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In Memoriam

FRED SHUNAMAN

1901 - 1991

Proceedings of The Radio Club of America, Vol. 65, no. 1, May 1991

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THE RADIO CLUB OF AMERICA, INC.

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In Memoriam

Fred Shunaman - Executive Secretary

Fred Shunaman, N2JLO (M 1968, F 1972, L 1983) died on March 1, 1991 at the Robert Wood Johnson Medical Center, New Brunswick, NJ at age 89. He donated his body to Rutgers University Medical School for medical research.

A memorial service was held on March 16th at The Religious Society of Friends (Quakers) Meeting House in Plainfield, NJ. The family requested that memorials be through contributions to The Radio Club's Grants-in-Aid Fund.

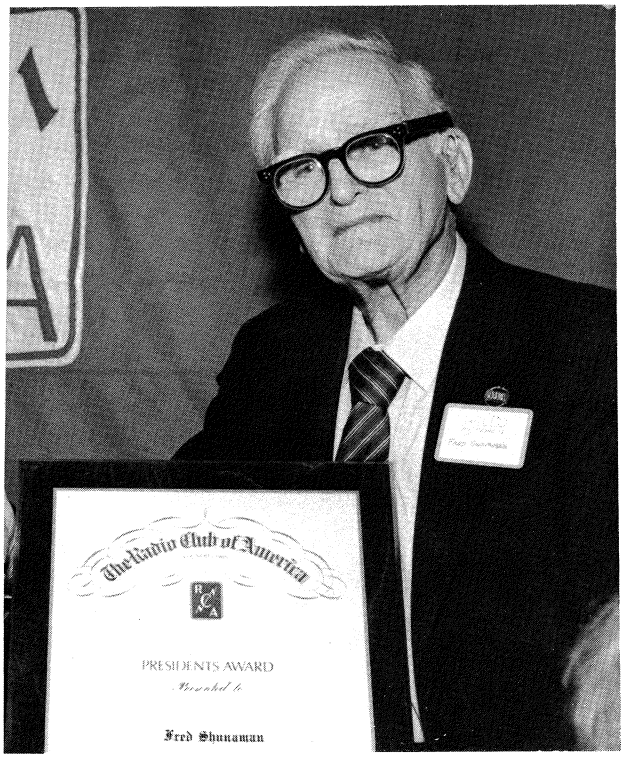
Shunaman began life on a farm in Leominster, MA and attended schools there until the age of twelve when his family moved to Crane Valley, Saskatchewan, Canada where they had received a land grant for wheat farming. The prairies had not been developed enough to have schools buildings so Fred's formal education came to a temporary end. His desire to learn prompted him to read and learn from any books that he could get.

He taught himself about radio from Hugo Gernsback's magazines and purchased equipment from Gernsback's Electro Importing Company. The first radio he heard also was the first that he had built; it also was the first radio in the area. Friends became interested in owning sets so Fred built several for them. Because of his interest in radio communications, he became a Ham in the early 20's with the call VE4AA.

At that time, he earned a living as a wheat farmer but foresaw the possibility of an economic slump and the devastating effect that it would have on farming. He then obtained employment in radio shops in Saskatoon as a local service technician, and also wrote for a small newspaper.

In 1932, he came to New York where he again worked in radio servicing. Later, he worked in or owned shops in New York, San Francisco, and Shanghai. While in Shanghai, he also taught radio and became a member of the International Amateur Radio Association of China.

He left China when the war with Japan broke out, and returned to New York again to work in radio repair shops. Occasionally, he would write an article for the Gernsback publications. In the early



Fred Shunaman
1901 - 1991

1940's, he served for a year as a radio operator aboard the tankers *Niobe* and *Prometheus*.

Once again ashore, he joined the staff of Gernsback Publications first as an associate editor and then as managing editor of *Radio-Craft* and *Radio Electronics*. Being in New York in the 1940's gave Shunaman the opportunity to formalize his education. He took examinations at Brooklyn College to get high-school credit, then took the college entrance examination and was admitted as a matriculated student in the Brooklyn College Evening School. He was on the Dean's Honor List every year that he was in attendance.

At Gernsback Publications as Managing Editor of *Radio-Electronics* he took great efforts to develop contributors of articles who showed the potential to become technical writers, thus assuring good free-lance writers for the magazine. Amongst his duties at *Radio-Electronics* was the translating of articles from French into English. He retired in 1966.

He was author of *Test Instruments in Electronic Servicing* and was co-author of *101 Questions and Answers About Hi-Fi and Stereo.* He also edited *From Spark to Satellite*, written by Stanley Leinwoll, and put together the 50th anniversary issue of *Radio-Electronics*, writing the lead article "50 Years of Electronics."

Joining The Radio Club of America in 1968, he was elected to the grade of Fellow in 1972 and became a Life Member in 1983. He became the Club's Executive Secretary in 1972, assuming the responsibilities of maintaining the Club's records, editing and publishing the *Newsletter* and *Proceedings*, and handling most of the communications with the membership. In recognition of the excellence of his work, the Club presented him with The President's Award at the annual banquet in 1985. In 1989, he was presented with The Lee de Forest Award in recognition of his long-time friendship with Dr. Lee de Forest.

Shunaman wrote an article entitled "Lee de Forest, The Father of Radio" that was published in the August 1973 issue of *Radio-Electronics* and reprinted in the Club's *Diamond Jubilee Yearbook.* The January 1947 issue of *Radio-Craft* was dedicated to de Forest.

In 1989, at the urging of his daughter, he again took a course in amateur radio communications, passed the code speed test of 13 words per minute, and received his license with the call N2JLO.

Shunaman was a member of the American Radio Relay League (ARRL), the Antique Wireless Association (AWA), and a Life Member of the Institute of Electrical and Electronics Engineers (IEEE). He was an avid student of languages and was fluent in many. He was learning Hungarian from his hospital nurse during his last illness.

Fred leaves his wife of 41 years, Angie, whom he met at Gernsback Publications, three daughters: Ellen Shunaman; Evelyn Shunaman Baer; and Margery Patterson together with two grandchildren, and two sisters in Saskatchewan.

At Shunaman's memorial service, an elegy by a young high-school friend was read:

March 2, 1991 For Fred Shunaman, Who Left Us Yesterday

My special friend
How I miss you in ways
I'll be years finding out

You had incalculable knowledge
but you never showed off;
Profound wisdom
but you never preached;
Deep love and concern
but you never meddled;
Abundant affection
but you never behaved
possessively:

Never "Why haven't we heard from you?"
Always, "What's the good word?"
Never "Sorry you have to leave."
Always, "Be seeing!"

How I have envied
your ability to enjoy life
down to the simplest detail

How I have been amazed
by the things you did
and refrained from doing
which freed me to grow up
in countless ways

How I treasure every pearl
every anecdote
every moment we shared

How I wish and hope
I may still learn to be
a little more like you.

From a dear friend, Erica Mandell

AUTHOR. . .AUTHOR!

by **Fred Shunaman, N2JLO (LF)**

The following article was written by the late Fred Shunaman (LF and Executive Secretary) and published in the 50th Anniversary issue of Radio-Electronics *magazine during October 1979. The article concisely describes how Shunaman developed writers for the magazine.*

In the long run, a magazine's value depends on the quality of its contents. And the contents, in turn, depend on the authors. Many of *Radio-Craft's* authors were developed by the magazine itself. Because of specialized readership, that was a necessity. Neither the writer for the popular journals, nor for the engineering magazines, spoke the language of the technician-hobbyists who make up the bulk of *Radio-Craft/Radio Electronics* readership.

So the magazine's authors have been to some extent a special breed. They have ranged from at least one semi-illiterate writer (whose only qualification was that he knew what he was talking about and could express it only in simple language) to heads of college physics departments.

The near-illiterate writer described the replacement of a part in series of short sentences, each beginning with "I . . ." (i.e., I unsoldered three wires to the part. I removed the nut holding it to the panel . . .etc.). We printed the item in more conventional form, and should have saved the original as an example in the use of simple English. But nobody thought it was possible to forget it -- and so we did!

When a person submitted even a short technical hint that showed compatibility with the *Radio-Craft* style and seemed able to put his thoughts in writing, he was encouraged. He would then sometimes come back with a longer article, which was often returned to him with suggestions that he rewrite it. Even outright rejections were regularly returned with detailed suggestions. (One author and, later, teacher of technical writing, Allan Lytel, told his class: "*Radio-Craft* is the only magazine whose rejections are sometimes longer than the article.")

It was through a rejection that Jack Darr came to the magazine. His first contribution was returned with the comment: "It is worth about $35 to us, but if we accept it at that price you will probably never send another one." Correspondence continued to the point of planning a coherent series on television servicing, and his contributions increased until he became the Service Editor.

One of the steps in developing authors is to encourage reader-correspondents to think for themselves. That sometimes fails. (One correspondent wrote: "This is a new low in reader service!") On one occasion it paid off beautifully. Otto Wooley, who had occasionally supplied short hints and "kinks," asked a question that went something like: "The circuit calls for a 70-mA choke. I have a 75-mA choke, can I use it?" Especially jolted because the reader had been a semi-author, we reprimanded him mildly and called his attention to a few of the electronic facts of life.

We got no reply from Wooley, and were about to consider him another case where we'd been too "helpful," when a manuscript arrived -- his first full-length story. He went right through the circuit of a small receiver, showing what parts values were critical and in what locations large variations could be tolerated. (The RF screen bypass could be any value from .02 to 2.0 mfd without making any noticeable difference.")

The story was just what we needed, and we printed it under the title "Circuitry and Common Sense." Apparently, other editors also needed such a story because it was reprinted in almost every country in the world! We saw it first in the magazines with which we exchanged publications. Then, magazines we had never known existed mailed us copies with the article, including the only radio magazine in Turkish that we had ever seen.

Once he learned that he could write, Wooley contributed several other articles until his early death (related to injuries received in World War II).

Another unexpectedly developed author was a young German, Otto von Gericke, who sent in a hint that was interesting but not as interesting as his name. When we printed his suggestion, we used the ancient spelling of his name -- Otto von Guericke. He came right back and admitted he was a descendent of the man who -- because of his early work in producing a vacuum -- he called the father of electronics. Later, he contributed a number of useful articles.

There are other ways of obtaining good material. The television issue of 1965 carried an article "World Television," written by E. Aisberg (the world's foremost radio-television author, whose book *Television -- It's a Cinch*, has been translated into 22 languages). Aisberg suggested that some Europeans translate the initials of the American system, NTSC, as "Never Twice the Same Color." RCA indignantly demanded equal time and was mildly surprised that *Radio Electronics* seemed so willing to open its pages for a rebuttal (by one of their top scientists, who otherwise would never have "had the time" to prepare an article for the magazine.)

Unexpected talent sometimes lurks under our very noses. The Question Box editor, Schendel, wrote a "Letter to the Editor" that concerned service technician licensing. We needed a story on licensing, so sent him all the notes we had been gathering on the subject and asked him to write an article. He responded with a reasonably good story, Then, some months later he sent in two excellent articles on iron-cored components -- magnetic circuits, a subject on which few are competent to write but on which he was an expert. We immediately sent a talent-scouting questionnaire to all our authors!

Once in a while, one author breeds another. An article from a young woman started out: "Whenever I need a little extra money, my husband asks, 'Why don't you write an article, like I do?' " So she wrote a story on the special problems of radiomen's wives, whose husbands work hard in the radio shop all day and experiment with new circuits or talk to Timbuctoo all night, and sent it to the magazine her husband wrote for. The story was not particularly complimentary to the craft, and even went so far as to suggest that radiomen's families tend to be smaller than the national average. Next time our author appeared in the office, we complimented him on his wife's work, but his replies were in monosyllables. We wondered just what was the cumulative effect of his well-meant suggestion on his family life!

In Memoriam

Edgar F. Johnson - Radio Pioneer

"The world is definitely a better place for his having been in it,"... so spoke his townspeople at the funeral of Edgar F. Johnson.

Founder of E. F. Johnson Company and one of Waseca, MN most prominent citizens, Johnson died at his home on Clear Lake in Waseca on February 11, 1991, at age 91. Just two days later, his wife of 67 years died on her birthday. The double funeral of Edgar and Ethel Johnson was held on February 14th.

Edgar Johnson was born in 1899. Four years earlier, Marconi, inspired by reading of Hertz's experiments, sent a message across his father's estate in Italy. In 1899, Marconi came to America at the invitation of the *New York Herald* to report the progress of the America Cup Races off the New Jersey Coast and, in that year, incorporated the American Marconi Company.

At the age of ten or twelve, Johnson and a friend began to comprehend the age of electricity with their first accomplishment of building a Morse telegraph system between their homes. He reported that it didn't work very well probably because of the many questionable splices in their discarded rusty-iron telegraph wire. "But," he said, "our eyes were opened to a new world and, by high school days, the mystery and magic of radio telegraphy made an indelible impression."

"We lived a thousand miles from where everything was happening, and sources of information were few. I discovered the *Experimenter* magazine and acquired treasured catalogues of the Electro Importing Company of New York and the William B Duck Company of Toledo. My few pennies went for gadgets and hardware such as a coherer, headphones, and the like of which I couldn't very well make."

During his high school days, the elements of a rudimentary Ham station were acquired or built. That led to his decision to attend the University of Minnesota where he was enrolled in their first course in radio theory which was taught by C.M. Jansky Jr., later head of Jansky and Bailey of Washington, DC and a Fellow of The Radio Club of America.

Edgar F. Johnson and Ethel Johnson

He related: "During the Christmas holiday of my junior year at college, I brought home a regenerative receiver I had put together. I recall that I borrowed the single vacuum tube it needed. Only the month before, KDKA had made broadcasting history on November 2, 1920 by airing the results of the Harding-Cox presidential election. With a few friends, we had eagerly listened with headphones to KDKA and the wonder of it was related in the Waseca newspapers." Johnson earned a bachelor of science degree in electrical engineering in 1921 from the University of Minnesota.

Two years later, in partnership with his bride of a few months, the E.F. Johnson Company began business. With pooled capital of about $2,500, including a few hundred dollars worth of radio parts, the first offices of E.F. Johnson Company were in the bedroom. The first focus of the company was toward the retail sales of component radio parts to broadcasters, Amateur radio operators, and broadcast listeners. The classified *Ham-ad* column of *QST* and a mailing list of names from *The Radio Amateur Call Book* were the sole means of reaching potential customers.

During the 1924 World Series, Johnson brought the games to Waseca residents through loudspeakers set up in front of his store now located in a small frame building in downtown Waseca. By November of that year, he placed their first display advertising -- an ad of two-inches, one-column wide in *QST*!

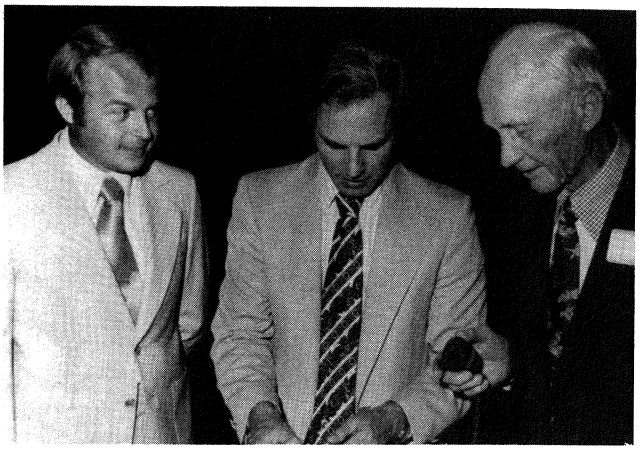
Depression days -- the thirties -- were hard. Yet in the fall of 1936, the Company built its first factory and office building of 8,000 square feet. Seventeen people were employed to design and produce components...by then, the company had discontinued retail sales to concentrate upon manufacturing. With World War II, the demand for the parts and complete radio equipments resulted in the growth to 500 employees with manufacturing underway in a garage, a grocery store, and the Oddfellows Hall. The company received three Army-Navy Awards For Excellence.

With the termination of hostilities, the Company began to sell kits of parts to Ham radio operators. The customers began to ask for assembled radios so employees took kits home and assembled them. In 1949, the first complete Amateur radio transmitters were manufactured by E.F. Johnson Company on an assembly line, the company being the first because of their extensive experience during the war. The *Viking I* transmitter followed and was an immediate success.

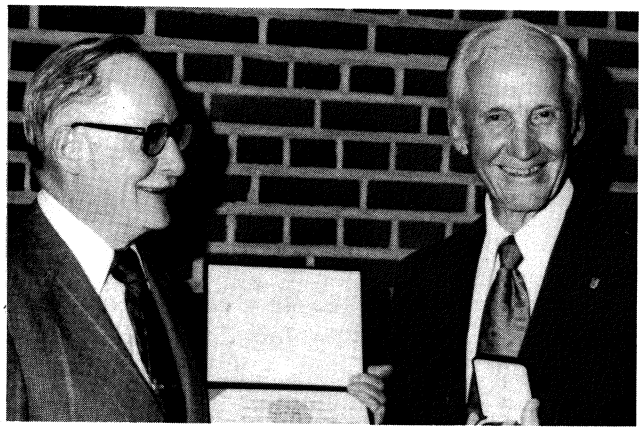
In 1950, the company largely abandoned broadcast equipment to manufacture radio-paging and two-way mobile communication equipment. In 1958, the Company developed its Class D Citizens Band (CB) Radio, bringing personal radio communications to millions of people. Under Johnson's leadership, the Company dominated the market with products sold under the name *Messenger*. The technical significance of the *Messenger* is best illustrated by its placement in the Smithsonian Institution.

When the popularity of CB radios diminished, production began on cellular radio equipments. Employment peaked in 1976 at 3,400 employees. In 1978, the Company was merged with Western Union; Johnson retired from his role as Chairman of the Board but continued as a Board member until 1983.

In 1975, Johnson traveled to the Peoples Republic of China with a delegation of major U.S. manufacturers of communication equipments. The visit was considered a significant step in the promotion of friendly trade relations between the two countries. Two years later, he was given the University of Minnesota's Outstanding Achievement Award which is conferred upon alumni who have attained unusual distinction in their chosen field, profession or public service. In that same year, Edgar Johnson was inducted into the Minnesota Business Hall of Fame.



Edgar F. Johnson (right) presents a *Messenger I* and a *Messenger III* Citizens Band transceiver to Dr. Bernard Finn (center) curator of the Smithsonian Institution Division of Electricity & Nuclear Energy. Looking on is Minnesota Congressman Thomas Hagedorn.



Edgar F. Johnson (right) receiving the University of Minnesota's Outstanding Achievement Award from Professor William G. Shepherd, director of the University's Space Science Center.

Mr. and Mrs. Johnson gave $500,000 to Gustavus Adolphus College to establish a professorship in fine arts. It was the first endowed chair in Gustavus' history. During January 1991, The Edgar F. Johnson Professorship in Electronic Communication was established in his name in the electrical engineering department at the University of Minnesota with a major contribution by the E.F. Johnson Company Foundation.

Edgar F. Johnson was a Life Member of the Institute of Electrical and Electronics Engineers (IEEE) and a Life Fellow of The Radio Club of America. He was awarded the Club's Sarnoff Citation in 1975 for his significant contributions in electronic communications.

Edgar F. Johnson (left) receiving the Sarnoff Citation from Fred M. Link, President of The Radio Club of America. Mr Johnson was the keynote speaker at The Radio Club banquet in 1971.

In delivering the keynote address to The Radio Club's 62nd Anniversary Banquet in 1971, he spoke on "A Lifetime of Radio", wherein he concluded with a theme note "The Way to the Future":

> "Ladies and gentlemen, business and industry need a favorable climate at home and a reasonable chance to compete for world trade. There needs to be a new realization of partnership among industry, labor and government. Perhaps out of the present turmoil and uncertainty gripping our economy, this new realization may yet come about."
>
> "There have been grievous problems before, for the nation as well as our industry. They have been overcome. There is reason for great hope that we will go on from here to realize the enormous promise of the future. I said initially that radio has been good for *me*. Many of you -- perhaps all of you -- will join me in that declaration, and certainly in the hope that our children and our grandchildren will find as great satisfaction as we have received from this exciting and rewarding vocation."

Two years ago, Johnson was asked how he felt about the company which he had started. As he toured the operations center built during the late 1950s on Johnson Avenue, a street named after him, he remarked that - given the variety of products and the automation of the production processes - he couldn't have dreamed that it would have been anything like it then was.

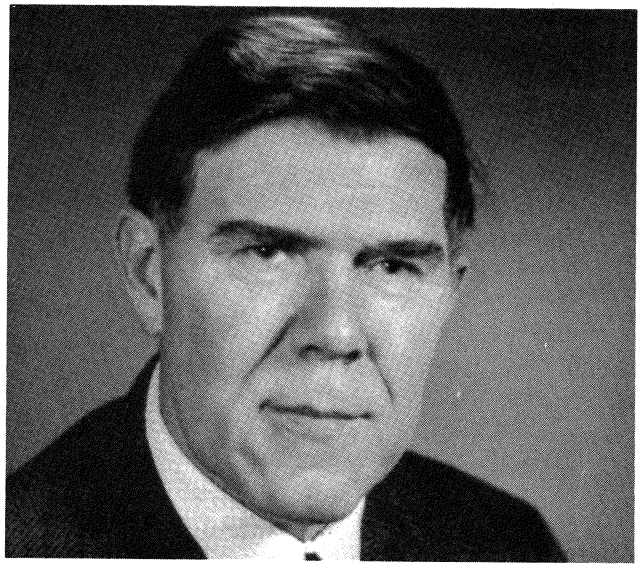
He commented that the high degree of automation, miniaturized parts and high-density circuits were remarkable. Asked about his biggest challenge over the years as the Company's leader, he said: "Challenges were a common everyday thing. No one knew how to do all of the things they were involved with. They just had to work them out, and always work hard."

"The secret of success is to set a goal and work for it."

This article was prepared with the assistance of Ms.Kathleen M. Conroy, Manager-Communications, Special Projects and Publications of the Johnson Communications Department of Diversified Energies, Inc., and from the address given by Edgar F. Johnson at the 62nd Anniversary Banquet of The Radio Club of America.

IN RETROSPECT: THE RADIO CLUB'S STATION 1BCG

by **Bruce Kelley, W2ICE (LF)**, and **Robert M. Morris, W2LV (F)**



Bruce Kelley (LF)

Robert M. Morris (F)

THE BEGINNING

1991 is the 70th anniversary of a very significant and important event in the annals of Amateur radio communication. The event was the first recognized and documented transmission of Amateur short-wave radio signals across the Atlantic.

From the earliest days of wireless, it had been the dream of radio pioneers to span the Atlantic. This was first realized in December 1901 when Marconi received the letter "S" at Signal Hill, Newfoundland as sent from his powerful longwave station at Poldu, England.

Again in the month of December, twenty years later (1921), American Amateurs achieved the same goal with a fraction of the Poldu power and on the supposedly inferior short wave length of 230 meters. This did not happen by accident.

Prior to December 1921, there had been much discussion and speculation as to the possibility of short-wave signals spanning the Atlantic and even a few tests were made during the previous year. No satisfactory results had been achieved. As early as the formation of the ARRL in 1915, President Hiram Percy Maxim had envisioned the possibility of sending signals across the Atlantic.

A year later, Louis Pacent suggested such a project to the Board of Directors of The Radio Club of America. Because of World War I, nothing came of his suggestion.

Following the war, Milton B. Sleeper, editor of *Everyday Engineering*, promoted a sending and receiving schedule for transatlantic transmissions. Sleeper's plan never materialized but it did arouse interest in the ARRL officials who arranged a test for American Amateurs to send on a prearranged schedule to English Amateurs. The results were not successful, in part because of interference at the receiving end.

To achieve success, there was a need to coordinate efforts on both sides of the Atlantic. In the Fall of 1921, at an ARRL Board of Directors meeting in Chicago, a decision was made that a transatlantic test should be organized and sponsored. The plan included sending a skilled short-wave receiving expert to Europe to assure the best possible results. To this end, the ARRL selected a highly-qualified Radio Club member Paul Godley, 2XE, to go to England with the best receiving equipment. Two receivers were prepared for the test: a Paragon regenerative and a special short-wave superheterodyne.

Godley left for England on November 15th aboard the Aquitania. The night before departure, a dinner was held in his honor by friends and members of The Radio Club of America. It was to some of these that Paul Godley said: "Please build a station that will get over there." Undoubtedly, it was this plea that created the determination on the part of six members to build such a station. Thus Amateur station 1BCG was born.

THE TEST

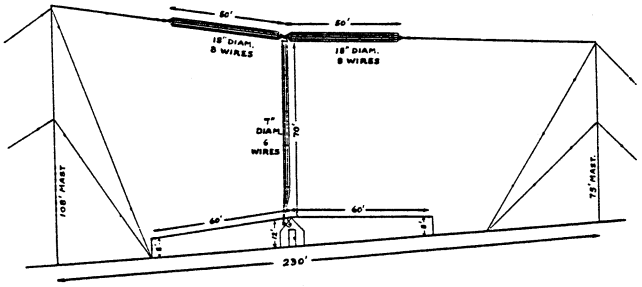
For six hours each night on ten successive nights, from December 7th to 16th, Amateur stations transmitted on prearranged schedules with Godley listening in Scotland. More than 30 stations were heard by Godley and British Amateurs. Although several spark stations were heard, the vast majority used CW on wavelengths from 200 to 375 meters. 1BCG was the predominate signal and the first to have a complete message acknowledged.

STATION 1BCG: The Location

1BCG was built in Greenwich, Connecticut in three weeks, including the erection of a "T" antenna approximately 85 feet high, a 30-wire counterpoise 120 feet in diameter, and a 1 KW master oscillator - power amplifier transmitter. This was done in spite of many problems including weather of snow and rain. The six determined gentlemen had all of the characteristics of good DX-ers: patience, perseverance and fortitude. The results paid off because 1BCG was, by any criterion, the outstanding station participating in the tests.

The station was on the property of fellow member Minton Cronkhite in Greenwich, Connecticut. Cronkhite held the call letters 1BCG and had a site of several acres with an existing antenna system and radio shack to house the equipment.

A lengthy description of 1BCG and its operation is told in October 1950 Commemorative issue of *The Proceedings of The Radio Club of America.* Participants Ernest Amy and George Burghard describe the station, with Major E. H. Armstrong covering the transmitter and its numerous problems.



Antenna at 1BCG

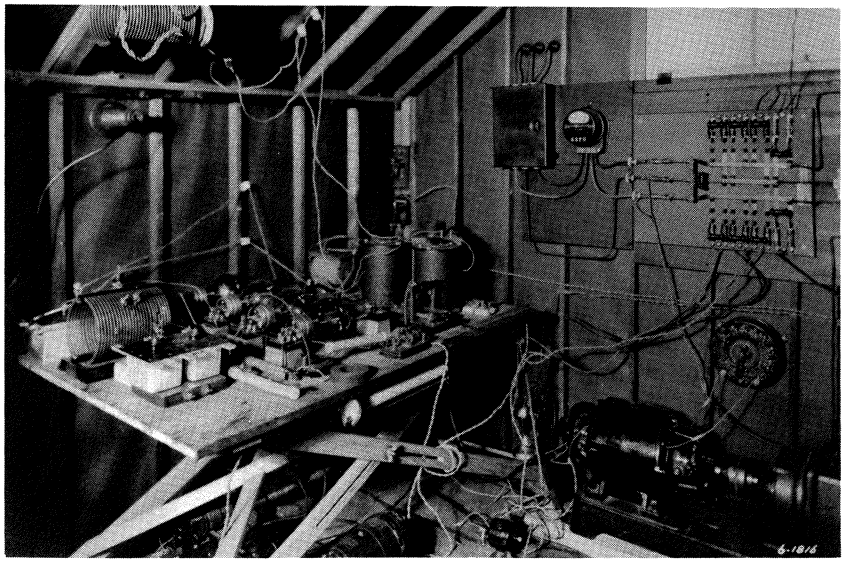
THE ANTENNA

Members of The Radio Club took advantage of the existing 75 foot antenna pole and added another 108 foot steel mast at a distance of 230 feet. The 100-foot radiating portion of the antenna consisted of two 50-foot, 8-wire, 18-inch cages fed in the center with a vertical 70-foot, 6-wire cage dropping directly into the radio shack and transmitter. The "T" type antenna worked against an elaborate counterpoise of 30 radials suspended at an average height of ten feet above the ground. The antenna resonated nicely around 200 meters.

The antenna was one that would be the pride and joy of any "top band" station, today. It undoubtedly was responsible for the excellent results achieved by 1BCG. In the light of today's knowledge, could they have erected a better antenna under the existing circumstances? We think not. We wonder if they appreciated the radiation properties of the 70-foot vertical section. In addition, many present-day designers prefer above-ground radials to those buried underground.

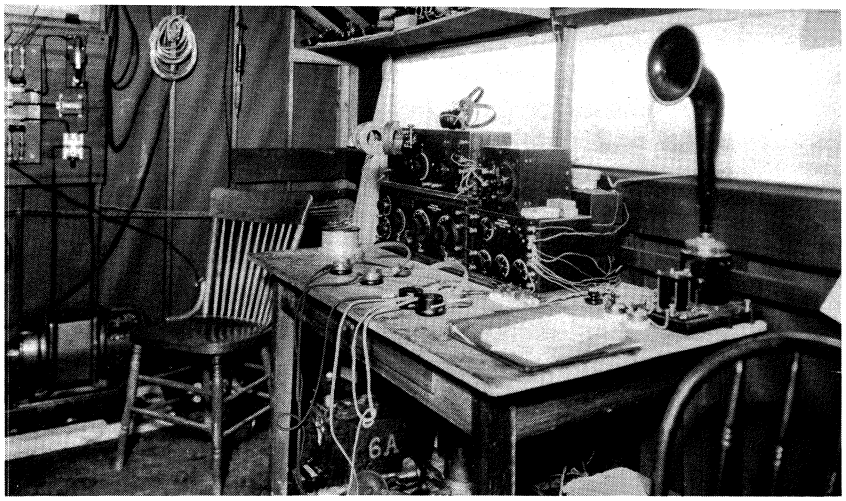
THE TRANSMITTER

At Major Armstrong's insistence, a decision was made to use a MOPA or master-oscillator type transmitter with pure DC on the plates. With few exceptions, all tube-type transmitters of the period were self-excited oscillators with poorly regulated power supplies. A clean, steady CW signal would make ideal reception for Armstrong's super-heterodyne receiver which Godley used.



1BCG TRANSMITTER

Pictured here is the transmitter section of the shack. The four type "P" Radiotron UV204 vacuum tubes can be seen mounted on the center of the table, the oscillator tube on the right and the three amplifiers on the left. The oscillator circuit with ribbon inductance and mica condensers left foreground and the power amplifier variable plate tuning condensers rear center. A choke coil of the filter system is to the left of the plate tuning condensers just below the other keying relay mounted on the wall. Upper left -- counterpoise lead-in insulator, antenna coupling coil, radiation ammeter, and antenna leadin. The 2000 volt DC motor-generator set can be seen lower right and the filament transformer under the table left foreground. Note the electric fan for cooling the high voltage generator.



1BCG RECEIVER

This is the other half of the shack showing the receiver section. The short-wave Paragon RA 10 regenerative receiver and amplifier are on the table right center. The long-wave set for copying the nightly reports from WII is mounted on top of the Paragon. The small cabinet to its right contains the frequency monitor. The sending key and the two transmitter power control switches can be seen at the right in front of the Magnavox loud speaker.

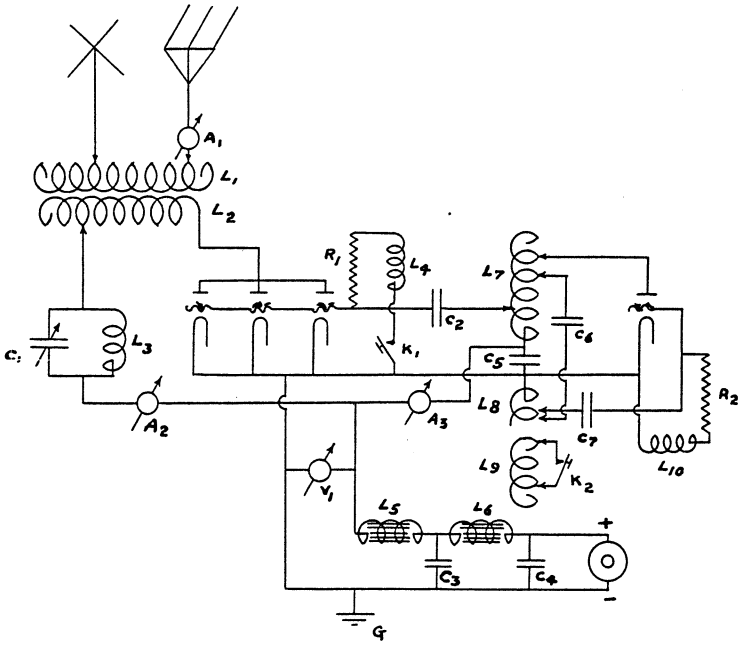
Pictures show that the transmitter was a mess of haywire which is not surprising considering the time available to get it together.

There was a problem with the MOPA circuit; neutralization had not been perfected so it was difficult to feed the oscillator output into the RF amplifier without developing all kinds of spurious oscillations and over-heating. The greatest challenge, however, was keying the transmitter.

The problem finally was solved by keying both the oscillator and the amplifier simultaneously. This was accomplished by grid-keying the amplifier and keying the oscillator frequency. Frequency-shift keying reminds us of keying the old arc transmitters by changing the wavelength, thereby producing a backwave.

In retrospect: Club members were wise in selecting RCA's high-power 250 watt UV-204 or "P" tubes. One tube was used as an oscillator driving the other three in parallel as RF amplifiers. An ESCO motor-generator set supplied 2200 volts DC for plate voltage.

A steady DC supply insured a far better note than could a primitive AC power supply. Was this a wise choice, or was the motor-generator set the most readily available? We're inclined to believe that it was a wise decision.



1BCG Transmitter Circuit

Armstrong's description of the agony of trying to tame the un-neutralized MOPA is a classic. Numerous changes were made in both circuit design and components before they produced a steady note. Looking at the picture of the transmitter, one sees all four tubes tightly grouped together with little separation between the oscillator and the amplifier. The RF amplifier plate coil is mounted some distance away on the ceiling, with long leads. One wonders whether a better physical layout of components would have lessened the instability and keying problems.

THE RECEIVING STATION

Paul Godley could not have selected a finer receiver for his transatlantic reception. Most receivers of the period were regenerative detectors with one or two stages of audio. Godley used a super-heterodyne receiver especially designed by Armstrong, with one of his own Paragon receivers as a backup. Much of his success must also be attributed to the terminated long-wire Beverage antenna pointed toward the States. After 70 years, present-day low-band DX-ers still prefer the Beverage antennas.

ROBERT M. MORRIS, W2LV, REMEMBERS 1BCG

I am happy to be able to say that I am one of those who heard 1BCG during December 1921. I was in my second year of engineering at the Case School of Applied Science, in Cleveland, was rooming with Jack Victoreen (Amateur station 8ACH), and had access to his shop at that time. I was also a member of the Cleveland Radio Association. Although I was not yet licensed, I had ample access to information regarding the ARRL transatlantic tests. I probably used the receiver at 8ACH to listen to 1BCG; this would have been a 3-circuit regenerative tuner with two variometers and a variocoupler.

While my memory of the details are vague, my principal recollection is that the signals were unusually strong for signals from Connecticut being heard in Ohio. The signals were good CW signals but not "pure DC". Perhaps there had been some slight modulation caused by AC on the filaments. I very much wish that there were audio recordings of 1BCG signals. I feel sure that 1 BCG did much to popularize and encourage the use of CW at a time when spark was still dominant.

Another station active in the 1921 tests was that of Radio Club member Harold Beverage whose station 2BML was widely heard during the tests. Bev was not the operator since he had gone to England aboard the Aquitania on the same crossing as Godley. It was fortunate that happened since it made it possible for Bev to give information to Godley regarding the new "wave" antenna. Godley built such an antenna at Ardrossen and used it almost exclusively for his remarkable reception of American Amateurs' signals.

2BML, located in Riverhead, Long Island, used a "T" type antenna quite similar to that used by 1BCG. The transmitter used a pair of 250 watt G.E. Pliotron tubes as oscillators fed by Kenotron-rectified high-voltage AC. This station was successful in the transatlantic tests using two calls: 2BML and 2EH operated by members of the new Radio Central staff of RCA, at Riverhead, Long Island. It is understood from Harold Beverage that Roland Bourne (later W1ANA) was the operator of 2BML during the tests.

IN RETROSPECT: Summary

The transatlantic tests proved:

1. The practicability of low-powered communication on short wavelengths.

2. The effectiveness of CW vacuum-tube transmitters over spark transmission.

3. The effectiveness of Armstrong's superheterodyne receiver with Harold Beverage's antenna for reception.

Lastly, the building and operation of 1BCG displayed a spirit and camaraderie seldom seen today. A tribute to the team's effort and success is a memorial monument erected in 1950 on the Greenwich, Connecticut station site.

The Club still has available a few copies of The Story of the First Trans-Atlantic Short Wave Message *published as the "1BCG Commemorative Issue" of the* Proceedings *in October 1950. They are priced at $ 5.95. Orders should be sent to Radio Club of America, Inc., 45 South Fifth Street, Park Ridge, NJ 07656, with the covering payment. Please note that* The Proceedings *show small watermarks resulting from their storage.*

The station building at 1BCG and five of its owners. Left to right: Messrs. Amy, Grinan, Burghard, Armstrong, Cronkhite. Mr. Inman is missing in this photo.

THE HERITAGE OF EDWIN HOWARD ARMSTRONG

by **Frank A. Gunther, W2ALS**
(LF & Director Emeritus)

Presented at The Radio Club of America's 81st Anniversary Dinner & Awards Presentation and Major Edwin H. Armstrong Commemorative Banquet , November 16, 1990

Mr. President, Officers and Directors of The Radio Club of America, Honorees, newly-elected Fellows, members and guests:

I am deeply honored to have been selected by the Club's Board of Directors to speak to you on this important occasion...all the more so since there are others more capable than I to speak on this subject.

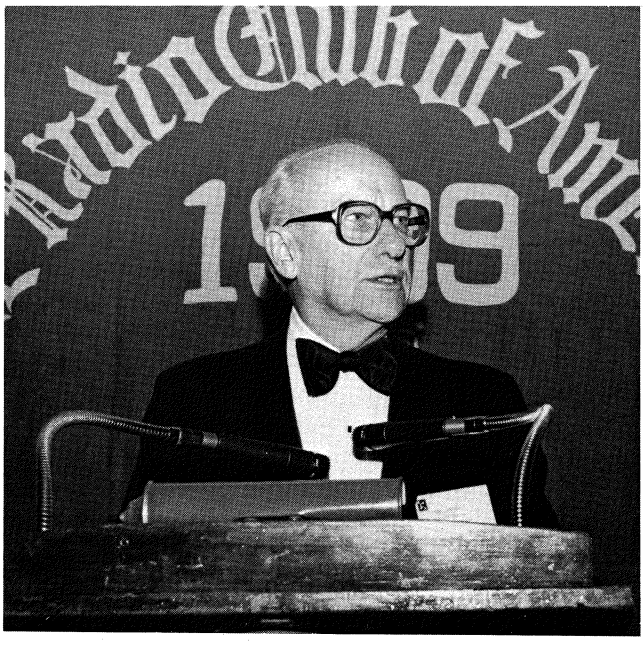
Early on, John Morrisey suggested that this talk should be titled "The Heritage of Edwin H. Armstrong" so, therefore, I shall try to keep my comments in that theme.

The art of invention or discovery generally brings with it frustration, resistance and outright opposition from the entrenched interests...the more revolutionary the discovery, the more the opposition. The greatness of Howard Armstrong's inventions can best be judged by the fact that he endured more opposition in his lifetime than perhaps any other.

To help me illustrate that fact, let me first tell you about two other hero inventors of mine. First, the Wright brothers and then Dr. Robert Goddard, the rocket pioneer.

When the Wright brothers first flew a heavier-than-air machine successfully at Kitty Hawk, North Carolina in 1903, the next day *The New York Times* editorial stated: "If God had meant man to fly, He Would have given him wings." As for the Wright brothers who did something no other human had done before, they were sure of only one thing... they were not going to have a mid-air collision.

In the late thirties, Dr. Goddard thought that he had a revolutionary device with his small rockets. In order to test one, he secured permission to use his Aunt Effie's farm outside of Boston. The first attempt witnessed by the press ended in a flight of 184 feet and the rocket landed on the roof of his aunt's barn which immediately was set afire.



Frank A Gunther

A young Boston news reporter said to Dr. Goddard: "You seem to be having a lot of trouble, sir." Dr. Goddard replied: If anyone else had tried this before, I wouldn't be having any trouble at all."

Further, the editorial of a Boston paper stated that there was no future to this rocket stuff...why every high-school student knew from physics' class books that rockets could not go forward at high altitudes because the air had no resistance against which the rocket could push forward.

In our country, for many years, no one took Goddard seriously. The Nazis in World War II did -- with their devastating V1 and V2 rockets. Today, Dr. Goddard's dream appears in the form of the space shuttle: 184 feet long, 76 feet high, 78 feet wide with a lift-off weight of 4,500,000 pounds. At launch, the orbiter's three liquid-fueled engines and two solid-propellant rocket boosters burn simultaneously; together, they generate 7 million pounds of thrust at lift-off.

In the case of Armstrong, things became very much more complicated than those of the Wrights or Goddard. Certainly, this was the case with his last great discovery of wide-band frequency modulation for this was not only novel but was very upsetting to an entire well-established industry: AM broadcasting.

Our Radio Club was and is the home of numerous inventors and pioneers in the communications industry and, as in any democratic type of society, there is the possibility of division of opinion and I sense that this still exists in the Club today.

However, for the record, let me state that Howard Armstrong loved our Club, was a former president, a large contributor to its finances during times of need, and it was the one place in which he felt most comfortable. This was for two reasons: first, because he always took great interest in the Club and, secondly, because at all Club meetings commercialism was reduced to an absolute minimum and he felt that he could speak freely.

To help illustrate the great importance of Armstrong's discoveries to all of us, let me briefly explore radio communication's growth in the past century.

For one thing, the growth was not uniform but grew in some rather large quantum jumps which coincided with the announcements of Armstrong's discoveries. Prior to 1913 when radio-telephony and loudspeakers were unknown, communication was confined to the transmission of the continental Morse code which could be heard in headphone whispers, and where the strength of the signal was completely dependent upon the amount of energy that could be captured by the receiving antenna from the passing electromagnetic wave. That energy, and that alone, was all that was available to move the diaphragm of the receiving headphones. In order to hear weak signals, it was necessary to use painfully-tight telephones, frequently with the equally uncomfortable necessity of holding one's breath for prolonged intervals.

In 1912, it is safe to say, 99.9 percent of radio communication was carried on with spark transmitters, and rectifying (crystal or Fleming valve) or magnetic detectors. Not a tenth-of-one-percent of the stations made use of the deForest audion (triode) and those that did use the audion were mostly stations of the Amateurs. And it will be still more difficult to grasp the incredible fact that the three-element vacuum tube (audion) had been invented six years before this period, and yet lay idle, neglected, and almost forgotten.

The reason for this unbelievable situation lay in the following set of facts.

The inventor of the audion never understood the operation of his device nor did anyone else in radio, for the idea that there might be such a thing as an electron discharge had not penetrated into the art. As a result, some weird theories of the operation of the audion were advanced.

With the art in the state just described, there came Armstrong's invention of the regenerative circuit in 1912. That circuit nor only amplified the incoming radio frequency currents and increased the sensitivity of the receiver hundreds or thousands of times but also, by reason of its ability to generate continuous-wave oscillations with a stability and uniformity thereto unknown, brought heterodyne reception to commercial perfection and ushered in a new era in long-distance communication.

In 1913, it had become possible in New York City, with an antenna of Amateur dimensions, to receive spark or CW signals from European stations as well as continuous-wave signals from the west coast of the United States and from the Hawaiian Islands, and to demonstrate regularly such reception.

I wish to correct any misapprehension some may have that this description of conditions prior to 1912, was first hand. This came from a much higher authority -- it was taken from Edwin H. Armstrong's own paper delivered before our Club in 1948.

Incidentally, the demonstrations referred to wherein Armstrong could receive signals at heretofore unheard distances with much greater volume, lead to one given to the principals of the American Telephone & Telegraph Company. These disclosures brought AT&T (which was solely in the wire business) into the field of communication by radio and thus began the never ending expansion that has resulted in the amazing organization of today.

I believe that Armstrong's first discovery in 1912 of the regenerative receiver and oscillation with the vacuum tube played the largest part in the first explosive growth in the industry and thus spawned the broadcast era. Now with the great increase in the use of the relatively-same

radio-frequency spectrum, the limiting factor to its use was the limits of selectivity of the receivers. Here again, Armstrong's invention of the super-heterodyne not only solved the limiting problem but produced a receiver that was very much more sensitive than heretofore. This brought about still further growth in the industry.

It is interesting to note that when Armstrong demonstrated this superheterodyne to David Sarnoff, then Vice President of RCA, an Honorary Member of our Club (1926), and to his chief engineer, Dr. A. N. Goldsmith, also an Honorary Member of our Club (1922) who was highly regarded in the industry, Dr. Goldsmith stated that while the receiver did evrything that Armstrong claimed, it would not come into popular use because it was too complicated for the public to operate.

On the other hand, many years later, Dr. Harold A. Wheeler, an Honorary Member of our Club (1983) and a distinguished inventor in his own right, stated that Armstrong's invention of the super-heterodyne was very extraordinary and that it never would become obsolete.

However, natural static still was with us and with the growth of many industries with all of their accompanying machines and products, radio communication was further burdened by man-made static in addition to the natural or lightning static. All the leaders in our industry at that time believed that static and man-made noise would always be with us.

In 1932, the mobile radio business made its feeble start with the installation of many two-way radios in police cruisers. The first such installation was made in the City of Bayonne, New Jersey.

Here, again, Armstrong's invention of the super-regenerative receiver made all of this possible. Although the receiver never exhibited great selectivity, it was extremely sensitive and had inherent automatic volume control characteristics; it was simple and it employed only three vacuum tubes. This latter fact was important since, in those days, car batteries were of the six volt variety and the battery system wasn't designed for very much more of a load than needed to start the car, operate the lights and, when necessary, to blow the horn.

When the City of Bayonne let bids for procurement of this revolutionary system of police radios, Harold Vance, then Vice President for one-way police radio for the Radio Corporation of America, wrote a letter to the mayor stating that this new two-way radio never would come into popular use because the antenna whip would give-away the police cruiser to the criminal.

Finally, Armstrong's demonstration of wide-band frequency modulation in November 1935 proved to the world that the problem of natural static and man-made noises had essentially been conquered. Thus came about the greatest explosion in communication history.

This took longer than it should have, first by the resistance brought forward by the endowed interests headed by R.C.A., and then furthered by the advent of World War II. Here it is important to point out the character of the man Armstrong.

Without hesitation, and against the advice of every one of his attorneys, he offered his FM patent rights free of charge to the U.S. government for the duration of the conflict. What a God-send that decision turned out to be; this eliminated the patent royalty problem to be considered when and if large volumes of equipment had to be manufactured for the duration of the war.

However, in spite of Armstrong's gesture in eliminating the patent royalty problem, converting the Army to FM from AM was not a simple and easy task. There were people in the Signal Corps itself who gave long arguments against FM.

Colonel Colton's report in 1940, as Director of the Signal Corps Laboratories at Fort Monmouth, New Jersey, made a point of the lack of funds that had prevented any development of FM. He passed up an opportunity to send an observer to New York in April for a special test of the Armstrong equipment despite the fact that his superior, General Mauborgne, had thought it a good idea -- thus neither in the Washington, DC headquarters nor at Fort Monmouth was the Signal Corps extraordinarily alert to the possibilities of frequency modulation.

Meanwhile, 28 FM mobile radios were designed and manufactured by REL - Radio Engineering Laboratories, Inc., of Long Island City, New York, and loaned without charge by Armstrong to the U.S. First Army for use in their summer maneuvers of 1940. Suffice to say, the FM equipment outperformed the Signal Corps' regular AM radios by very wide margins and, at once, intensified the demands from the field that the Army change over to FM.

It should be noted here that a young captain in the U.S. Army Signal Corps Reserve, the late David Talley, a Director Emeritus of our Club, was instrumental in making many of the arrangements for these tests. I am sure that he would have liked to have been with us this evening, for Dave and I have talked many times over the years about that very successful event.

There was, nevertheless, a long struggle within the Signal Corps before FM finally was approved and the go-ahead was given so that large scale manufacturing could begin by the Link Radio Company, the Western Electric Company, Motorola, and others.

It is important not to forget that through the history of that Signal Corps decision, that Major Armstrong was involved with offers of equipment, advice and consultations -- truly a great contribution and one that finally brought about the choice of FM's use in military mobile radio.

One generally hears tributes to radar and, to a lesser degree, to Loran with credit for shortening World War II, and rightfully they should be. Let me suggest that Armstrong's invention of FM definitely should be included in that same category. In the U.S. Army's history of the Signal Corps in World War II, there are many references of commanders and troops alike stating that their FM radios permitted them to perform actions faster and better than could the enemy.

In 1946, just after World War II, the U.S. Army Signal Corps Laboratories at Fort Monmouth opened the World of Outer Space Communications with Project Diana wherein their radar received echos from the surface of the Moon. It should be noted that Colonel Jack DeWitt and E. K. Stodola, both Fellows of our Club, were a part of the small group of scientists that accomplished this feat. Finally, again it was Howard Armstrong who donated the know-how and essential components of the FM receiver used in that project. The hardware was taken from an FM radar on which he had previously worked.

The tests proved for the first time that man could communicate by electronic means through outer space. The Moon, and the artificial satellites of the future, could serve man's interests and so we come to the present, the last decade of the 20th Century.

The communication business has exploded many fold from wireless to radio to television to telecommunications. Call it what you will, it will encompass many separate industries within it:
Ships-at-sea and all other types of marine radio;
Broadcasting including stereo and other forms of multiplexing;
Television with its FM sound;
Aircraft radar FM altimeters;
Microwave systems;
Mobile radios for all types of users;
Space communications;
Paging;
Cellular telephones.

The common thread that made these possible were Edwin H. Armstrong's four basic discoveries. Had not Armstrong in his patriotic duty to our country, offered his FM patents royalty-free for the duration of World War II, it is conceivable that the same established interests would have further persisted in confusing the road to technical progress.

I know from personal experience when the F.C.C. set up the Radio Technical Planning Boards to set future technical standards for the post-war industry, one of the committees upon which I served called for the setting of standards for television. It was during this time that the decision was to be made whether the sound portion of TV broadcasting was to be amplitude or frequency modulation.

Raymond Guy, then Chief Engineer of NBC -- undoubtedly with directions from R.C.A. then the mother company of NBC -- fought very hard in favor of AM sound notwithstanding the fact (I am convinced) that he along with the other engineers knew full well the advantages of FM over AM. Thanks to enough independent-thinking members of that committee, FM won out over AM by a narrow margin of two votes out of a total of about 33.

In another nine short years, we shall begin the 21st Century. I would hope that our Club will be in the forefront to help educate the young people of that time, about the heritage left to us and to all of them by Edwin H. Armstrong, one of The Radio Club of America's own sons.

When we visualize the tremendous use of FM in all forms of communications, we gain some idea of the impact that this invention has on the entire world as well as its benefits to our own nation. To us, this alone should be a perpetual memorial to the great inventor, Major Armstrong, and an indestructible legacy from him to all peoples of the Earth.

However, we should deal with the Major's accomplishments in proper perspective and not restrict our consideration solely to the parochial vein of FM broadcasting as is so often done. I repeat that without the regenerative circuit devised by him, radio might have remained an interesting speculation just as it was in 1912. The same circuit became the general basis for the superheterodyne circuit which, today, has become the foundation of practically all radio receivers regardless of the type of modulation employed.

In 1922, Armstrong also invented the super-regenerative circuit which enjoyed wide use in radio receivers for a relatively short time in making two-way police radio communication possible. Despite its lack of selectivity, it was another important step in the development of radio.

It is my personal opinion that the super-regenerative principle may still prove to be a most useful basis for future developments in radio, and that it should not be written off the book as an obsolescent development.

When all of his inventions and other contributions to radio communication are viewed in relation to the benefits accruing to mankind today, I think you will agree with me that Major Armstrong's genius has done more to advance the science of wireless communications than that of anyone else since Marconi harnessed electromagnetic waves and initiated the true era of radio communications.

While those of us close to the industry may be conscious of the value and importance of the Major's work, the general public recognizes only vaguely that he invented FM broadcasting, and has little knowledge of the broad contribution that he made to all types of radio communication, and how dependent the development of them rests on his solid accomplishments.

Lastly but of no less importance, I would trust that our Club, The Radio Club of America, honor its former president by perpetuating the exemplary principles he exhibited so clearly and with so much integrity in his way of life, and in his methods of working. At this gathering, tonight, I would hope and trust again that we carry out this particular objective, and pay him the honor which is his due.

Everyone of us in this Club owes a part of his or her fortune be it small, medium, or large, to the genius of Armstrong. I might add that everyone in the entire world-wide communication industry owes part of his or her fortune to the genius of Armstrong. In fact, his discoveries have affected in a positive way, all mankind forever.

I am sure that we are united at this moment in paying the highest tribute to our friend and former Club member, formost genius of radio communications in this century, a sincere patriot and a man of lofty character: Major Edwin Howard Armstrong.

What a heritage he has left us all.

* * *

Frank A. Gunther was an associate of Major Edwin H. Armstrong for nearly a quarter of a century during which time, he was intimately involved in Armstrong's battle to develop FM - frequency modulation.

Gunther then was Chief Engineer of Radio Engineering Laboratories (REL) and led in the design and installation of the world's first two-way mobile radio systems starting with that of the Bayonne, NJ Police Department (1930 - 1935), to be followed by the installation of nearly every pioneer FM broadcast station (1934 - 1955). During World War II, he directed the successful design and manufacture of all LORAN transmitters used by the Allies.

He was elected president of REL in 1961 when REL was developing, manufacturing, and installing nearly all of the world's first tropospheric scatter systems employing advanced FM technology, for the accounts of the U.S. Air Force, Army and Navy. Retiring in 1970 as president of REL and Executive Vice President of Dynamics Corporation of America, he remains a member of the Board of Directors of Dynamics Corporation, and is president of Highpoint Enterprises, Inc.

Mr. Gunther is the recipient of the Distinguished Service and Meritorious Service Awards, and the Medal of Honor from AFCEA; he served as its president (1961 - 1963) and is a Distinguished Life Member and Permanent National Director. Active in Amateur radio with the call of W2ALS, he is a former president of the Quarter Century Wireless Association. He was awarded the deForest Audion Award from the Veteran Wireless Operators Association in 1969.

He was elected to the grade of Life Fellow of the IEEE in 1964 for contributions in the fields of UHF and VHF communications and leadership in communications practice. During 1956 - 1958, he served as president of The Radio Club of America, and presently is a Director Emeritus. He was awarded the Club's Armstrong Medal in 1970, the Henri Busignies Memorial Award in 1986, and the Fred M. Link Mobile Radio Award in 1987. In 1991, he was awarded The Bronze Order of Mercury from the United States Signal Corps Association.

He was a founder and president of the Armstrong Memorial Research Foundation, Columbia University.

THIRTY - ONE MEMBERS BECOME FELLOWS

Twenty-two of the thirty-one members who were elected to the Grade of Fellow were present at the Annual Awards Dinner and received their plaques from the Club's president, Mr. Fred M. Link.

Eighteen of those attending the Awards Dinner appear in the photograph above. Seated (L. to R.): Frank M. Butler, Jr., Fort Walton Beach, FL.; Jack G. Hofeld, Coronado, CA.; Thomas R. Poor, Bakersfield, CA.; Elaine D. Baugh, Englewood, CO.; Thomas A. Stroup, Alexandria, VA.; Robert M. Morris, Sparta, NJ.; Francis L. Fuson, Sr., Las Vegas, NV.; and Melvin E. Parkinson, Levelland, TX.

Standing (L. to R.): Louis Tischler, Westfield, NJ.; Joseph J. Fairclough, Sea Cliff, NY.; Gerald L. Agliata, New Rochelle, NY; Hugh A. Turnbull, College Park, MD.; Gilbert R. Houck, New Cumberland, PA.; Ronald Formella, Glen Rock, NJ.; Bertram C. Erickson, Waseca, MN.; Nicholas W. Diamond, Eden Prairie, MN.; Robert E. Sirls, Fountain Hills, AZ.; and Stephen A. Mendelsohn, Dumont, NJ.

1990 Fellows not in photograph: John E. Balint, Eugene, OR.; Robert J. Hajek, Riverside, IL.; Donald L. Huebsch, Los Angeles, CA.; J. Peter Maehling, Pittsburg, PA.; Gerald T. Martin, North Miami, FL.; George W. Murray, Lake City, GA.; John W. Obradovich, Camp Hill, PA.; Louis Rabinowitz, Long Beach, NY.; Joseph R. Schaap, Brookville, MD.; N. Arthur Sowle, Reno, NV.; and Frederick E. Witt, Cobleskill, NY..

HUGH A. TURNBULL RESPONDS FOR FELLOWS

Mr. Hugh A Turnbull, W3ABC, was elected a Fellow of The Radio Club in June 1990 in recognition of his outstanding work in the field of Amateur Radio Communications, and for his leadership in the scholarship program of the Foundation For Amateur Radio.

President Link, distinguished members of The Radio Club of America, Ladies and Gentlemen:

Once again, the Club recognizes the professional contributions of its members by conferring upon them the Grade of Fellow. This year, there are 31 of us, and it is my pleasure to respond for the Class of 1990.

While more than half of us so honored can trace our careers back to the time when we became licensed radio Amateurs, all of us share the advantages offered by the finest educational system in the world. Tonight, we are delighted and proud to be recognized for our personal accomplishments.

Slightly more than a half a century ago while attending my college fraternity's Founder's Day dinner, the future looked rather bleak -- not much different from today. Banks were in trouble; unemployment was high; and there were several areas of unrest around the globe. The speaker attempted to provide some encouragement as we looked to an uncertain future. His name has long since been forgotten, but his brief message has not.

It went something like this: "Look up -- not down; Look forward -- not back; Lend a hand." That simple theme has continued to remind me of the responsibilities borne by those of us who took advantage of the opportunities which the system offered. It was a good philosophy to follow not only as a radio Amateur but also as a profressional starting a career. In all proability, similar guidelines were followed by each one in this year's Class, thus accounting for the many fine individual achievements that are being noted here.

HUGH A. TURNBULL

No doubt the paths which brought us here this evening have crossed many times. It is even possible that some of those present may have witnessed a few of us start our careers. As mentioned earlier, involvement in Amateur radio played an important role in the lives of more than half of this year's Class. Three of us, with completely different professional backgrounds, serve as volunteers on the 15-member Board of Directors of the American Radio Relay League. I am proud to serve on that team. Together we represent almost a half-million licensed radio Amateurs and provide the necessary leadership that determines the policy decisions in the domestic, international, and technical arenas associated with Amateur Radio Service.

All thirty-one of us being honored as Fellows this evening sincerely thank you. As we look up, as we go forward, helping others along the way, we hope you will continue to be as proud of us as we are of you.

The annual meeting and banquet commemorating the 81st anniversary of The Radio Club of America and the centennial of the birth of Major Edwin Howard Armstrong was held on Friday, November 16, 1991 at the New York Athletic Club. Two hundred and fifty members and guests attended.

Mr. Frank A. Gunther, *Life Fellow and Director Emeritus* was the keynote speaker at the banquet and addressed the audience on "The Heritage of Edwin Howard Armstrong."

The annual meeting held during the afternoon included a technical and historical seminar directed by Stuart F. Meyer, *Executive Vice President.* The speakers were Dr. Thomas S.W. Lewis (F), Bruce Kelley (F), Jerry B. Minter (LF and Director Emeritus), and Hugh A. Turnbull (F). A reception for members and guests followed. The meeting concluded with the formal announcement of the election of directors for the 1991 - 1992 tenure.

The achievements of 31 members of the Club were recognized by their advancement to the Grade of Fellow. Eighteen were present at the Awards Dinner and received plaques from President Fred M. Link.

Awards and Citations were made to Club members for distinguished services to the art and science of radio communications. Those receiving recognition were: John D. Goeken (F) - Sarnoff Citation; Alexander A. McKenzie - Pioneer Citation; Robert M. Morris - Jack Poppele Broadcast Award; Raymond C. Trott - Fred M. Link Award; Brother J. Patrick Dowd, F.S.C. - Ralph Batcher Memorial Award; William G. Donaldson - Henri Busignies Memorial Award; Donald G. Fink, P.E. - Allen B. DuMont Citation; Mrs. Marguerite E. Warshaw - Lee de Forest Award; Jay R. Huckabee - Special Services Award; and John W. Morrisey, P.E. - President's Award.

Once again, the success of the meeting, reception, and banquet resulted from the generous contributions of 26 industry sponsors and friends of the Club plus the hard work of the Banquet and Meetings Committees.

FELLOWS - 1990

The following members were elevated to the Grade of Fellow in The Radio Club of America in recognition of their achievements in furthering the goals of the Club, and are here Cited:

Gerald L. Agliata, WA2WPR, (M 1979, S 1989, F 1990) - President and CEO of mobile telephone system.

John E. Balint, (M 1987, F 1990) - Retired communications engineer.

Ms. Elaine D. Baugh, (M 1983, F 1990) - Group Publisher of radio communication magazines.

Frank M. Butler, Jr., W4RH, (M 1985, F 1990) - Retired electronics engineer.

Nicholas W. Diamond, (M 1986, S 1990, F 1990) - Applications Engineering Manager.

Alan S. Douglas, (M 1979, F 1990) - Designer of oceanographic research equipment.

Bertram C. Erickson, (M 1984, F 1990) - Technical writer.

Joseph J. Fairclough, WB2JKL, (M 1986, F 1990) - Teacher and amateur radio program director .

Ronald Formella, (M 1987, F 1990), - Senior marketing representative.

Henry L. Fowler, Jr., W2FQF, (M 1956, LM 1988, F 1990) - Retired engineer.

Francis L. Fuson, Sr., (M 1977, F 1990) - Retired founder and company president.

Robert J. Hajek, W9QBH, (M 1973, F 1990) - Senior telecommunications engineer.

Jack G. Hofeld, (M 1980, F 1990) - Retired vice president and general manager.

Gilbert R. Houck, W3BXO, (M 1985, F 1990) - Frequency control consultant.

Donald L. Huebsch, (M 1986, F 1990) - Telecommunications engineering manager.

J. Peter Maehling, W3TQO, (M 1983, S 1987, F 1990) - Founder of company and president.

Gerald T. Martin, K4DI, (M 1983, S 1987, F 1990) - Retired corporation president.

Stephen A. Mendelsohn, WA2DHF, (M 1985, F 1990) - Broadcast engineer.

Robert M. Morris, W2LV, (M 1989, F 1990) - Retired broadcast engineer.

George W. Murray, WB4DYQ, (M 1986, F 1990) - APCO president.

John W. Obradovich, W3IS, (M 1978, F 1990) - Radio telecommunications specialist.

Melvin E. Parkinson, (M 1983, F 1990) - Founder, president and CEO of electronics company.

Thomas R. Poor, (M 1979, F 1990) - President, mobile radio communications company.

Louis Rabinowitz (LM 1983, F 1990) - Retired motion picture sound mixer.

Joseph R. Schaap, K4IWF, (M 1985, S 1986, F 1990) - Commander of TV production unit.

Robert E. Sirls, (M 1971, F 1990) - General Manager, mobile radio sales organization.

N. Arthur Sowle, W7CX, (M 1983, S 1987, F 1990) - Retired police captain.

Thomas A. Stroup, Esq., (M 1987, F 1990) - President, Telocator.

Louis Tischler, W2EMM, (M 1965, F 1990) - CEO and Chairman of computer marketing company.

Hugh A. Turnbull, P.E., W3ABC, (M 1988, F 1990) - Retired professional engineer.

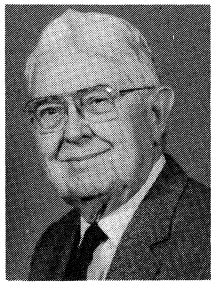
Frederick E. Witt, K2HUY, (M 1961, LM 1988, F 1990) - Retired associate of Major Edwin Howard Armstrong.

SARNOFF CITATION
John D. Goeken

Awarded in recognition of his significant contributions to the field of voice and data communications.

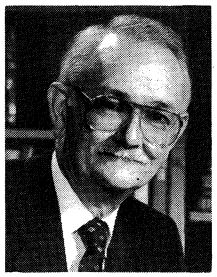
PIONEER CITATION
Alexander A. McKenzie

Awarded in recognition of his pioneering in the field of LORAN.



JACK POPPELE BROADCAST AWARD
Robert M. Morris

Awarded in recognition of his contributions to the early develment of radio and television broadcasting.



FRED M. LINK AWARD
Raymond C. Trott, P.E.

Awarded for his significant contributions to the advancement of land mobile radio communications.

RALPH BATCHER MEMORIAL AWARD
Brother J. Patrick Dowd, F.S.C.

Awarded in recognition of his work in preserving the history of the vacuum tube through the establishing the museum at Manhatten College.

HENRI BUSIGNIES MEMORIAL AWARD
William G. Donaldson

Awarded in recognition of his work in pioneering tropospheric and ionospheric forward scatter communication systems.

ALLEN B. DuMONT CITATION
Donald G. Fink, P.E.

Awarded in recognition of his leadership in the development of monochrome, NTSC color, and high-definition television.

LEE deFOREST AWARD
Marguerite E. Warshaw

Awarded in recognition of her long-time work in presenting the story of Dr. deForest and radio communications.

SPECIAL SERVICES AWARD
Jay R. Huckabee

Awarded in recognition of his help in bettering The Radio Club through the generous donations of computer equipments.

PRESIDENT'S AWARD
John W. Morrisey, P.E.

Awarded in recognition of his work in editing and publishing the Club's *Newsletters, Proceedings* and *Yearbooks.*

RADIO PIONEER - DR. HAROLD A. WHEELER

Under date of April 17, 1980, the Fiftieth Anniversary Issue of *Electronics* magazine was published. It was priced at $ 9.00 and contained 650 pages.

Eleven pages were dedicated to Great Innovators -- those men whose accomplishments in the field of electronics during the period of 1930 - 1980 were significant. One page told the story of Harold Alden Wheeler. Here is what it said:

"HAROLD ALDEN WHEELER

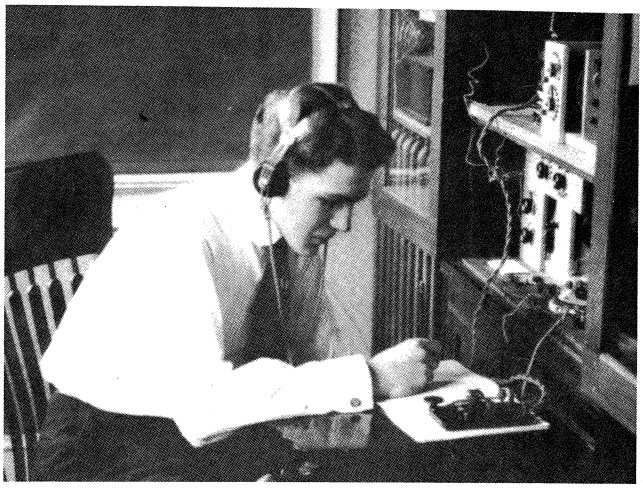
' "I was born in the year that the Wright Brothers lifted off the ground at Kitty Hawk," says Harold Wheeler. "That was two years after Marconi sent a radio signal across the Atlantic. Those events colored my learning years and destined me to pursue one of those avenues...In the seventh grade I elected radio, and I never swerved from that course."

'He began early -- the accompanying picture taken by his father in late 1920 shows him at 17 operating his homemade ham radio set. Soon after he met Alan Hazeltine, already a pioneer in radio receiver design: "He became my mentor; I was his understudy."

'The understudy, still in college, was the first employee of Hazeltine Corp. in 1924, beginning an association that lasts to this day. In the ensuing 55 years, Wheeler has made major contributions to radio and television receiver design and to microwave, radar, and antenna design. In fact, the mention of his name to a microwave engineer is likely to bring a response such as "Harold Wheeler! I was just reading a paper by him the other day."

'In the early days, Hazeltine Corp. was perfecting patentable innovations in receiver design that it licensed, often designing the units for the licensee. The starting point was Alan Hazeltine's neutralized radio-frequency amplifier, the basis for the Neutrodyne radio that dominated the market in the mid 1920s.

'Working independently, the teen-aged Wheeler had also dreamed up the Neutrodyne circuitry. He did not know of Hazeltine's work -- still quietly making its way through the patenting process -- and the parallel developments were a surprise to both at their first meeting. Hazeltine got the patent, but granted royalties to Wheeler, as well as taking him under his wing.



Harold Wheeler, 1920, at 3QK receiving first broadcast of Radio Market News Service.

'Meanwhile, Wheeler was hard at work, obtaining the first BS in physics awarded by George washington University and then taking graduate courses at Johns Hopkins University. Summers and spare time were spent at the corporation's first laboratory on the grounds of the Stevens Institute of Technology or in his own lab in the basement of his parents' Washington, D.C. home.

It was at home during the Christmas vacation of 1925 that Wheeler came up with the first practical circuit for automatic volume control on receivers. It was a marvel of simple design, because a single triode electron tube was connected as a diode for detecting the signal and for developing the bias voltage controlling the amplification.

' "I really didn't appreciate how good it was," says its inventor. "That came on gradually." For years, his invention served as the principal source of income for the corporation. Now known as automatic gain control, the basic circuit is still in use today, notably in AM radios and TV picture amplifiers.

'In the 1930s, television receiver design was the prime object of Wheeler's attention. Then heading Hazeltine's research lab in Bayside, N.Y., he was on his way toward garnering his present total of 180 patents. Among the many awards he also received over the years, the 1940 Liebmann Memorial Prize from the Institute of Radio Engineers for his TV work is particularly dear to his heart.

'The World War II years for the corporation were devoted to military electronics, notably radar development. They also marked a turn to

microwave and antenna research that continues to occupy him today.

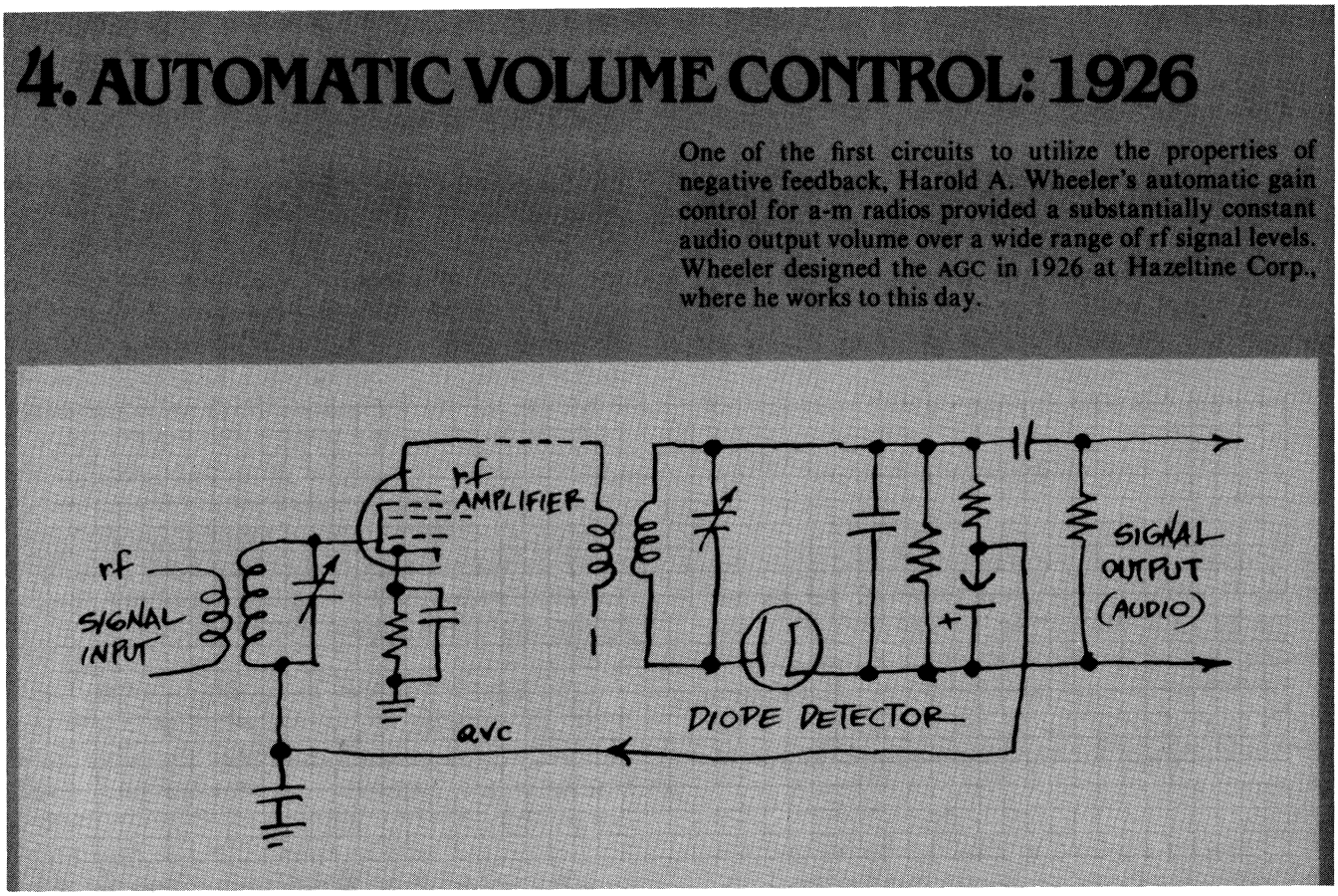
'In 1946, he left to form his own firm, Wheeler Laboratories, which did consulting research in communications. Hazeltine bought the labs in 1959, merging them into the parent research group in 1971. The purchase marked a new phase in Wheeler's career, for he served Hazeltine as chief executive officer in 1965 - 67 and as chairman of the board of directors from 1965 to 1977. He is still a board member and holds the title of chief scientist at the Greenlawn, N.Y. labs."

* * * * *

Another section of the commemorative issue of *Electronics* was titled "Classic Circuits." Therein, Wheeler's automatic volume control circuit was included amongst the twelve which were diagrammed. Prefacing the section, the editor commented:

"The growth of electronics as a group of industries has resulted from a complex of factors -- technical, social, economic, and political. But in the last reckoning, it has been the development of the circuits themselves that has made electronic communication and data processing possible.

'Although there have been many innovations over the years, all circuits actually trace their roots back to only a dozen or so, from which all else was created. Presented here are some of the great circuits, those that *Electronics* feels have been basic to the commercialization of radio, TV, and computers and other data-handling systems. The selection has been difficult, and others indeed might have been chosen, but *Electronics* believes that these truly innovative circuit designs would occupy a spot in just about everyone's all-star list."



Writing a short story about Harold Wheeler is both easy and difficult. This dichotomy comes about because so much already has been written about the man both in autobiographies and in reviews of his life and accomplishments -- and the need to select and compress the information into a capsule that can published in the limited space available in the pages of these *Proceedings.*

Wheeler has written two books that give complete details of his life prior to World War II: *Hazeltine the Professor* (1978); and *The Early*

Days of Wheeler and Hazeltine Corporation -- Profiles in Radio and Electronics (1982). Both books present clear and incisive information about Wheeler and his associates, and the work that they did in the pioneering of radio.

Born in St. Paul, MN in the few years between the flight of the Wright brothers at Kitty Hawk and the transatlantic reception of a wireless message by Marconi, Wheeler also had the fortune of having a father who had a scientific education.

During his early school years, an itinerant lecturer demonstrated the phenomenon of wireless by transmitting from one end of the stage to the other using a noisy spark transmitter to a coherer with a buzzer. Reading about aeroplanes and wireless, Wheeler decided to be wireless engineer.

After World War I, he began experimenting with radio receivers and to qualify for an operator's license, attended evening classes at the National Radio Institute where he qualified for a Commercial Operator's License (Second Grade). He built and operated amateur radio station 3QK and, during his college days at George Washington University, was a member of the Washington D.C. Radio Club.

With the advent of broadcasting in 1921, he became interested in receiver design for long-distance reception. A significant development was his father's interest in using radio for transmission of daily market reports relating to agricultural products, in his new position as Chief of the Market Information Division of the Department of Agriculture.

During the summers of 1921 and 1922, he was employed in the radio laboratory of The Bureau of Standards. He was responsible for publishing designs of simple radio receivers which anyone could build to receive market reports. At this job, Wheeler became aware of the need for a tuned radio-frequency (TRF) amplifier that would be free of oscillation.

During the second summer, he perceived a solution by using a closely-coupled reversed coil and an external capacitor connected to neutralize the internal coupling of the triode vacuum tube.

Wheeler's father was appointed as a member of the 1921 National Radio Conference which also included amongst its members Major Edwin Howard Armstrong, Dr. A. N. Goldsmith, John V. L. Hogan, Dr. C. M. Jansky, Jr., and Professor Alan Hazeltine -- all members of The Radio Club of America. Harold Wheeler attended the conference with his father, and was introduced to other members including Professor Hazeltine, the head of the Electrical Engineering Department at Stevens Institute of Technology..

Shortly afterwards, Wheeler was in Hoboken, NJ with his father. Lunching together, they were approached by Professor Hazeltine and invited to call on him during the afternoon. During the visit, Wheeler told Hazeltine about his neutralizing circuit. Hazeltine was surprised and told Wheeler that he had invented a similar circuit and filed a patent application, but had not tested it.

In 1923, he had summer employment with Hazeltine at the Stevens Institute of Technology, working on the newly-designed Neutrodyne TRF radio receiver. On April 20, 1923, Wheeler presented his first paper before The Washington Radio Club, describing the Neutrodyne receiver -- a five-tube set with two stages of tuned radio-frequency amplification with neutralization, a grid-leak detector, and two stages of audio-frequency amplification, all transformer coupled.

Late in 1925, Wheeler made the invention that he considered the most important of his career. It came to be called the diode AVC (automatic volume control) and linear detector. It came to be the keystone of the Hazeltine Corporation's patent portfolio, on which royalties carried the company in a growth mode through the Great Depression of the 1930's. It came into universal use in AM receivers; it carried over into the age of transistors, and even today shows no sign of obsolescence. It is an old-fashioned "analog" circuit that may not be superseded in the "digital" world.

On March 8, 1933, he addressed The Radio Club of America at its meeting at Columbia University. The subject was "The Emission Valve Modulator for Superheterodyne Receivers" which was published in the Club's *Proceedings* issue of April 1933. At another meeting of The Radio Club on January 14, 1943, Wheeler described the Smith hemisphere chart and its applications. An invited paper on the history of the Carter and Smith proposal was prepared by Wheeler for the Centennial Issue of the *IEEE Transactions on MTT,* published in August 1984.

Harold Wheeler had received the B.S. Degree in Physics from George Washington University in 1925. In 1972, the University recognized his achievements with the honorary degree of Doctor of Science. For his scholarly work on the life and achievements of Prof. Louis Alan Hazeltine, Wheeler was awarded the honorary degree of Doctor of Engineering from the Stevens Institute of Technology, in 1978.

Dr. Harold A. Wheeler *(right)* receiving the Pioneer Award from Mr. Frank A. Gunther

The Radio Club presented Wheeler with the prestigious Armstrong Medal in 1964, and with The Pioneer Citation in 1984. The Armstrong Medal award cited Dr. Wheeler as follows:

> "Although his contributions have been recognized by his professional colleagues in numerous pre-eminent awards, it is particularly appropriate that this year which marks the 25th Anniversary of FM broadcasting, the Armstrong Medal is awarded to one who also pioneered in the field of frequency modulation. His theoretical analysis of frequency modulated signals helped outline the boundries of this new discipline.
>
> "In forty years devoted to the radio art, Harold Wheeler has made substantial contributions by the theory of television systems, wide-band amplifiers, transmission lines, antennas, microwave elements, circuits and receivers. The awarding of this medal is in recognition of his rare talent in reducing to practice, for the good of all, the results of individual research."

Before World War II, Wheeler's activities were mostly related to the design and testing of receivers for AM, FM, and television broadcasting, plus all-wave receivers. He was in charge of the Bayside Laboratories of the Hazeltine Corporation from 1930.

During the War, he became active in antenna and microwave designs for IFF (Identification: Friend or Foe), an adjunct to all fire-control radars. After the War, these specialties were applied to the theory and design of phased arrays for radars.

Wheeler's postwar activities (1957 - 1971) were centered in the Wheeler Laboratories in Great Neck and Smithtown, Long Island. In 1959, the company became a subsidiary of the Hazeltine Corp., and was merged into the parent company's research laboratories in 1971. Wheeler was named Chief Scientist and remained active in that position until he retired in 1987 and moved to California.

Joining The Radio Club of America in 1935, he became a Fellow in 1936, a Life Member in 1971, and was named an Honorary Member in 1983. He was active in the Institute of Radio Engineers (IRE), serving as a Director in 1934 and again through the period of 1940 - 1945, and as Chairman of its Standards Committee. The IRE awarded him its Morris N. Liebmann Memorial Prize in 1940 for "his contributions to the analysis of wideband high-frequency circuits particularly suitable for television." He was elected to the Grade of Fellow of the IRE in 1935 and became an AIEE Fellow in 1946.

The IEEE awarded Wheeler its Medal of Honor in 1964 "For his analysis of the fundamental limitations on the resolution in television systems and on wide-band amplifiers, and for his basic contributions to the theory and development of antennas, microwave elements, circuits, and receivers."

Dr. Wheeler has received numerous other awards from the Microwave Theory and Technical Society, the National Association of Manufacturers, and the U.S Navy. He was elected to the National Academy of Engineering in 1986. He holds 180 U.S. patents and numerous foreign patents. He is a member of Sigma Xi, Tau Beta Pi, and Gamma Alpha.

RECOLLECTIONS #1 - MOBILE RADIO IN THE OLDEN DAYS

by **Stanly A. E. Harter, KH6GBX (F)**

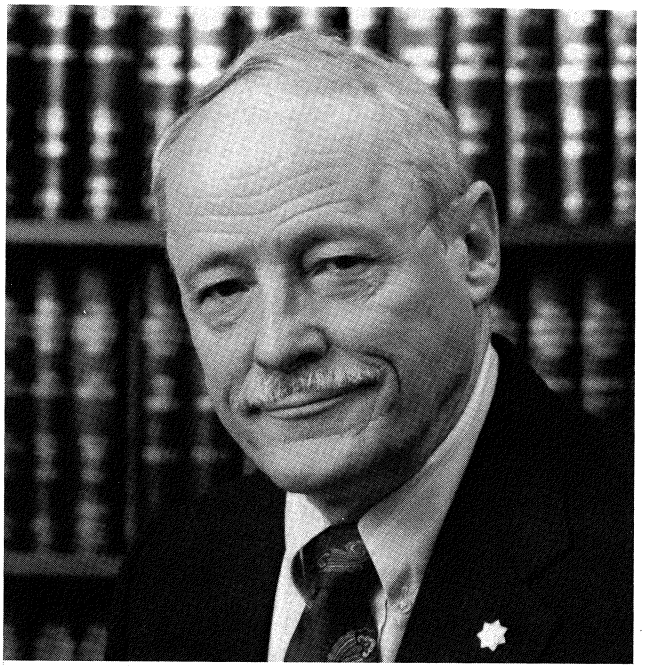
Too few Hams today know the joys of HF mobiling -- or the tribulations that went along with it 30, 40, or 50 years ago. I'm talking about the pre-SSB days...when amplitude modulation was king. Ten meters was big after World War II. The solar activity was such that with a couple of watts on ten, either AM or some converted FM tank radios, one could talk to the East Coast with ease. But I'm talking now about really "low bands" -- those between 2 and 5 megahertz.

In the early 50s, the Civil Air Patrol used HF for the majority of their fixed and mobile communications. Many of the CAP communications people, then as now, were Hams. The two HF frequencies in California were 2374 and 4585 (or 4507.5) kilohertz. The 2374 kHz channel was good only at night and was the mainstay for all communications between the Wing (state) headquarters on the Presidio of San Francisco and the "southern sector" in Los Angeles. The Wing Net Control Station was in a beautiful wooded section of the Presidio, in an underground bunker across the road from what now is the Army MARS station.

Conventional dipoles were used for 2374 and 4585. Our HF A.M. transmitter was the standard headquarters radio of the day, the venerable BC-610 built by Hallicrafters and others. The BC-610 put out 400 watts. In CAP, unlike Ham radio, transmitters are rated and discussed in terms of power output -- not input.

One day Major Clay Bernard, the director of communications, decided that we needed a better antenna to punch through the QRM created by the Los Angeles Police Department on their frequency close to 2374 kHz. Remember, even the best receivers were not too selective in those days. So, with the assistance of the Army Signal Corps, we somehow (don't ask) had installed a Beverage antenna on 2374 kHz that was ten wavelengths long. That's right, 3,940 feet long! It was aimed right at L.A, and probably provided the best 2 MHz signal over such a path anywhere, anytime. What did it do for receiving the LAPD signal in San Francisco? Why, better than ever, of course!

Other popular HF base stations in the CAP included the TCS-12. I don't recall the power output



Stanly A. E. Harter

but it may have been in the neighborhood of 75 watts. Many of us wished that we could have a Harvey-Wells TBS-50 but I, for one, couldn't afford it. The Harvey-Wells was a neat, 50-watt output transmitter that could be used mobile or fixed.

It still left you with the problem of what do you use for a receiver. In a fixed station, this was not really a problem. We had a choice of modifying no-cost military-surplus WW-II radios or commercial radios made by Hallicrafters, Hammarlund and National.

Mobile radios, however, presented a challenge. My first transmitter was a crystal-controlled (required by CAP) transmitter made by Lysco. Tiny -- it measured about 4" wide, 5" high, and 8" deep. It had three tubes and employed clamper tube modulation. This, in essence, allows you to use common audio tubes with virtually no carrier power until modulated to a 25-watt envelope.

This still left you with three more problems to solve: (1) A 6-volt DC dynamotor to develop the required 350-400 volts DC high voltage for the tubes ("What's a dynamotor, daddy?" What's a tube?") A

dynamotor, son, looks like an automobile generator -- uhh --- alternator, to you. When you squeeze the mike button to transmit, the dynamotor winds up to deliver high-voltage DC to the transmitter, the headlights dim, and a small car will lean to one side from the torque. Just kidding, son -- just kidding.

(2) A receiver. We usually went one of two ways. The most popular was to use a military surplus receiver. Yes. this too required a much smaller dynamotor to run ALL of the time to keep its tubes supplied with high-voltage DC. Another method was to build a converter for your broadcast receiver. I used both and preferred the converter approach because it had the lowest battery drain and utilized a better-than-surplus receiver. I improved the car radio receiver by designing and installing a simple squelch circuit. Gonset made an HF converter, too, as recall.

(3) The antenna. How many of YOU would like to haul around a 2 MHz skyhook, 365 days a year? Well, we didn't like it either. My playing with 2374 kHz mobile was short lived. I moved up to 4585 kHz.

I used a 45-watt tank transmitter that had what amounted to a dual 807 in the final. This time I scrapped the surplus junk image in my car by using a Motorola microphone and control head instead of the usual T-17 carbon mike. Turning it on automatically switched on the 4585 receiver converter through the broadcast receiver.

The transmitter and antenna tuner were in the trunk. The antenna was the heavy-duty ball joint-and-spring mount supporting a fiberglass antenna made expressly for CAP and the military by Bay Electronics in San Francisco. (I have asked around for 25 years what ever became of its owner Bob Harrell, and no one seems to know. Do you? He moved to Grass Valley in the sixties and dropped out of sight. He was the co-inventor of the GAM TG-2 broadband VHF gain antenna. I don't recall his Ham call.)

This leads me up to why I was asked to tell this story in the first place -- how did we tune the HF mobile transmitter for maximum radiated power? Most Hams would have a simple r-f absorption meter sitting up on the dashboard -- ugly as sin -- a junk-box meter mounted in an LMB box and a wimpy wire sticking out the top. Essential, of course, to the average Ham because he changes frequencies and bands. He tunes his transmitter, adjusts his tuner, and fine tunes the antenna. But when you're operating on just one assigned frequency, you can dispense with all that unpleasantness.

You put the transmitter and antenna tuner in the trunk of the car. It's important that the transmitter be tuned with the trunk lid down. This is done by using a step ladder, the ubiquitous r-f absorption meter, binoculars, an associate and a flashlight. It also helps to be either small of frame or get someone who is. I have long suspected that stoop shouldered Hams about my age had their share of stooping over and crawling into trunks of sedans.

You then find a field without any buildings, power lines or other metal for a hundred-yard radius. Set up the step ladder with the r-f meter on top. The rear of the vehicle faces the ladder. Crawl into the trunk and pull it almost all the way down, leaving only a crack through which to view the r-f meter with the binoculars. Now, you tune the transmitter p.a. and antenna tuner for the maximum reading on the meter. Your associate, of course, is adjusting the r-f meter's sensitivity as required.

I preferred a variation on this method. That is to tune the transmitter into a dummy load with the usual maximum plate current. Remove the dummy load and connect the antenna tuner. The tuner usually has a heavy-duty roller inductor. Now tune the antenna to the transmitter. Resist all temptation to touch the transmitter tuning.

I picked up some pretty severe cramps in some trunks. But the satisfaction in achieving the maximum transfer of r-f energy was always worth it in the end. Thank goodness we don't have to do it that way today. Commercial Ham radios today are transceivers -- everything is in one box small enough to go up front. No dynamotors. More efficient antennas. Automatic antenna tuners are available that will load any chunk of metal you choose to attach to your mobile. They will even tune a horizontal whip to achieve superior close range (0 - 300 miles) communications.

That's called NVIS -- Near Vertical Incidental Skywave -- propagation. But that's another story.

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George Jacobs, P.E., W3ASK, President, George Jacobs & Associates, Inc., Consulting Broadcast Engineers, 8701 Georgia Avenue, Suite 410, Silver Spring, MD 20910-3713, 301-587-8800

Joel I. Kandel, KI4T, Kandel & Associates Consultants, 9370 SW 87th Avenue, #S-18, Miami, FL 33176-2429, 305-596-9373

Arthur P. Kay Jr., Kay Electronics Inc. (Motorola Service), 1910 West Cardinal Drive, Beaumont, TX 77705, 409-842-1776, 800-852-7915

Eric A. Landau, WA2KER, Repeater Telecommunications 2-Way Radio, 460 West 35th Street, New York, NY 10001, 212-736-6500

Harrison (Harry) W. Moore Jr., W2JQS, The New York Institute for Management Studies, 260 Millard Avenue, North Tarrytown, NY 10591, 914-631-3683

John P. Murray, JMA / Applied Spectrum Research, 2975 Valmont Road, Suite 100, Boulder, CO 80301, 303-444-4871

Joseph Y. Nasser, Center For Public Safety Studies, Inc., 595 North Nova Road, Suite 207, Ormond Beach, FL 32174, 904-676-7518

Paulla Nelson-Shira, Radio Resource Magazine, P.O. Box 24768, Denver, CO 80224, 303-756-0690

Donn R. Nottage, NRM Marketing Group, Inc., 7 Fennell Street, P.O. Box 421, Skaneateles, NY 13152-0421, 315-685-8991

William L. Ordway, Cellular Strategies, 2042 Inwood Lane, Santa Ana, CA 92705, 714-544-2404

J. J. Pomparelli, Radio Page Communications, 102 Centre Boulevard, Suite J, Marlton, NJ 08053, 609-985-1500

Thomas R. (Tom) Poor, Communication Enterprise Inc., 2315 Q Street, Bakersfield, CA 93301, 805-327-9571, (fax) 805-327-2732

Luther S. Pully P.E., Consulting Engineer, Radio/Microwave Systems, 3910 Cedarbrush Drive, Dallas, TX 75229-2703, 214-352-2069

Jack Reichler, Meridian Communications, 23501 Park Sorrento, #213A, Calabasas, CA 91302, 818-888-7000, (fax) 818-888-2857

John J. Renner, Advanced Technology Systems, Inc P.O. Box 1608, Arlington, VA 22210, 703-532-2155

Francis J. Rodriguez, Francis J. Rodriguez, M.S. - Consulting Services, P.O. Box 761, Ridgewood, NJ 07451-0761, 201-612-0646

Ron Ross, Ross Associates/Surveillance, 2495 Vista Drive, Upland, CA 91786-1136, 714-981-8855, (fax) 714-981-7386

BUSINESS DIRECTORY

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Carolyn Servidio, HCS Telecommunications, 1110-G Burnett Avenue, Concord, CA 94520, 800-346-6442

William J. Smith, Sales Manager, Middle-East and Africa, Maxon Electronics (HK) Ltd, 24 Raffles Place, #26-02, Clifford Centre, SINGAPORE 0104, 5341122, (fax)5342616

Louis Tischler, Westwood Computer Corporation, 155 Route 22 East, Springfield, NJ 07081, 201-376-4242, 800-221-1127

Bill Torbick, W. Torbick Associates, Consultants & Executive Search, 226 Ivy Lake Drive West, Forest, VA 24551, 804-525-7246

William A. Wickline, President, Kathrein, Inc., 7372 Lake Shore Boulevard, #9, Mentor, OH 44060, 216-257-8111.

CROSS REFERENCES

Advanced Technology Systems, Inc. - John J. Renner
Amtol Radio Communications Systems, Inc. - Gaetano Amoscato
Cellular Strategies - William L. Ordway
Center For Public Safety Studies, Inc. - Joseph Y. Nasser
Communication Enterprises, Inc. - Thomas R. (Tom) Poor
Consulting Radio/Microwave Engineer - Luther S. Pully
Evans & Evans Associates, Inc. - R. James Evans
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Teletrol, Inc. - Rafael A. Garcia
The New York Institute for Management Studies - Harrison W. Moore Jr.
The Radio Club of J.H.S. 22 N.Y.C., Inc. - Joseph J. Fairclough
Universal Cellular, Inc. - Jim "J.R." Hendershot
W. Torbick Associates - Bill Torbick
Westwood Computer Corporation - Louis Tischler

TREASURER'S REPORT FOR FISCAL YEAR 1990

(October 1, 1989 — September 30, 1990)

REVENUES

Dues Collected & Applied	$13,687
Other Member Fees	1,090
Sections Operations - net	551
Banquet - net	9
Advertising Sales	5,430
Pins & Plaques Sales	534
Interest on General Funds	2,344
Miscellaneous	300
TOTAL Revenues	$23,926

EXPENSES

Publications	
Printing & Supplies	$14,933
Mailing Expenses	2,842
Meeting Expenses	3,587
Office Expenses - Rent	122
Printing & Stationery	646
Postage	577
Telephone	50
Computer Expenses	366
Consulting Fees	500
Legal & Accounting	900
Pins & Plaques	1,569
Miscellaneous	1,837
TOTAL Expenses	$27,929
NET Revenues less Expenses	($4,003)
Other Adjustments (net) (see note -->)	11,880
Net Increase in Fund Balance	$7,877

BALANCE SHEET

ASSETS

Inventory & Receivables	$4,346
Section & Banquet Funds	14,959
Cash in Bank - Operating	40,791
Investments - Securities	31,164
GNMA Certificates	92,317
Putnam fund	28,494
TOTAL Assets	$212,071

LIABILITIES

Prepaid Dues	$12,118
Prepaid Banquet Tix-90 Banquet	3,575
Fund Balances:	
Scholarship Funds - Principal	118,434
For Distribution	13,994
General Funds - Op'g Balance	30,267
Reserve for Oprt'g Deficits	12,522
Life Member Fund	15,022
Legacy Fund	2,527
Other Assets & Liab-Net	3,612
TOTAL Liabilities	$212,071

N.B. Other adjustements include contributions to funds, scholarships and grants awarded, earnings on funds and changes in values of investments.

SCHOLARSHIP & GRANTS FUNDS

	Capital	Available for Distribution	Totals
Opening Balance Oct. 1, 1989	$113,699	$ 8,878	$122,577
Contributions	4,735		
Interest Earned		11,816	
Scholarships & Grants Awarded		(6,700)	
Ending Balance Sept. 30, 1990	$118,434	$13,994	$132,428

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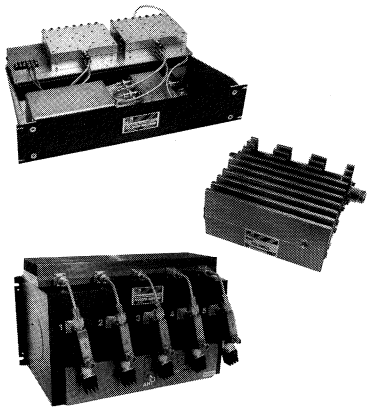

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- Duplexers
- Isolators
- Diplexers
- Bandpass filters

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- Roof mounts
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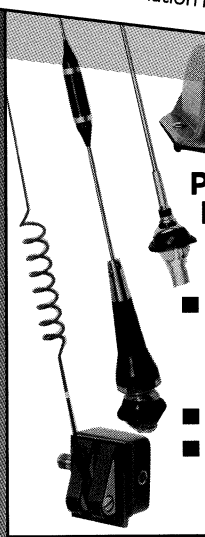
- Complete line of ARMOR-FLEX™ portable antennas



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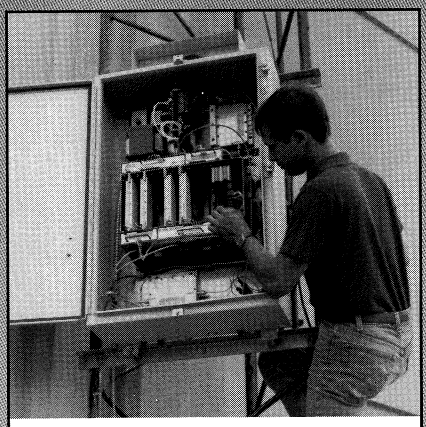

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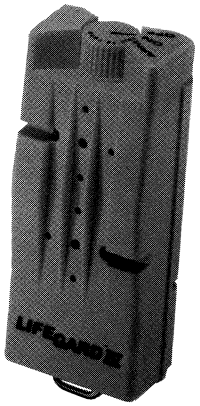

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- High-capability wideband models, choice of power levels: 16, 48 or 99 channels.
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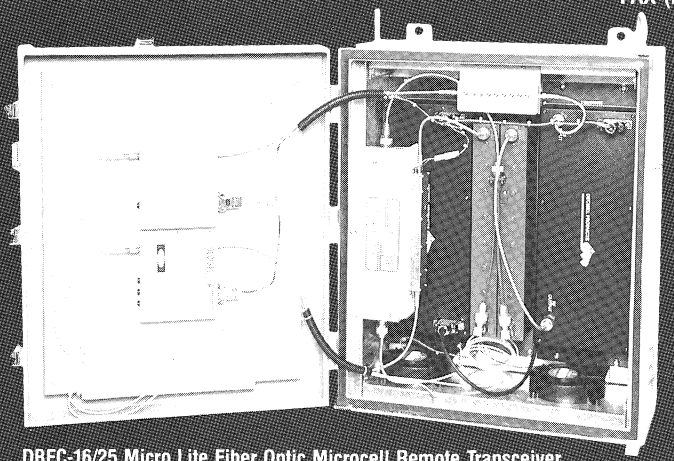

DBFC-16/25 Micro Lite Fiber Optic Microcell Remote Transceiver

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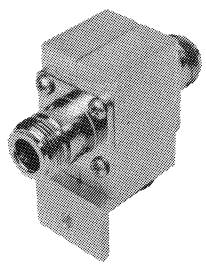
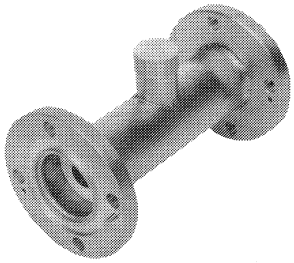
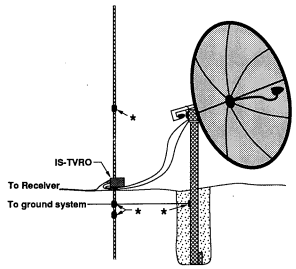


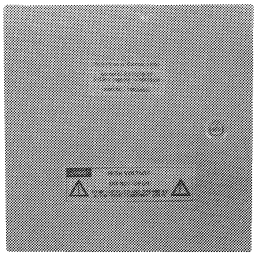
COAX TO 6 GHz



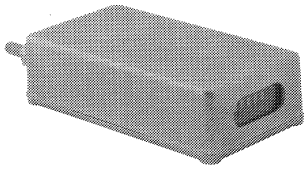
BROADCAST & MILITARY TO 50 KW



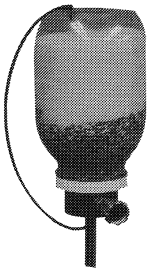
TVRO



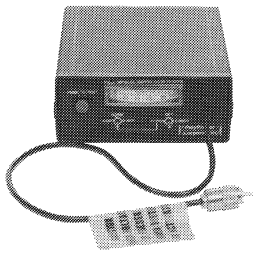
3ø POWER TO 480 VAC



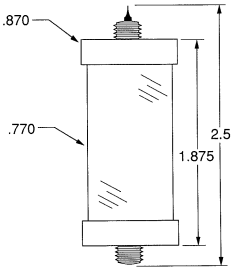
STRIKE COUNTERS TOWER/POWER/PHONE



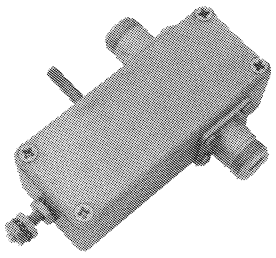
CHEMICAL GROUND SYSTEMS



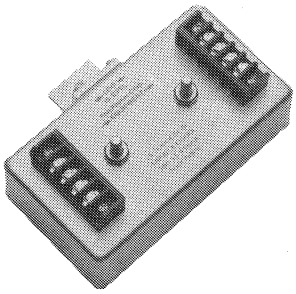
BREAKDOWN TESTERS



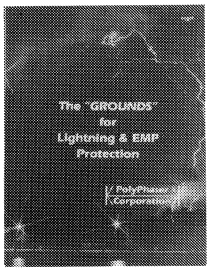
GAS TUBES TO 100 KA



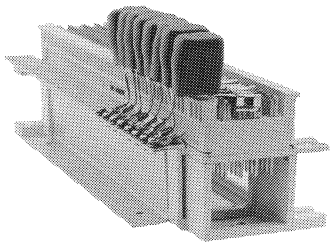
4 TO 23 GHz MICROWAVE DOWNCONVERTERS



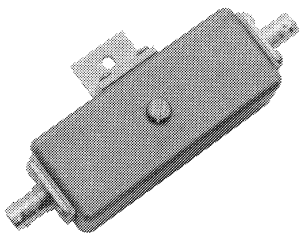
T-1 (TO DS-3 RATES)



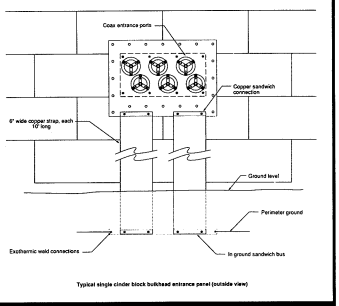
VIDEO & TUTORIAL BOOK



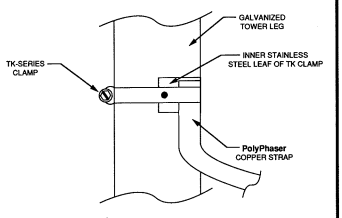
TWISTED PAIR



LAN/VIDEO



ENTRANCE PANELS



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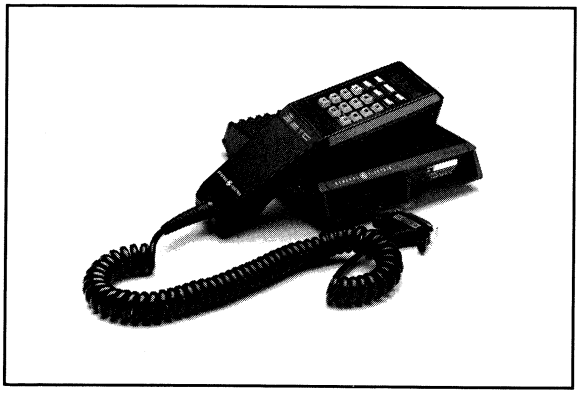

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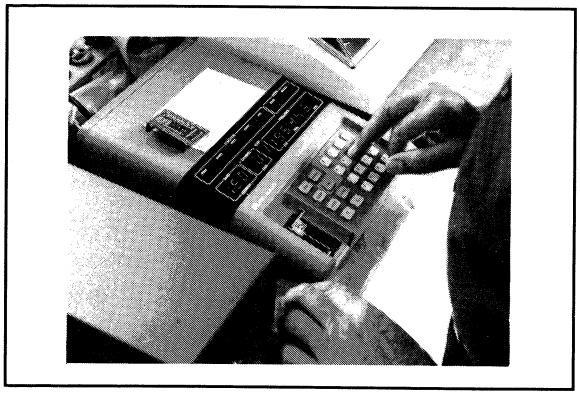

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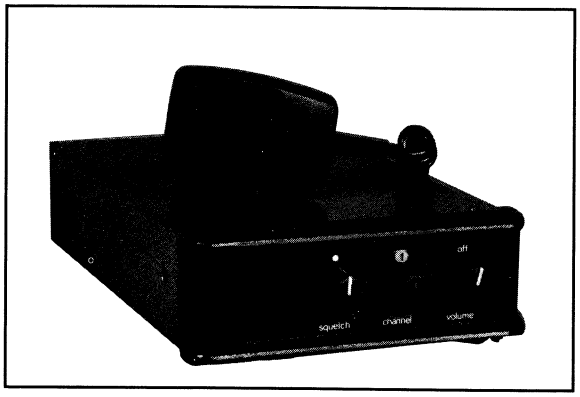

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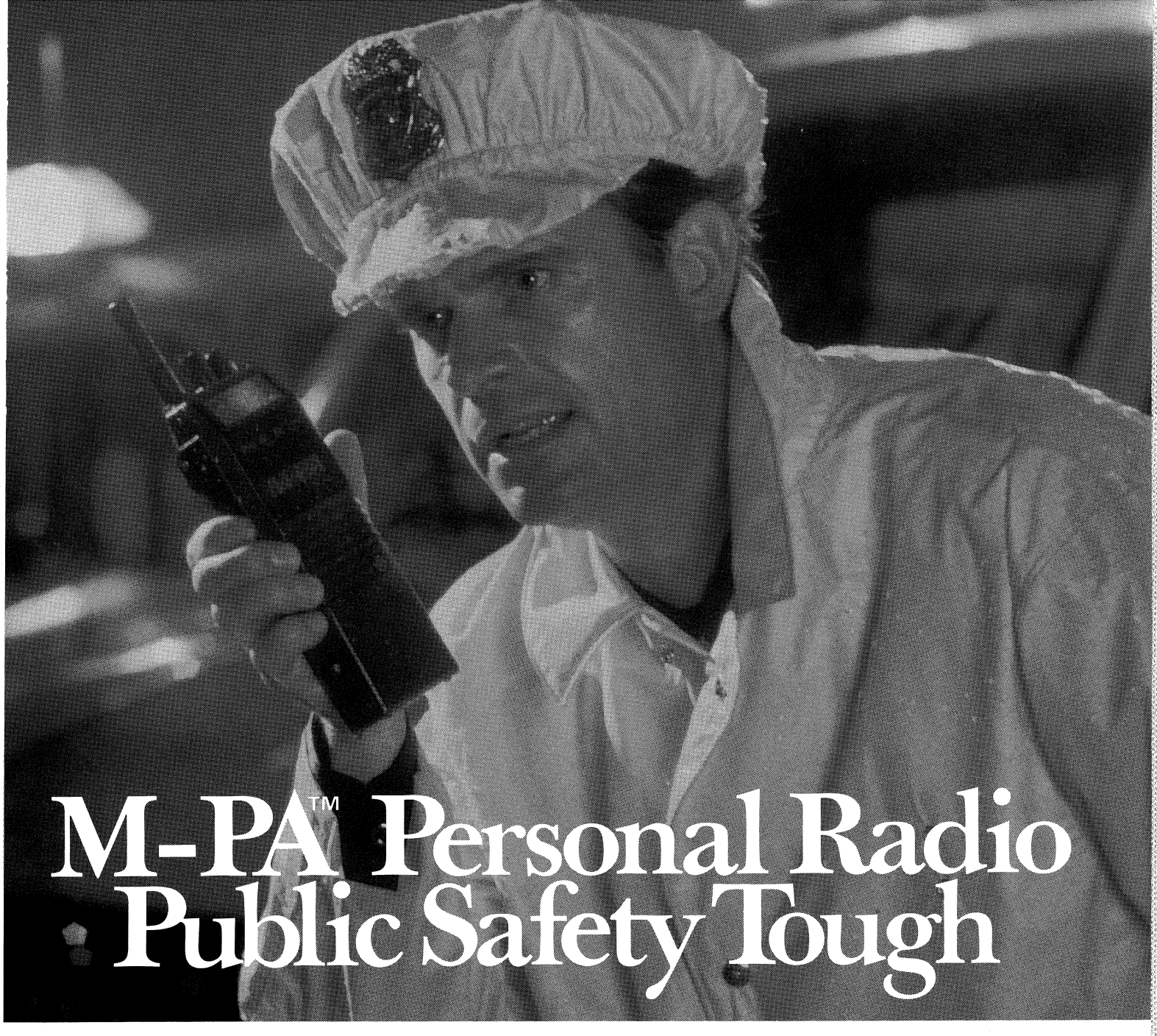

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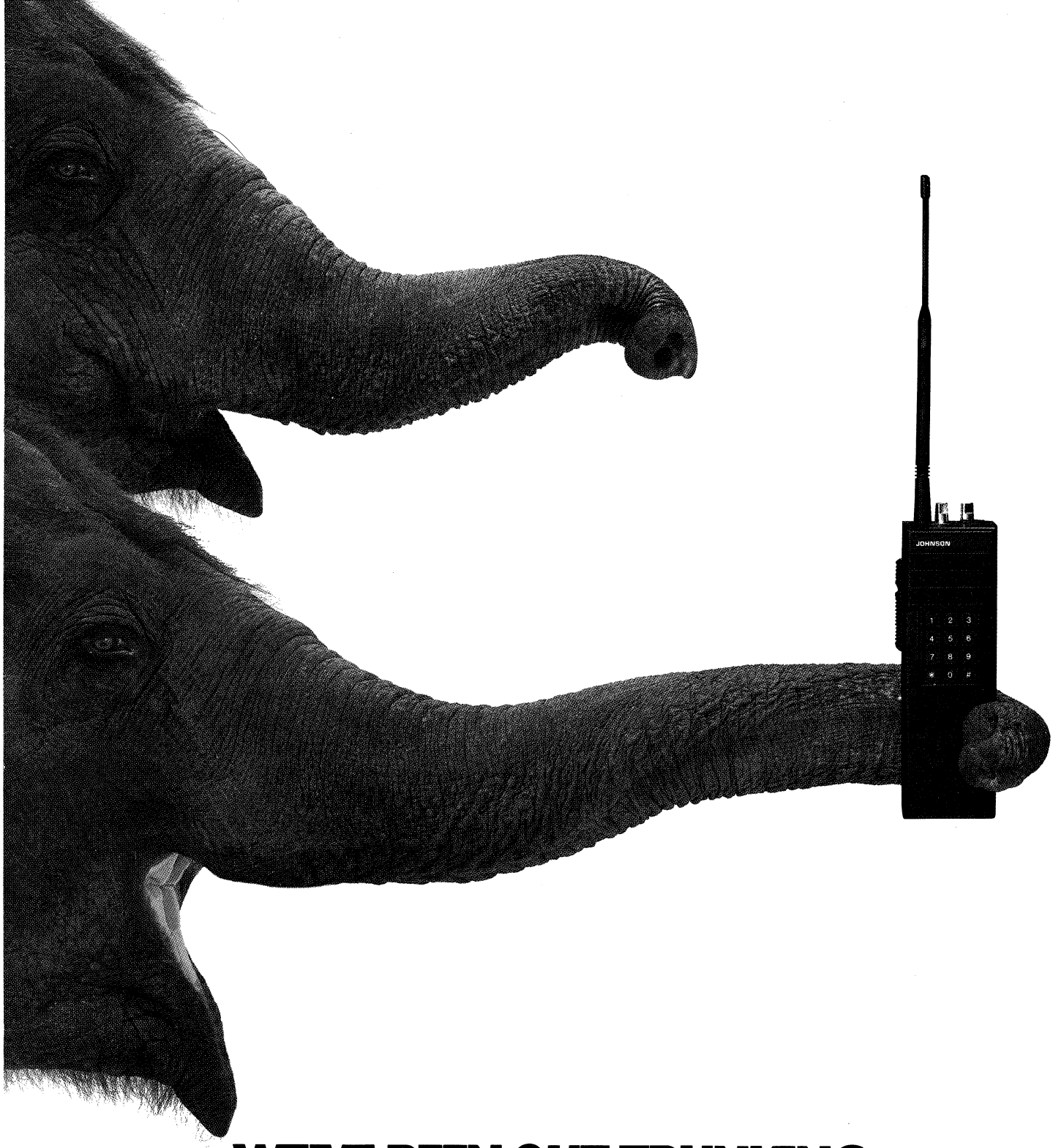

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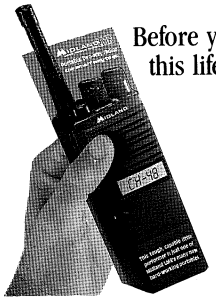

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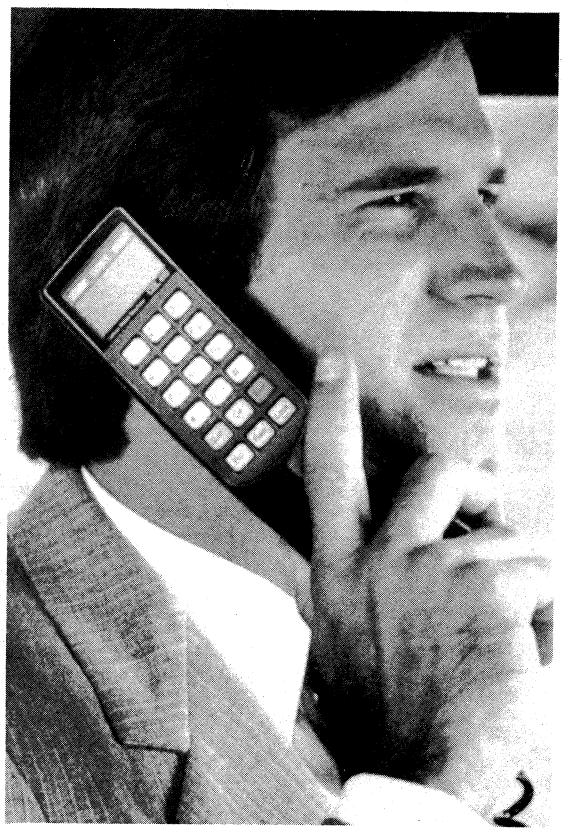

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