen. . . . . 145

ABSTRACT: This is primarily the story of a diminutive Medium / Short Wave receiver, a British- made Eddystone 'All World Two' (AW2. Part of the story is told by Ian Mc-Queen, the son of the set's original Australian owner, Dr. George McQueen. Another part was by an Eddystone enthusiast and radio restorer, Gerry O'Hara, recruited (most willingly) by the present owner, Louis Vermond, to conserve, test and render the set operational. In addition, and by way of context, Graeme Wormald presents a brief history of Eddystone Radio for those that are unfamiliar with this marque. Additional information on Eddystone Radio can be found at the Eddystone User Group (EUG) website, <http://eddystoneusergroup.org.uk/>, and in 'A Century of Achievement- The Laughton Story, 1860-1960'.

**THE RADIO PRODUCTS OF THE GLOBE ELECTRIC COMPANY**

By Glenn Trischan . . . . . 167

ABSTRACT: The formal establishment of Globe Electric Company as an electrical sales and manufacturing concern has reached its centennial anniversary in 1911. Originally founded to offer electrical plants for smaller communities and rural applications, the changing business climate required new products and markets to survive. One market, though short-lived, was the manufacture and sales of battery operated radios. Although production lasted only about four years, a proliferation of models was sold. A number of examples, as well as factory documentation, have survived to the present day. The objective of this paper is to document the range of radio receivers produced and review the distinguishing features of the major model variants.

**THE AIRSHIP AMERICA**

by John Dilks . . . . . 189

ABSTRACT: On the morning of October 15, 1910, Jack Irwin was awakened about 4 o'clock and told to go aboard the *America*. There was not a breath of wind. A dense fog dripped down over everything. The crew of the ship consisted of Messrs. Walter Wellman, commanding; Melvin Vaniman, chief engineer; Louis Loud and Fred Aubert, assistant engineers; Murray Simon, navigator; and Marconi Wirelessman Jack Irwin. With the help of a few hundred police and firemen, they proceeded to launch the largest non-rigid airship ever constructed. What follows is the story of the launch of *America* on its first trans-Atlantic flight, followed by her demise and the rescue of her crew a few days later.

**THE ORIGINS OF THE INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS' MEDAL OF HONOR**

by David and Julia Bart . . . . . 207

ABSTRACT: A Medal of Honor is awarded each year by the Institute of Electrical and Electronics Engineers (IEEE). It is the highest international award specifically recognizing accomplishments in the fields of electronics and electrical engineering. Edwin H. Armstrong was the first recipient of the Medal in 1917 when it was initially established by the Institute of Radio Engineers (IRE). The Medal quickly gained stature, and its distinguished recipients include the most important contributors to electrical science and technology. In 1963, the IRE merged with the American Institute of Electrical Engineers (AIEE) to form the IEEE. Since that time, the Medal of Honor has been administered by the IEEE as its highest award. This article describes the history of the Medal of Honor and its relationships to other kept scientific and technical awards, including the IEEE's Edison Medal, the Nobel Prize and the Radio Club of America's Armstrong Medal.

**WIRELESS COMES OF AGE ON THE WEST COAST**



by Bart Lee. .... 241

ABSTRACT: Radio as we know it had many fathers. California enjoyed unique circumstances that gave rise to independent development. Young men explored and advanced devices and means of communication as soon as they read about earlier advances, especially Marconi's use of wireless spark systems. The arc as a generator of high power continuous wave energy for communications came to California and then the world. Doc Herrold began the first regular broadcasting to a known audience around 1912 in California, using an arc. Lee de Forest perfected his "Audion" triode in California in 1913. Amateur radio trained thousands in the new radio arts. The Navy led the way from the beginning, from the earliest spark systems around San Francisco Bay, to playing music from the Great White Fleet, to its world-wide networks at the time of the First World War. Radio grew up in many places, and the West Coast was one of the more important of those places.

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**WIRELESS TELEGRAPHY IN THE AUSTRIAN K.U.K. ARMY**

By Franz Pichler..... 1

ABSTRACT: The paper discusses three quenched spark stations for wireless telegraphy which were in use during World War One (1914- 1918) by the Austrian army. The first station was designed to provide wireless communication for troops in alpine regions and could be transported packed on seven mules. The second station provided communication between airplanes and the artillery on the ground, for spotting shots. The third station was devoted to the war in the trenches. All three stations were designed in cooperation with the Austrian army and manufactured during the time 1914 to 1917 by Austrian companies in Vienna. It is unfortunate that only a few examples of these stations have survived. Original documents are available however. It is hoped that the information given in our paper will be of interest outside of Austria.

**WIRELESS EQUIPMENT OF THE TITANIC: A COMMEMORATIVE OVERVIEW**

By Eric P. Wenaas and Parks Stephenson..... 21

ABSTRACT: This article describes the Marconi wireless equipment used on the *Titanic* based on early Marconi documents, photographic evidence from the only known photograph of the Marconi Room, and from video images taken during two expeditions by James Cameron to the wreck in 2001 and 2005. The images from the wreck are startling in terms of their clarity and completeness in mapping the Silent Room where the transmitter apparatus was installed. The stills extracted from the videos presented here provide a comprehensive view of what equipment was used on the *Titanic* and exactly where it was located. Detailed 3D computer generated models were made of each piece of Marconi equipment and placed in the correct locations according to models were rendered to allow interpretation of the wreck photos. We now know that the equipment on *Titanic's* sister ships *Olympic* and *Britannic* do not represent the configuration on the *Titanic*.

**WAVEMETERS FOR FREQUENCY MEASUREMENT BY THE BRITISH ARMY IN WORLD WAR TWO**

By Anthony Davies..... 79

ABSTRACT: Wavemeters fulfilled an essential need in support of military communications and various special military requirements over the first half of the 20<sup>th</sup> Century, and the rapid advances in electronics technology led to many different wavemeter designs. The paper explains their basic principles and continues with illustrative examples of actual wavemeters, particularly those used by the British Army during World War Two and shortly after, explaining the contexts within which they were needed. Contrasts and similarities with wavemeters for Navy and Air Force use are briefly mentioned and the subsequent developments of crystal-control and digital electronics which provide the basis for modern frequency synthesized communications and the consequent obsolescence of wavemeters are explained.

**FATHER ARCHIBALD SHAW - AUSTRALIA'S "WIRELESS PRIEST"**

By Graeme Bartram.....101

ABSTRACT: American readers may be familiar with the stories of Father Joseph Murgas, who pioneered wireless telegraphy in Wilkes-Barre, PA and perhaps even that of the Brazilian Father Roberto Landell De Moura. Less is known about another 'wireless priest', Father Archibald Shaw, who played an important role in the establishment of wireless telegraphy in Australia. This paper traces the emergence of Father Shaw as an entrepreneur in the field of wireless, how he built the first large scale wireless telegraphy station in Australia and went on to establish the country's first wireless manufacturing works. By shrewd management of the press and the cultivation of Government relations Father Shaw found himself in a pre-eminent position in wireless telegraphy by July 1911. Beneath this were a tangle of financial arrangements, accusations of the theft of others' ideas and a strained relationship with the Catholic Church.

**EARLY MARTIAN RADIOS: THE BIG 4, LITTLE GEM, SPECIAL AND BEAUTY**

By Erich Brueschke..... 125

ABSTRACT: The Martian Big 4 crystal radio with its unique tripod legs and overall futuristic appearance is popular, rare, and today, expensive. The information on the Martian Manufacturing Company's early sets is sketchy, but some can be recreated by an analysis of its sets, including the Big 4, the Martian Special, the controversial Little Gem and the very rare Martian Beauty. These are the subject of this article which is intended to shed more light on these wonderful, early crystal radios. All of the sets of this early Martian era are included. An attempt to understand the relative number of each type was made by tracking eBay and some auction sales for the last 20 years. While incomplete, this provides a better understanding of what has survived the past 85 or so years and some clues, albeit incomplete, about the reasoning behind the changes and additions made over time by the Martian Manufacturing Company.

**WIRELESS -- ITS EVOLUTION FROM MYSTERIOUS WONDER TO WEAPON OF WAR, 1902 TO 1905**

By Bartholomew Lee..... 147

ABSTRACT: The following four events are covered. 1) Wireless Spying on Marconi at Porthcurno, Cornwall, UK - A First 2) Lee de Forest Fails in Ireland and Wales in 1903 -'04: One Door Closes, another Door Opens ... 3)

Rejection and Renaissance: A. Lee de Forest Sails Away From "Perfidious Albion," but Makes a Deal  
B. Lionel James -- Naval Spying on Russians and Reporting at Sea 4)  
Commander Kurakichi Tonami's Wireless Wins the Russo -Japanese War, 1905. In the midst of this, a Japanese master spy enables Lee de Forest to snatch renown from the jaws of rejection, with a little help from Fessenden's electrolytic detector.

**ELMER T. CUNNINGHAM AND THE TUBE TANGLE**

By Eric P. Wenaas ..... 185

ABSTRACT: The vacuum-tube tangle refers to the tangled web of conflicting patent rights associated with the Fleming valve and the DeForest audion that resulted in numerous imbroglios among RCA/Marconi, DeForest, Western Electric/AT&T, Elmer Cunningham, Otis B. Moorhead, and Elman E. Myers. This article—drawing on original sources including thousands of pages of original documents from Gerald's Tyne's personal library, greatly expands the knowledge base. A number of enduring enigmas are explained. For example, why was Elmer Cunningham alone able to negotiate a deal with RCA in which Cunningham was licensed to market tubes manufactured by General Electric for sale under his own brand name? Who really made all those infringing tubular audions that appeared on the market between 1916 and 1920?

**TITANIC - LESSONS FOR EMERGENCY COMMUNICATIONS**

by Bartholomew Lee.....253

ABSTRACT: By Bartholomew Lee, K6VK, Fellow of the California Historical Radio Society, copyright 2012 (no claim to images) but any reasonable use may be made of this note, respecting its authorship and integrity, in furtherance of better emergency communications. Please see the author description at the end of the article, *Wireless -- Its Evolution from Mysterious Wonder to Weapon of War, 1902 to 1905*, in this volume at page 183. Correspondence is invited: [KV6LEE@gmail.com](mailto:KV6LEE@gmail.com).

**THE RISE AND DECLINE OF THE CATHODE RAY TUBE REBUILDING Industry**

by James O'Neal.....259

ABSTRACT: With the post-WWII introduction of consumer television receivers, it was logical that repair would extend to the "big ticket" cathode ray tubes and this business began in the early 1950s. CRT rebuilding grew into a multi-million dollar industry, reaching its peak in the 1980s/1990s. A gradual decline followed as disposable, rather than repairable, consumer items appeared. As this decline steepened, many CRT rebuilders were forced to close their doors. During the past decade this situation was further exacerbated by the move to high definition flat screen displays. Consumer acceptance of these new technologies spelled the demise of both cathode ray tube-based television receivers and the need for CRT rebuilding services. The last U.S. business providing rebuilding services for consumer products ceased operation in 2010. This paper provides historical information about the cathode ray tube business, as well as describe in detail the operations involved in rebuilding CRTs.

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LETTER TO THE EDITOR by Bart Lee .....1

HAZELTINE, THE NEUTRODYNE AND THE HAZELTINE CORPORATION

by Mike Molnar .....3

ABSTRACT: The 90<sup>th</sup> anniversary of the Neutrodyne patent presents a good opportunity for us to look back at a part of radio history that some may pass over. As the generation of today's radio collector is further removed from the radio engineers that were contemporary with these sets, we can lose the appreciation of what made them special. These radios filled a void in the marketplace in 1923. One can even argue that corporate policy at RCA helped create that void. Louis Alan Hazeltine, and the company he started, did more than answer the call with a new radio circuit. By collecting a talented engineering staff, they would become a powerful force in building the future of radio, television and electronics in the 20<sup>th</sup> century. This is the legacy of Louis Alan Hazeltine, the Neutrodyne and Hazeltine Corporation.

MAGNETO-ELECTRIC DIAL TELEGRAPHS

by Franz Pichler .....21

ABSTRACT: A reason for writing this paper was the discovery of a transmitter for a magneto-electric dial telephone as invented in 1840 by the English scientist Charles Wheatstone. The details of this invention are presented together with the efforts of Cooke and Wheatstone to make their telegraph system known to investors for its use by the public. In addition the later development of dial telegraphs which use a magneto-electric machine to generate the signals for the communicator are covered. A report on the restoration work done on two original Wheatstone magnet-electric communicators for dial telegraphy is given. This paper relies in many parts on the content of the e-book by Steven Roberts and the fundamental paper of John Liffen on the history of the inventions of Cooke and Wheatstone in the field of telegraphy.

PART II: ELMAN B. MEYERS AND THE VACUUM TUBE TANGLE

by Eric P.Wenaas .....37

ABSTRACT: This article is the second in a series dealing with the tangled web of conflicting patent rights associated with the Fleming valve and the DeForest audion that resulted in numerous imbroglios among and between the Radio Corporation of America (RCA), DeForest, and infringers who threatened the patent rights of RCA, DeForest, and DeForest assignees AT&T and Western Electric. The first article appearing in the 2012 edition of *The AWA Review* focused on the role of Elmer T. Cunningham in the vacuum-tube tangle, while this article focuses on the role of Elman B. Meyers.

**THE FIRST HEATHKIT, THE O-1 OSCILLOSCOPE**

by Erich E. Brueschke .....95

ABSTRACT: The positive influence of Heathkits is well understood today but the first Heathkit, now called the 'O-1', is not well documented since only the instruction sheets and parts sheet were known to survive until recently. With discovery of a complete O-1 for study, a better understanding of the development of the entire earlier Heathkit oscilloscope line, including oscilloscope size, design, components, and appearance is possible. The early dependence on surplus components progressed to changes required by availability of commercial parts while still maintaining low cost and acceptable commercial quality of the product. Heathkits went on to be the standard in electronics kits as well as a vehicle to train future radio amateurs, technicians, engineers, and scientists on how things work, the feel of how things are put together, as well as the joy of assembling something yourself and having it function. This article emphasizes the rapid comparative technical changes in the first few years of production of this model, as well as the first oscilloscope models called "red-face", through the O-9 model, and then through the charcoal grey models O-10 through the O-12, covering 1947 through 1959.

**THE TITANIC'S IMPACT ON WIRELESS RADIO**

by David & Julia Bart 113

ABSTRACT: This year marked the centennial of the Titanic disaster. The 2012 AWA Review included several articles documenting our members' research about the Titanic, Marconi wireless and maritime radio. The 2012 AWA Conference featured a special display of Titanic and Marconi artifacts and a Titanic film festival. The following article is the Keynote Address given at the 2012 AWA Conference on behalf of the AWA and Radio Club of America by David Bart. It concluded the AWA's centennial commemoration of this important event in radio history.

**THE SAN FRANCISCO RADIO CLUB, SINCE 1909**

by Bart Lee .....133

ABSTRACT: The San Francisco Radio Club has enjoyed more than a century of the advancing radio art, fraternity and public service, as an exemplar of the Amateur Radio Service at its best. Its technical investigations have explored radio's potentials since 1909. The Club's earliest days show enthusiasm with which young men took to the new art, both as a hobby and as professional preparation. It also established, from its beginning, cordial relations with its government regulators, from whom it received the first Amateur Radio license issued by the Federal Radio Commission in 1927. Its members pioneered pre-war VHF work on 5 meters and 2 ½ meters, and then 2 meters. The Club adopted the call sign of an early member, W6PW, as its own, for its repeater and field operations. In recent decades it has continued its public service, education, and social activities in the best traditions of amateur radio, on its deep foundations as one of the oldest radio organizations in the world.

**RCA TV DEVELOPMENT: 1929-1949**

by Richard Brewster .....155

ABSTRACT: The Radio Corporation of America, under the direction of David Sarnoff, took the idea of television and brought it to a place where it could become a useful medium of communication and entertainment. This required a considerable financial investment at a time when funds were not available for a questionable return. And, in fact, RCA did not recoup its investment till well after World War Two! Engineers began their work when TV was but a mechanical plaything. New imaging and amplification methods were required. Special vacuum tubes had to be designed and constructed. The television studio, too, was a new idea to be created. TV receiver design proceeded along with the cameras. As image standards (a moving target) were upgraded, new cameras had to be invented. This, of course, required a more advanced receiver to reproduce the image. Synchronizing proved to be a challenge as well. Details and images for this paper have been collected from many sources and clearly show how RCA succeeded in bringing to the public the amazing system of television.

**Robert E. LACAULT AND THE INVENTION OF THE ULTRADYNE**

by David Willenborg .....179

ABSTRACT: History has remembered the names of the giants in radio development but many of the radio pioneers that made less significant contributions have been lost to time. One of these men is Robert Lacault. When I started my research, I found very little information about Lacault, or his radios. Ed Lyon had written a short piece in the Mid-Atlantic Radio Club Newsletter which explained the operation of the Ultradyne's modulator circuit but did not focus on the inventor. There were also the *Vintage Radio Identification Sketch-Books of D.H. Moore*, and his monograph entitled *The Ultradynes*. These sources and a few schematics in the Rider service manuals were all I could find. What I have learned is very different from what was documented by D.H. Moore. I am sure that like Moore, I will also come to wrong conclusions. The purpose of this article is to rekindle interest in Lacault and his radios. During his short 31 year life he was a soldier, engineer, author, editor, inventor, businessman, and husband. He had works with such greats as General Ferrie, Lucien Levy, and Hugo Gernsback. His writing has been credited with refueling interest in television development.

**LEE DE FOREST AND THE INVENTION OF SOUND MOVIES, 1918-1926**

by Mike Adams .....201

ABSTRACT: Lee de Forest was one of the most influential 20<sup>th</sup> century inventors. As a Yale science he studied the work of Hertz, Edison, Poulsen, and Bell, and he understood the practical application of Marconi's wireless. By 1906 he had patented his signature invention, the three-element vacuum tube he called the "Audion." In 1907 he broadcast music experimentally in New York, using a radiotelephone of his own design. Beginning in 1918 he developed and patented a system of writing sound on motion picture film for synchronized talking pictures. Between 1920 and 1926 he worked with fellow inventor Theodore Case to develop the Phonofilm system of variable density recording. For all future systems of entertainment delivery the de Forest tube was the key as it allowed amplification of audio over loudspeakers, thus making it possible for families to enjoy radio together and audiences to experience sound movies.

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**W.W. GRANT**

by Jacqueline (Jaci) Grant .....1

ABSTRACT: William (Bill) Walter Westaver Grant, was a true radio pioneer. He began his career as a technician and noted innovator in the early 1920s. He later used a multifaceted approach to bring radio into the public domain. Grant originated the trademark "The Voice of the Prairie" and the historic radio station CFCN in Calgary, Alberta, Canada. Grant burst into the headlines in the very early years of broadcasting. He was often promoted as strong contender in the race for transmission distance. The excitement of those early years was palpable, perhaps even overwhelming at times. In 1943 Grant, reflecting back to the early years, commented that broadcasting took hold of the country with a rush that was almost panic. His life is a series of snapshots illustrating the development of radio.

**PATENT BATTLE**

by Mike Molnar.....31

ABSTRACT: Everyone with an interest in the history of radio and electronics know that Edwin Howard Armstrong was one of the greatest inventors of the 20<sup>th</sup> Century. Everyone with this interest knows of his great inventions - Regeneration (feedback), the Superhetrodyne, and Wideband FM radio. Everyone who has seen the regenerative patent tags on the earliest broadcast radios would know that the regenerative circuit was his first invention. Everyone knows this except the United States Government, US Patent Office and the United States Supreme Court. This article will follow the battle for the patent on regeneration which will span parts of three decades.

**PART III: OTIS B. MOORHEAD AND THE VACUUM TUBE TANGLE**

by Eric P. Wenaas.....51

ABSTRACT: The vacuum-tube tangle refers to the tangled web of conflicting patent rights associated with the Fleming valve and the DeForest audion that resulted in numerous imbroglios among RCA/Marconi, DeForest, Western Electric/AT&T, Elmer Cunningham, Otis B. Moorhaed, and Elman E. Myers. This article dealing with Otis Moorhead, his companies and associated sales agencies draws on original sources including thousands of pages of original documents from Gerald Tyne's personal library dealing with the vacuum tube tangle, 4000 pages of testimony in eight volumes taken from principals during the FTC hearings on the RCA monopoly, and many other contemporaneous documents.

This article greatly expands the knowledge base of Moorhead's involvement in the tube tangle and provides explanations for several enduring enigmas. What is the "DeForest 20 Audion Detector" that appeared only once in an ad placed by A-P Radio Supplies Co. and never again? Why did RCA allow Moorhead to sell vacuum tubes for two years after canceling the three-party agreements that allowed Moorhead to legally manufacture tubes before filing suit? Who actually made the DeForest Singer type tube with the Shaw base

sold by DeForest in 1920? Who actually made the A-P solenoid tube?

**STRANGE TO MY AMERICAN EYES**

by Robert Lozier.....129

ABSTRACT: It may be obvious to many people interested in the development of home broadcast receivers that cabinet designs, fabrication techniques and performance specifications can often be recognized as originating in a particular country or region of the world. I wanted to understand why such differences existed. While technical and advertising information is not too difficult to obtain, I rarely found direct references to socioeconomic background information in searches. Having attained some notoriety in the style of exhibitions I have presented at various national and regional historical radio conferences, I was asked to present illustrated talks in 2012. The goal was to highlight design and fabrication differences from American practice and talk about why they were, or might be, different. Developing these lines of inquiry has added new, interesting and challenging dimensions to my lifelong hobby. At the same time, it has provided me with an increased sense of purpose for preservation and documentation of these artifacts. This paper builds on the themes of these talks with the hope that the reader will be encouraged to include these lines of inquiry into their own activities.

**HUGO GERNSBACK: PREDICTING RADIO BROADCASTING, 1919-1924**

by Mike Adams.....165

ABSTRACT: Hugo Gernsback was a critical thinker. He understood the history of wireless communication beginning with Marconi, he knew about the early experiments with voice transmission by de Forest and others. He comprehended the needs of a growing audience of radio parts consumers and he marketed and sold them through the mail order company, Electro-Importing. Following WWI he began to synthesize several decades of technical content for a magazine he called *Radio Amateur News*, changed to *Radio News* a year later. His was the major voice predicting the transition from radio code for young men with crystal sets and headphones, to a family medium that would actually broadcast entertainment into the home in a manner that all in the family could enjoy. His connection with inventors, programmers and manufacturers allowed him to know and publish monthly stories on the latest trends in radio. He was a strong voice against the possibility of government control of radio, he profited through advertising for the latest radio receiver and loudspeaker, and became a trusted voice that united both creator and audience in that important period of time known as the 'radio Boom' 1919-1923.

**GENERAL ELECTRIC'S EARLY TRANSISTOR RADIOS**

by Steve Auyer.....193

ABSTRACT: When commercial quantities of transistors became available in the early 1950s, incorporating them into consumer products was more difficult than simply removing a vacuum tube, making a few circuit adjustments and inserting a transistor. This article



describes how the General Electric Company phased out vacuum tube technology in their portable radios over a period of 2 years, and then continued as a major producer of transistorized portable radios for the next 3 decades. The application of transistor technology was complicated by: shortages and process control issues with the early transistors; availability of miniaturized components; and tradeoffs between cost, size, weight and audio quality in their portable radios. Once these challenges were met, cost competition from foreign suppliers became an issue. How the General Electric Company met these challenges is the subject of this article.

**DOCUMENTING DISCOVERY: THE CENTENNIALS OF TWO LEADING JOURNALS**

by David & Julia Bart.....221

ABSTRACT: The years 2012 and 2013 marked the centennials of two esteemed publications that document the important discoveries in radio and electronic communications. The *Proceedings of the Institute of Electrical and Electronics Engineers* and the *Proceedings of the Radio Club of America* both trace their origins to the earliest days of wireless telegraphy and radio. One marks the beginning of the world's largest professional society, and the other marks the beginning of a less formal, but highly prestigious club, or forum, where many of the preeminent leaders of the new technology gather. Both organizations counted among their members many of the major inventors, academics and developers of wireless technologies. Both publications shared numerous historically significant articles that introduced the ideas and techniques that proved essential for the new electronic communications technology to expand and prosper. This article outlines the contributions of these two historic publications to encourage use of their materials by AWA members and other researchers in these fields.

**EARLY HISTORY OF ELECTRICAL DETECTION AND WARNING OF NATURAL**

**DISASTERS**

by Robert Colburn.....249

ABSTRACT: Electrical storms were the subject of study by the earliest electrical pioneers, Benjamin Franklin and Joseph Henry being among the most famous. It is fitting that the earliest electrical technologies were in turn applied to understanding severe weather as well as to other natural disasters, and used to mitigate their effects by warning of their approach. Electrical and computing technologies have greatly advanced our understanding, detection, and warning of impending natural disasters. Nonetheless, the ability to detect and warn the public have faced policy obstacles. For example, tornado warnings were long forbidden in the United States. This paper describes early telegraph weather warning networks, the invention of electric seismographs, and finishes with a brief description of the current DART tsunami warning buoys.

**CLARENCE D. TUSKA (1896-1985)**

by Bart Lee.....255

ABSTRACT: Born in the last years of the 19<sup>th</sup> Century, Clarence D. Tuska started out as a kid with a coherer at the beginning of the 20<sup>th</sup> Century, and ended up as RCA's Director of Patents. As a teenager he nurtured the nascent American Radio Relay League as its chief (and only) operating officer. He helped the Army implement the new technology of radio communications. He turned to manufacturing parts and then elegant, now collectable, radios for the burgeoning home market of the "Radio Fad" 1920s. The Superdyne circuit he invented cured a flaw in the vacuum tube circuits of the day. He flourished as an inventor, and wrote often about the creative process of invention. In joining RCA, he joined the cohort of talented radio pioneers that David Sarnoff brought together to manage one of most successful companies of the electrical age.

**THE 5-T HALLICRAFTERS SKY BUDDY AND ALL OTHER SKY BUDDY MODELS**

by Erich E. Brueschke.....273

ABSTRACT: Although Hallicrafters made innumerable radios and other electronic products over many years, the Sky Buddy stands out as an early and important series highly prized by collectors. The fact that the first Sky Buddy, the 5-T, had a boy depicted on the celluloid dial is especially intriguing and attractive to collectors. If one includes the Sky Buddy II, the Sky Buddy name lasted over 25 years. This article includes information on restoration of the 5-T Sky Buddy tuning mechanism and comparative information on the 5-T, S-19, S-19R, and S-119 receivers, thus the entire Sky Buddy series.

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**EVOLUTION OF THE AM DIAL**

by P.A. Kinzie.....1

ABSTRACT: At the beginning of commercial broadcasting, most home radio tuning dials featured numbered scales on either the knobs or the panel behind them. When expansion of the broadcast band with stations assigned to 10 kHz channels was approved, the straight line frequency variable capacitor, together with a linear dial that could be labeled with frequencies instead of a simple 0-100 scale came into use. This combination became popular with the public, yet contrary to expectations, a nonlinear scale that spread the lower frequencies apart and compressed the higher ones was what became universally employed.

The early use of a linear dial is explained by the fact that at first most radios were assembled in the home by listeners, and their interests predominated.

Later, production of factory built sets outnumbered home built products, and manufacturer preference for a type of nonlinear scale prevailed, in part because of changing consumer habits. Other important changes also affected both the scale and overall dial appearance, and for some applications styling became more important than scale. This article describes how all of these developments and conditions led to the dials we used more recently.

**RADIO ARCHEOLOGY, MT. TAM WIRELESS AND A CALL TO ACTION**

by Bart Lee.....25

ABSTRACT: At the beginning of commercial broadcasting, most home radio tuning dials featured numbered scales on either the knobs or the panel behind them. When expansion of the broadcast band with stations assigned to 10 kHz channels was approved, the straight line frequency variable capacitor, together with a linear dial that could be labeled with frequencies instead of a simple 0-100 scale came into use. This combination became popular with the public, yet contrary to expectations, a nonlinear scale that spread the lower frequencies apart and compressed the higher ones was what became universally employed.

The early use of a linear dial is explained by the fact that at first most radios were assembled in the home by listeners, and their interests predominated. Later, production of factory built sets outnumbered home built products, and manufacturer preference for a type of nonlinear scale prevailed, in part because of changing consumer habits. Other important changes also affected both the scale and overall dial appearance, and for some applications styling became more important than scale. This article describes how all of these developments and conditions led to the dials we used more recently.

**EDWARD WESTON: THE MAN AND THE METERS**

by Mike Molnar.....57

ABSTRACT: Isaac Newton said "If I have seen further it is by standing on the shoulders of giants". Edward Weston was the giant upon whose shoulders the electrical engineers and inventors of the 19th and 20th century would stand. His many inventions in electrical measurement allowed him to build the accurate, reliable instruments that made their research possible. The familiar Weston meters are only a part of Edward Weston's long legacy of invention.

**THE FIRST BROADCAST FM AUTO RADIO - MOTOROLA FM-900**

by Ray Schulenberg and Olin Shuler.....73

ABSTRACT: The promises of FM radio being of high quality and static-free made it a logical offering for a car radio. An FM car radio project was launched at Motorola

in 1959, 30 years on from when Motorola had first entered the car radio business. It would be known as the Model FM-900, and Ray Schulenberg was assigned as the electrical design engineer. Ray describes the design activity first-hand, and initial tests are summarized in detail. Preparations at the assembly plant are described by Olin Shuler, production engineer. The assembly went very smoothly, indicating that the initial design was well conceived. The model went into production and continued for about four years, with not one electrical design change required, a remarkable feat indicating a well-thought-out design.

**ARVIN METAL CABINET RADIOS**

by Dan Howard.....89

ABSTRACT: Noblitt-Sparks Industries of Columbus, Indiana, began producing radios for home use in 1934. After leaving Atwater Kent in 1936, Albert D. "Duke" Silva joined the company and helped reshape the product line. Radios in drawn metal cabinets, were introduced in 1938 and remained the company's low-cost offering until the mid-1950s. In 1950, the company changed its name to "Arvin Industries" honoring the trademark under which it had sold auto parts and consumer goods since the 1920s. In addition to marketing radios under its own Arvin brand, Noblitt-Sparks was among those making Silvertone brand radios for Sears, and also sold radios under various other private brands both in the United States and Canada. Products included a Walt Disney-licensed promotional model for the animated feature Pinocchio, and the very famous Hopalong Cassidy radio.

**RESTORATION OF A TRANSMITTER FOR WHEATSTONE MAGNETOELECTRIC**

**DIAL TELEGRAPHY (A LETTER TO THE EDITOR)**

by Franz Pichler.....117

ABSTRACT: In 2013 I published in *The AWA Review* a paper on "Magneto-electric Dial Telegraphy" which included a short report on the restoration work for two Wheatstone transmitters of my collection of telegraph instruments. For one of the two, "Wheatstone 1," a transmitter for 11 letters and the + on the capstan, the restoration work could be finished. However for the second one, "Wheatstone 2, the restoration work had to be postponed. Now this work has been finished and I would like to give a short report on it.

**LETTER TO THE EDITOR**

by John B. Doolittle.....121

**RADIO IN 1922: WHAT THE BOYS AND GIRLS KNEW**

by Mike Adams.....123

ABSTRACT: "Radio in 1922, What the Boys and Girls Knew," looks at a single year and compares the rise in broadcasting, and what Americans were being told about its significance, with the information young readers were getting in their *Radio Boys* and *Radio Girls* series books. This analysis compares what was commonly known by the general reader through how-to and news publications with four 1922 novels about radio. This is the first article from a book project that examines meaning in wireless and radio-themed juvenile fiction. Both story and character are summarized. Questions are asked: First, is the technology presented accurate, and is it hobby or career focused? Beyond the radio aspect, how are the values of authority, patriotism, family, citizenship, race, law and order, religion and charity presented? What is the socio- economic position of the characters? Which values have been transmitted across generations to the current day? And did these stories affect or merely reflect society? This analysis adds perspective to hobbyists who surely operate in a larger circle of influence beyond wireless and radio.

**OLIVER LODGE'S FANCIFUL HISTORY OF THE COHERER PRINCIPLE**

by Eric P. Wenaas.....163

ABSTRACT: Oliver Lodge made claims of priority for the discovery of the coherer principle, the single-contact coherer, and the detection of electromagnetic waves with the coherer. His claims rest on a single lightning-guard experiment he performed in 1889 and documented in 1890. The original account of his experiment describing temporary coherence is inconsistent with the coherer effect, and while he did observe a form of cohesion, it was due to an entirely different effect, which has never heretofore been chronicled. This effect I call "spark-discharge coherence" is the coherence of two electrodes initially in physical contact but without any electrical contact, which occurs only when exposed to high-voltage discharges such as those Lodge used in his lightning-guard experiments. At some point, Lodge realized that the coherence effect he observed was not the classic coherer effect, and over a seven-year period Lodge methodically altered the original observations of his lightning-guard experiment in several publications with ambiguously worded language to bring them into line with what would be expected from a classic coherer. For the rest of his life, he maintained that he had discovered the coherer principle and the single-contact coherer in 1889, but it has now been proved that he did not, and that he knew it.

**90 YEARS OF PRE-ELECTRONIC VLF-TRANSMISSION**

by Bengt Svensson . . . . . 221

ABSTRACT: SAQ in Grimeton, near the town of Varberg on the Swedish west

coast, is the only remaining pre-electronic transmitter in working order. It was a part of the RCA Commercial Net from October 1924, when the first message was sent to "Radio Central" at Rocky Point, Long Island. On July 2nd 1925, the station was inaugurated by King Gustav V, sending a telegram to President Calvin Coolidge, praising the new link to America. In the year 2004, UNESCO decided to put SAQ/Grimeton on the World Heritage List, with the following declaration, somewhat shortened: *The Varberg Radio Station at Grimeton in southern Sweden (built in 1922-24) is an exceptionally well preserved monument to early wireless transatlantic communication. It consists of the transmitter equipment, including the aerial system of six 127-m high steel towers. Though no longer in regular use, the equipment has been maintained in operating condition. . . . The site is an outstanding example of the development of telecommunications and the only surviving example of a major transmitting station based on pre-electronic technology.*

**THE HEATHKIT DF-1 TRANSISTOR RADIO DIRECTION FINDER AND THE  
DF-2 AND DF-3 MODELS**

by Erich E. Brueschke.....233

ABSTRACT: The Heathkit Transistor Radio Direction Finder Model DF-1 is the first kit capable of using radio to find one's location out of sight of land or at night aboard vessels of all types as well as for the hunter, hiker, fisherman or aviator. Today we are used to the Global Positioning System (GPS) capable of telling us our position within a few feet. The DF-1 was quickly followed by the DF-2 and then the DF-3 within two years. These are all discussed in this article with a concentration on the DF-1. This article contains information on the restoration of the DF-1, which applies to the DF-2 and D-3 as well.

**WHA MADISON - IS IT REALLY THE NATION'S OLDEST STATION?**

by Dan Clark.....243

ABSTRACT: "The Oldest Station in the Nation-WHA Madison" That is the way the station identification of WHA was announced in the 1950s. But is it really the oldest? KDKA in Pittsburgh is usually considered the oldest broadcast station in continuous operation.

by Dan Howard.....1

ABSTRACT: In the early days of the U.S. Forest Service, the agency explored a number of technologies for communicating over vast areas of forestland. The telephone soon became the favored means of communication, and the Service installed a vast telephone network with thousands of miles of wire strung on trees. In 1912, employees of the Service in the Northwest, often referred to as foresters, began to discuss the use of aircraft and radios to detect and report forest fires and coordinate firefighting efforts. Finally, at the end of World War I, radiotelephone technology and manpower became available to test some of these ideas. In 1919, the foresters in the Northwest began testing Signal Corps radiophones developed during WWI to see if they could replace wired telephones. During three fire seasons from 1919 through 1921, wireless sets were tested at selected locations in the forests and cities, including the lookout cabin atop Oregon's Mount Hood. Radio pioneers throughout the West partnered with the Forest Service to conduct the wireless tests and analyze the results. While the results were promising, decision makers concluded that the technology had not yet been developed to the point where it was practical for deployment. The radio would not come into regular use for forest communications until the 1930s. Recounted here are the stories of the foresters and radio amateurs who conducted the Western Forest Wireless Tests.

**REMEMBERING UNCLE ARTHUR**

by David L. Willenborg.....33

ABSTRACT: Born at the dawn of wireless communication, Arthur H. Lynch would become one of radio's leading advocates. His interest in radio started as a child after he constructed his first crystal radio. It grew into a fascination that would remain with him for life. Arthur was one of those blessed individuals who turned their passion into a successful career. He was a wireless pioneer who explored all facets of this emerging field. He worked as a wireless operator on merchant ships, served America in two world wars, and was a prominent magazine editor and author for Radio News and Radio Broadcast magazines. Using his pen name A. Henry, he wrote a series of articles detailing real life experiences that provided insight into what it was like to be a wireless operator at sea before World War I. As an amateur radio operator, he pioneered the five-meter band and conducted the first two-way amateur television contacts at the 1939-1940 World's Fair. Arthur managed his own business, Arthur

H. Lynch, Inc., a radio parts manufacturing company that supplied parts to early radio enthusiasts and the amateur radio community. However, his most important contribution to communications was through his writing. His young audience became the generation that pushed communications to the next level, ushering in the age of computers and the exploration of space.

**TELEGRAPH IN THE AMERICAN CIVIL WAR**

by David & Julia Bart.....75

ABSTRACT: The wide-scale use of telegraph in the American Civil War directly impacted the outcome of the War. The Union's early adoption and rapid expansion of telegraph services was also an historic development in the field of military communications. The telegraph not only affected tactical, operational and strategic battlefield communications, it also

permitted civilian government officials to maintain control over the military in wartime. The telegraphers who served were never recognized by the U.S. government for the risks they endured and the contributions they made. Yet, they forged a newly defined trade craft with proud traditions that had lasting effects on the country, and they laid the foundation for a modern telecommunications society. This article outlines the role of the military telegraph in the Civil War and introduces historical resources that can be used for further research into this topic.

**AMORY H. "BUD" WAITE, POLAR EXPLORER**

by John Dilks.....167

ABSTRACT: This article presents a biography of Amory H. "Bud" Waite, a radio operator on numerous Antarctic and Arctic explorations with Admiral Richard E. Byrd, and a hero during the D-Day invasion in World War II. Included is a transcription of a rare firsthand account written by Waite contained in a nine-page "farewell" letter he wrote to friends and relatives shortly before his death from cancer. The letter recounts many of his exploits and experiences in the Polar Regions, and mentions many of his friends he met and worked with throughout his life. The letter came into the possession of the author in one of a number of boxes that he obtained in the late 1990s or early 2000s, but it was not discovered until 2010. This article is accompanied by a number of photographs from the author's Polar collections and other sources.

**THE RISE AND FALL OF THE DE FOREST COMPANIES**

by Eric P. Wenaas.....191

ABSTRACT: Much has been written about Lee De Forest and the various companies he helped to create, most of which focuses on the man, his radio apparatus and his accomplishments. This paper is a review of how and when his many companies were formed, how they transitioned from one to another, and how and why they failed—often spectacularly. It details how De Forest, whose goal was to achieve success and fame in the field of radio telegraphy and telephony, was willingly duped into forming a number of companies by conspiring with known stockjobbers whose goal was to sell as much stock and pocket as much of the proceeds as possible. As a result, De Forest was left with precious few resources for developing the necessary apparatus, much less for assembling the necessary infrastructure consisting of stations and operating personnel required to provide reliable communication services. Interspersed among interesting facts and figures about the rise and fall of each company, with their attendant accomplishments and failures, are stories of the shenanigans of colorful but deceitful cohorts of De Forest.

**AFTER 100 YEARS**

by William Hopkins.....265

ABSTRACT: June 15, 2016 marks the 100th anniversary of the Second German Reich's high-powered wireless transmitter site at Königs Wusterhausen (i.e., KW) near Berlin. In recognition of the historic accomplishments of KW's historic accomplishments and excellence as Germany's first broadcast transmission site in 1920, the IEEE has awarded the Transmitter and Radio-



Technology Museum at KW the honor," Mile- stone in the History of Technology." This study reviews the history of the station from its beginnings in the First World War through the end of the Cold War. The study then focuses on station activities between 1916 and 1918 and the early post-war years leading up to the period of statutory broadcasting in Germany that began in 1923.

**THREE 'RADIO BOYS' AND THE EIGHT-TRACK TAPE PLAYER**

by Olin Shuler.....287

ABSTRACT: This article takes the reader behind the scenes, describing the birth of a new concept for automobile radios, which became an icon of the 1960s. At the time, only radio entertainment was available in the automotive world. Prior to the arrival of the Lear tape cartridge and player, several unsuccessful attempts had failed to bring recorded sound into the automobile radio system. Several showed promise, but none attracted public interest or acceptance. Bill Lear, famous for the Lear-Jet business aircraft, brought forth a solution. His model shop fabrication facilities introduced a small number of tape units for aircraft use. These early units yielded encouraging results, and upscale jet passengers were interested and accepted the idea of recorded entertainment. Possible adaptation for home and automobile applications loomed ahead. But his business was airplanes not tape machines. An experienced manufacturer was needed. Motorola was selected to redesign the product for mass production and manufacture.1 Motorola's adaptation focused on selling tape players to the major automobile manufacturers. The timing was not favorable for a 1966 model year introduction. The 1966 dashboards and their related tools and dies were already finalized or committed. Ford Motor Company found a solution by mounting the player on the transmission hump and speakers in the door kick panels. Assembly line changes were avoided by making it a dealer-installed option. The race was on. Ford and Motorola had a year's exclusive lead on the competition. This article is a first-hand account written by a retired Motorola production engineer who participated in the introduction of the first successful automobile radio 8-track tape player.

**LETTER TO THE EDITOR** by Chuck Porter.....309

**LINCOLN RADIO CORPORATION**

by Norman S. Braithwaite.....311

ABSTRACT: The Lincoln Radio Corporation manufactured a line of progressive high-quality superheterodyne radios between 1928 and 1936. Their radios were designed for distance reception and competed with the products of the E. H. Scott Radio Laboratories and McMurdo Silver Corporation. Lincoln radios were known for DX reception and were advertised widely during the early 1930s. William H. Hollister, president and owner of the Lincoln Radio Corporation, authored numerous articles about Lincoln's models that were published in several contemporary magazines. Yet, despite all of the advertising and articles written, very few Lincoln receivers are known to exist today. This disparity between the extensive publicity versus the small number of remaining sets has been an ongoing enigma for the radio collecting community. Mr. Braithwaite has risen to the challenge of investigating this enigma by researching Lincoln and its products. In this article, Mr. Braithwaite unravels these mysteries and reports on the history, product lines and fate of the company. A brief biography of

William Henry Hollister, Lincoln's president and owner during its golden years, is also included.

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**PARADIGM LOST: NIKOLA TESLA'S TRUE WIRELESS**

By David Wunsch . . . . . 1

ABSTRACT: We examine an article written by Nikola Tesla entitled "The True Wireless," which appeared in the *Electrical Experimenter* magazine in May of 1919. His essay is analyzed as an example of the inability of a scientist or inventor to assimilate a paradigm shift in his discipline, and we use the language and thought of Thomas Kuhn in this discussion. The paradigm shift in question was created by Maxwell and Hertz in the latter third of the 19th century, a shift that explained the existence and generation of electromagnetic waves—the basis for wireless telegraphy and eventually radio. We also focus on the magazine in which Tesla's piece appeared and consider why the article might have been written and accepted for publication.

*"The Hertz wave theory of wireless transmission may be kept up for a while, but I do not hesitate to say that in a short time it will be recognized as one of the most remarkable and inexplicable aberrations of the scientific mind which has ever been recorded in history."*

—Nikola Tesla, "The True Wireless" 1919

*"... the man who continues to resist after his whole profession has been converted has ipso facto ceased to be a scientist."*

—Thomas Kuhn, *The Structure of Scientific Revolutions* 1962

**ZEH BOUCK, RADIO ADVENTURERPART 1: THE PILOT RADIO FLIGHT TO BERMUDA**

By Robert Rydzewski . . . . . 31

ABSTRACT: Zeh Bouck (2PI, W4FCP, W8QMR), born John W. Schmidt (1901-1946), was an early radio pioneer, engineer, writer, and adventurer who represented amateurs in Washington, D.C. and met with President Hoover. He helped design the Pilot Super Wasp, was one of the first newspaper radio columnists, penned stories and radio plays, and was an associate editor for journals such as *Radio Broadcast* and *CQ: The Radio Amateur's Journal*. An IRE Fellow and member of the Radio Club of America, he was most famous in his day for his role aboard the airplane *Pilot Radio*, a "flying laboratory." In 1930 the plane made two historic journeys: the first flight from the United States to Bermuda and the first flight of any land plane around the South American continent. This article provides a brief biography of Bouck to 1930 and summarizes the history of the Pilot Radio Company of Brooklyn and its interest in aircraft radio. Along the way, other figures such as Reginald Fessenden, Hugo Gernsback, and Milton Sleeper are encountered. A detailed account of Bouck's famous and hazardous Bermuda flight with pilot William Alexander and navigator Lewis Yancey follows, focusing on the role of radio communications. Remarkably, Bouck, who remains largely forgotten today,

accomplished all this in spite of a serious disability caused by childhood polio.

**A SOVIET ERA BROADCAST RECEIVER SYSTEM OF THE 1950s FOR REMOTE LOCATIONS**

*By Robert Lozier . . . . .71*

ABSTRACT: For nearly 20 years I have taken a special interest in studying how the various national broadcast systems of the world have developed. These variations have often resulted in the development of very different hardware to serve these systems. I was recently given a Russian made thermoelectric generator of the 1950s in very poor condition prompting me to research its significance before investing time in restoration. I was already aware of their existence for powering small broadcast receivers in remote locations of the former USSR and English language Google searches produced links to basic information. Examination of serial numbers found in Google Images searches lead me to believe that these generators were at least made in the tens of thousands and not just a novelty. With little to lose in trying to make my unit presentable, I started preservation and restoration activities. After about 15 to 20 hours work, I concluded that it could be made presentable for exhibition; this prompted me to locate an appropriate radio that would have been powered by these generators. A fellow collector provided me with a fine example that turned out to have one surprising construction method, perhaps making a virtue of necessity, and several other very interesting features that prompted a new round of research. This paper describes my research into this broadcast receiving system, and provides a narrative of how these artifacts were prepared for conservation and exhibition. Many aspects of this receiving system and these artifacts will be largely unfamiliar to American readers.

**WESTINGHOUSE RADIO AND TELEVISION PRODUCTION**

*By Mike Molnar . . . . .105*

ABSTRACT: "You can be sure . . . if it's Westinghouse!" This was the familiar advertising slogan used by the Westinghouse Electric Corporation for many years. Today, if it's a Westinghouse, even an experienced collector may have many questions about his or her radio or television. When was it made? Where was it made? Why are the ID tags on two radios so different? Surprisingly, the collector may have to ask, who really manufactured it? Read on, and we will puzzle through some of the mysteries. Successful companies must respond to changes in business conditions and changes in the marketplace. They also must incorporate new technologies into their business. By adhering to these principles, the Westinghouse Electric Corporation was able to endure as a successful company for nearly a century. For over fifty years they were leaders in the radio, television, and consumer electronics business. The changes Westinghouse made over this period, when studied today, make it difficult for us to make sense of their decisions. By understanding the business decisions they made over time, it may be possible to understand the effect they had on the artifacts found today. Locations, licensing issues, contractual issues, legal issues, new technologies, the Great Depression, three wars and more, have combined to make following the Westinghouse story an interesting journey.

**THE WIRELESS NEWS**

*By Bart Lee . . . . .141*

ABSTRACT: For well over a century, radio has provided ships at sea and their well-off passengers with current news of the world (and at times, war news), market data and sports. From Marconi's wireless telegraph to satellite delivery, the wireless news has been indispensable to voyagers of many sorts, especially on transoceanic routes. Steamship lines saw money to be made in providing this amenity. The technologies of communications and of the printing of newspapers at sea paced each other. Many of these seagoing "newspapers" themselves tell nautical tales and social stories about their readers. But they also illumine their producers in Europe, North America, and Asia, including the shipping lines, the shore side press, and the radiomen at sea. The radio technology evolved from long waves to satellites, and from spark sets to vacuum tube gear and then to modern solid-state circuits. A demand for current information at sea, far from its sources, created an important maritime revenue stream. The economics of news at sea and the higher socio-economic class of the passengers helped to further the development of the radio art.

**HENRY K. HUPPERT AND HIS VACUUM TUBES**

*By Eric Wenaas . . . . .* 173

ABSTRACT: This is the story of Henry K. Huppert and the four innovative types of thermionic vacuum tubes he designed over his lifetime. Much of what appears in this article is taken from the personal papers of Henry Huppert that have never been published previously. These Huppert papers have been in the possession of his granddaughter, Claudia M. Benish who inherited them from her father, Ralph M. Huppert. The focus of this paper is on the four vacuum tubes he developed—the Solenoid tube, the Two-in-One tube, a tube with the trade name Quadrotron, and a unique thermionic X-ray tube with a control grid that had no trade name. While the Solenoid tube and the Two-in-One tube have been chronicled previously, documents in the Huppert papers provide much interesting background information on how the tubes were designed and how they performed. The unique X-ray tube that he designed has never been chronicled previously. In addition to information on his vacuum tubes, this article also provides interesting details on his life and his work as a radiologist and as a doctor treating patients with radiotherapy techniques.

**THE NAVAL RADIO SCHOOL AT HARVARD: A NEW ERA IN MILITARY TRAINING**

*By David and Julia Bart . . . . .* 223

ABSTRACT: Wide-scale technical training was essential for U.S. mobilization in World War I. The country's ability to quickly recruit and to set up massive education programs allowed it to produce thousands of new soldiers and sailors for the Allied Powers. The Naval Radio School at Harvard University exemplifies these efforts. Prior to the war, the Navy did not maintain a coherent or cohesive approach to technical training for wireless telegraphy and other communications skills. In 1917, the Navy established an advanced radio school at Harvard that in only twenty-two months trained nine out of every ten naval radio operators who served in the war. This article outlines the origin, operation and role of the Naval Radio School at Harvard during World War I.

**THE CRADLE OF COLLEGE RADIO: WJD AND THE PRESCIENT PROFESSORS**

By *Mike Adams* . . . . . 257

ABSTRACT: Before broadcast radio there was college radio. It began with a series of science experiments as university professors, and then their students moved from the construction of equipment for sending coded wireless messages to entertaining friends and fellow students using the new wireless telephone. This is primarily the untold story of Richard Howe and his early 1922 Denison University station, the short-lived WJD. And while he was early to college broadcasting, he was not the first. The Howe work supports the idea that radio broadcasting did not begin with the idea of entertainment for a mass audience; typically, it was born in a quiet lab, the wireless curiosity of professors and their students. In this paper, Richard Howe's story is presented within the greater context of the evolution of university-based radio broadcasting.

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**THE RUSSIAN IMPERIAL TELEGRAPH**

By *David and Julia Bart* . . . . . 1

ABSTRACT: The Crimean War set the stage for modern warfare. Many innovations were tested, including the first use of telegraphy in warfare. At the outset in 1854, the telegraph was not even twenty years old. Needle instruments dated from the early 1830s, and Samuel Morse's demonstrations took place in 1844. Yet, telegraph networks were expanding across Europe and across the Eastern United States by the early 1850s. Numerous writings document the British and French experiences in the war. This article reveals the development of the Russian Imperial Telegraph and its impact on Russia.

**PRESERVING THE STORY OF GREATER BOSTON'S PIONEERING BROADCAST STATIONS 1XE AND WGI**

By *Donna L. Halper* . . . . . 29

ABSTRACT: Station 1XE, later known as WGI and then WARC, was also known as "the AMRAD station." But by any name, it was one of the first radio stations in the United States to broadcast voice and music, beginning in 1916. It had one of radio's first women announcers; it offered some of the first regular newscasts; and in early 1922, it began providing college courses by radio. The AMRAD station was also home to many of greater Boston's best-loved entertainers and announcers, some of whom went on to national fame. Yet today, this pioneering radio station is all but forgotten. Media historian Donna Halper takes a closer look at the AMRAD station's history, discussing its important role in early broadcasting, and why it deserves to be remembered.

**PICTURES BY RADIO FOR THE HOME**

By *Mike Molnar* . . . . . 63

ABSTRACT: The development of radio and television is not a story of some inventor's eureka moment, but rather a chain of small steps that progressed to the point of a service and products accepted by the public. Sometimes a small link in the chain and the work of an individual inventor is forgotten. The author uncovered a small, lost link in the chain between broadcast radio and television by finding a complete kit for a "Cooley Rayfoto System of Radio Pictures for the Home," in near mint condition. Its inventor, Austin G. Cooley, scarcely gets a mention in the literature nor does his system of radio pictures. This kit became the impetus for this article, which covers not only Cooley's system of still pictures for the home delivered by radio, but also similar systems of facsimile transmission made by others using the technique known at the time as "phototelegraphy." Systems developed by other early experiments are also summarized—those developed by N. S. Amstutz of Valparaiso, Indiana, circa 1891, Professor Arthur Korn of Berlin circa 1902, American inventor C. Francis Jenkins in the early 1920s, American inventor William Finch in the 1920s, and noted radio engineer and entrepreneur John V. L. Hogan circa 1937.

**RADIO & TV GRAPHICS: MAGAZINE AD ILLUSTRATION ART**

By John Okolowicz . . . . . 91

ABSTRACT: The "golden age of radio" (and later television) also coincided with the "golden age of magazines" and the blossoming of the advertising business. As advertising agencies were experimenting with how to make the best use of expensive magazine ad space for product promotion, many creative techniques were employed to grab the reader's attention and get potential consumers to buy their products. This article will take a look at twenty of those techniques and show how they were employed to create visually appealing radio-phonograph-television ads starting from the early 1920s on through the 1970s

**CBS ELECTRONIC VIDEO RECORDING (EVR) AND THE WORLD'S FIRST VIDEO TELEPLAYER**

By Olin Shuler. . . . . 141

ABSTRACT: The first home video player system, known as Electronic Video Recording (EVR), was designed by Dr. Peter Goldmark, president of CBS Laboratories in the early 1960s. The EVR system, which led the industry by ten years, was a playback-only system that could not record television signals in the home. Top management at CBS withheld its release until 1968, fearing it would draw viewers away from their TV network programming. Motorola was contracted to finalize the Electronic Video Record Teleplayer portion of the system and was prepared to produce Teleplayers by mid-year 1970. Internal problems at CBS delayed their ability to produce the supporting program material until late 1971. Awash in losses from the delay and facing many emerging competitive systems entering the dawning market, CBS cancelled the EVR project that December. The technologies in the system were astoundingly simple on the surface, but precisely intricate deep inside, and together the technologies produced high quality video and an interesting story. An account of this story is related here, much of it told in first-person recollections by key Motorola engineers who worked on the design and manufacture of the Teleplayer.

**ZEH BOUCK, RADIO ADVENTURER**

By Robert M. Ryzewski . . . . . 173

ABSTRACT: Zeh Bouck (2PI, W8QMR) was an early radio pioneer and writer who helped design the Pilot Super Wasp and directed the company's aircraft communication efforts aboard their "flying laboratory," the *Pilot Radio*.

In 1930, he, William Alexander, and Lewis Yancey accomplished the first flight from the U.S. mainland to Bermuda, demonstrating the value of continuous air-to-ground HF communications. An even more ambitious (and publicity-seeking) mission followed when Bouck, navigator Yancey, and pilot Emile Burgin set out to essentially circumnavigate the South American continent in a "goodwill flight." The rationale and logistics for this odyssey, and background information on related flights—including two by Charles Lindbergh and one proposed by another "radio adventurer," Donald Croom Beatty—are presented. The Pan Am radio system developed by engineer Hugo Leuteritz helped make it possible. Bouck's own accounts, other documentation, and information from government sources allow us to follow their journey from a meeting with the president in Washington, D.C., through aerial funeral duty in Mexico, a visit to U.S. Marine station NN1NIC in Managua, Nicaragua, and a stop at the Canal Zone, from where they would hop off for South America. Communications records were set along the way, and adventures were many on this Central American portion of their goodwill flight.

**DID MAHLON LOOMIS REALLY INVENT RADIO?**

*By Eric Wenaas . . . . .* 211

ABSTRACT: Some historians credit Mahlon Loomis for being the first to demonstrate the transmission of intelligible messages by electromagnetic radiation using two kites as "antennas" that were separated by a distance of approximately 20 miles in the Blue Ridge Mountains of Virginia in 1866. Loomis documented his approach in U.S. patent No. 129,971 dated July 30, 1872, which was supplemented by entries in his notebooks, an address to the Franklin Institute, and several other contemporaneous documents including those that accompanied his patent filing. His technique is unique among all methods of wireless telegraphy because he claims to have successfully extracted electricity from the atmosphere to power his system, as opposed to using batteries or rotating machinery as the source of power for the electrical disturbances he generated. Most mainstream scientists are skeptical of Loomis's claims because of the difficulty of obtaining the necessary energy and power from the atmosphere for communicating intelligence to such a distance, and also because he used a galvanometer as a detector without benefit of a nonlinear detector, such as a coherer or magnetic detector. If Loomis actually did send and receive messages with electromagnetic signals, then he deserves credit for being the first to demonstrate communication by radio, even though he did not realize the method by which he was communicating. If not, then he will remain a footnote in the history of wireless communication, remembered as the first one who tried but failed to transmit messages by extracting the necessary energy or power from the atmosphere.

**HISTORY OF VOICE OF AMERICA AUDIO PROCESSING**

*By Daniel D. Brown . . . . .* 259

ABSTRACT: The Voice of America (VOA) used various technologies in international shortwave (high frequency or HF), double-sideband, AM broadcasting to improve intelligibility and maximize reception. Advances included progressively higher transmitter power, improved transmitting antennas, propagation software, and increasingly complex audio processing. Some of the HF stations provided a signal that was clear and easy to understand while others did not, even though they may have had similar received signal strengths. The history of analog audio processing used at the Voice of America is recounted here with a short comparison to Radio Free Europe/Radio Liberty. A unique digital system that was designed and tested for the VOA, but never incorporated, is described. Commercial digital processing units that were actually deployed are also described. As many stations used similar techniques, this work can largely be considered a history of shortwave broadcast transmission processing, which uncovers some details that have been buried for decades and not brought to light until now.

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