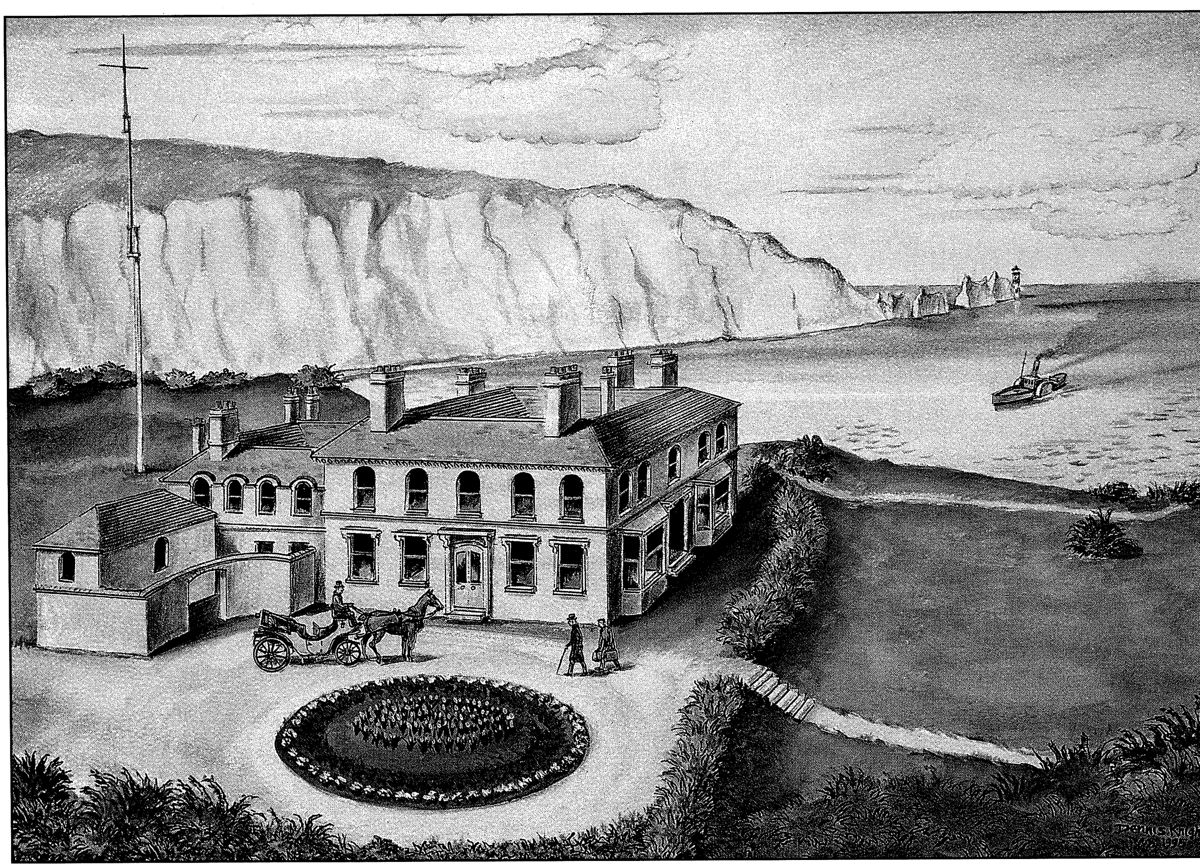
Proceedings of

THE RADIO CLUB OF AMERICA, INC.

Founded 1909, New York, U.S.A.

Spring 1997



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34 • **Site of First Wireless Telegram**

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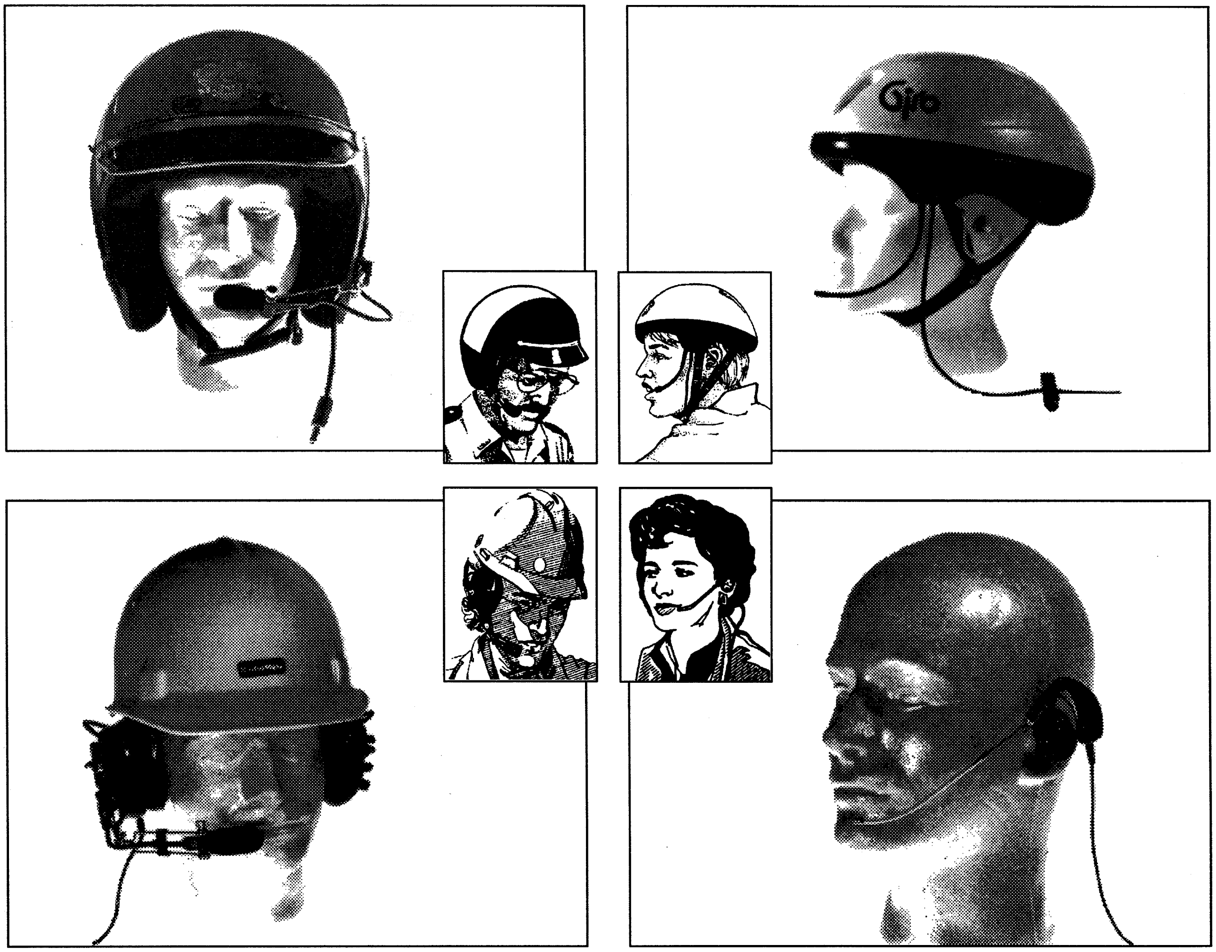

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Volume 71, No. 1

Spring 1997

THE RADIO CLUB OF AMERICA, INC.

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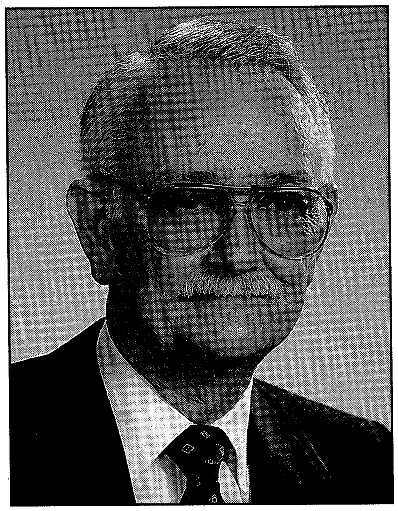
Subscription costs of $5 per year for The Proceedings of The Radio Club of America *and $2 per year for* The Newsletter *are included in membership dues on a non-optional basis.*

By Raymond C. Trott, P.E., RCA President

President's Message

This year will be an exciting one for the Radio Club of America and for me. I am looking forward to serving you and to providing leadership in achieving the goals set forth by the executive committee and the board of directors.


Raymond Trott

The club has recognized during the past few years that we need to keep pace with the exploding wireless industry of which most of us, either in the past or in the present, have been a part. The Long Range Planning Committee, chaired by Mal Gurian, has developed a plan to effect this tremendously important task.

One of the first tasks, which has been implemented, was the hiring of the professional management firm of Meredith & Henry (M&H). M&H will handle much of the clerical work that was performed by the club's volunteer managers. Its organizational management experience also will be an asset.

Other goals are:

❑ to solicit corporate donations for more scholarships.

❑ to enhance the current publications, including the *Proceedings*, the *Newsletter* and other special publications.

❑ to increase publicity for the club.

❑ to expand members' services.

❑ to increase the membership.

To be successful in completing these goals, we must produce more income. Increasing the membership will bring in more revenue from dues. One of my first goals in 1997 will be to increase membership by a net 200. This should be a snap. If every current member would recruit one new member, we would increase the membership by more than 1,000.

In this copy of the *Proceedings,* a new application form is printed. I want every member to copy this application and recruit at least one new qualified member to the club. This should be the catalyst to enable the Radio Club of America to be the foremost organization in the wireless and broadcast industries.

In the next issue, I'll tell you more about the happenings in the club. I hope to see many of you at some of the industry conferences and meetings.

Have a great 1997.

Raymond C. Trott, P.E.
President

By Don Bishop, **Proceedings** *Editor*

W2RCA Club Station

On Jan. 2, 1909, five boys with an interest in wireless telegraphy and telephony formed the Junior Wireless Club. They changed the club's name to the Radio Club of America on Oct. 21, 1911. Each member built receivers and transmitters and enjoyed exchanging messages among themselves and other amateur radio operators.

Currently, roughly half of the club's members have amateur radio licenses, and many maintain stations. A review of the club's history turned up no evidence that, until two years ago, the club has had an amateur station license of its own. It has not maintained a station for the use of its members, a situation that is about to change.

(One could argue that the club once had a station in the form of facilities at amateur station 1BCG in Greenwich, CT, that were built in November and December 1921 to send messages by shortwave radio across the Atlantic. Although 1BCG was licensed to an individual club member, an organized club effort led to the construction and operation of the facility that, in competition with many others, sent the *first* transatlantic shortwave message.)

On Aug. 10, 1993, the President signed into law the Omnibus Budget Reconciliation Act (OBRA) of 1993. Largely because Jim Wills, a radio amateur in Tyler, TX, persisted in an effort to change government regulations to make it possible for amateurs to request specific station call signs, OBRA contained a provision for the Federal Communications Commission to make them available.

Accordingly, the FCC issued rules on Dec. 23, 1994, that spelled out how individuals and clubs in defined groups could request specific call signs in a several-step process. The first step, the announcement of a date on which the first group could apply, was not to follow for nearly two years! Publicity about the pending availability of so-called "vanity" call signs attracted the interest of club member and Fellow, Raymond Minichiello, W1BC (now a director), who telephoned Frank A. Gunther, W2ALS, president emeritus, to suggest that the club apply for the call sign W2RCA. ("W2" is part of the call sign required to indicate the station location. "W" indicates the United States, and "2" traditionally indicates the New York-New Jersey area.)

There was one hitch. Before the club could apply for the specific call sign, it had to apply for a club license. Frank applied on behalf of the club for such a license, and it was granted on July 12, 1995, with the call sign KB2VHE.

On May 31, 1996, the FCC began accepting applications from people who want to recover call signs they previously held personally and who want call signs previously held by relatives now deceased, as well as from clubs seeking call

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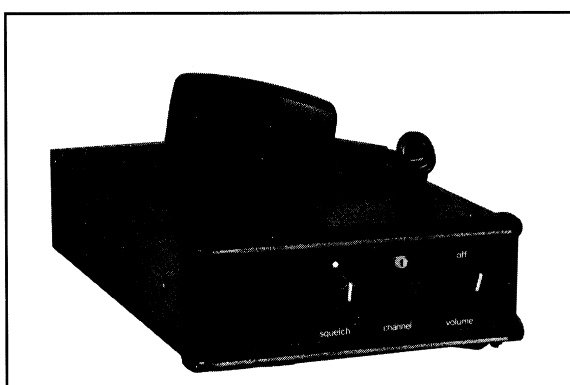

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By Martin Cooper and Marc Goldburg

Intelligent Antennas: Spatial Division Multiple Access

Antennas collect radio frequency energy from space for reception purposes and distribute energy into space for transmission. To date, they have been the most neglected of all the components in personal communications systems.

Yet the manner in which radio frequency energy is distributed into and collected from space has a profound influence on the efficient use of spectrum, the cost of establishing new personal communications networks and the service quality provided by those networks. The combination of the enormous increase in low-cost computing capacity and the development of new algorithms for processing signals from arrays of simple antennas make "intelligent antennas" for cellular-like communications systems possible. These antennas provide greater coverage area for each cell site, the rejection of interference and substantial capacity improvements.

There are many methods for using data from antenna arrays in wireless communications systems. The most advanced method is *space division multiple access* (SDMA). At the base station, SDMA continually adapts to the radio environment, providing each user with uplink and downlink signals of the highest possible quality.

At the network level, this improved base station performance can be exploited to increase base station range—thereby reducing network cost—or to increase system capacity and, hence, spectral efficiency. SDMA is comparable to any practical modulation method or frequency band. Practical SDMA intelligent antenna systems have been constructed and demonstrated for the Personal Handyphone System, the Advanced Mobile Phone System, personal communications service at 1,900 MHz (PCS-1900) and global system for mobile communications (GSM, formerly Groupe Speciale Mobile). Such systems appeared in commercial communications networks at the end of 1995.

Antenna Principles

Radio antennas couple, more or less efficiently, electromagnetic energy from one medium to another, from space to wire, coaxial cable or waveguide. The simplest antennas radiate and receive equally well in all directions. Antennas can be constructed to have certain fixed, preferential directions (such antennas are used in so-called sectorized systems).

One might reasonably ask, "Why use anything more than a single omnidirectional (no preferential direction) antenna at a base station?" The goal of the next several sections is to answer this question by describing, in order of increasing benefits, the principal schemes for employing multiple antennas at a base station.

Sector Antennas

Antennas can be constructed to cover a fixed sector of, say, 120°. Three antennas could cover all directions. Everything else being equal, these sector antennas provide increased gain over a restricted range of azimuths as compared to an omnidirectional antenna.

Sector antennas increase the reuse possible in such systems by reducing potential interference, and they are used widely for this purpose.

As many as six sectors per cell have been used in practical service. In a cellular radiotelephone system, each sector typically would be treated as a different cell whose range is greater than in the omnidirectional case. This results in a single antenna per (effective) base station and, therefore, does not really qualify as "multiple antennas at a base station" in our context. In the sequel, a sector will be considered to be the same as an independent base station.

Diversity Systems

Small displacements in an antenna's location can have a significant effect on the signal amplitude that appears at its output. This effect results from a propagation phenomenon known as fading. A class of antenna systems called "diversity antennas" employs a group of physically separated antennas with the assumption that at least one of the antennas will be in a favorable location at any given time.

So-called "switched diversity" systems continually switch among the antennas so as always to use the antenna with the largest output. Other diversity systems, such as maximal ratio combining systems, combine the outputs of all the antennas to maximize the ratio of combined received signal energy to noise. These diversity systems can be useful in environments where fading propagation losses are the dominant mechanism for signal degradation. In environments with significant interference, however, the simple strategies of locking onto the strongest signal or extracting maximum signal power from the antennas are clearly inappropriate and can result in crystal-clear reception of an interferer at the expense of the desired signal.

Principles of Antenna Arrays

By combining the outputs of the individual antennas in an array, a single effective antenna can be created with gain and directional characteristics that are very different from those of the individual elements comprising the array.

For example, consider a row of *m* simple and identical, antenna elements (called a linear array) with elements spaced one half-wavelength apart. Suppose that one simply adds the outputs of all the elements. Signals arriving at the array from broadside, or perpendicular to the axis of the array, arrive simultaneously at each element of the array, and their sum, therefore, will be m times as large (m^2 times as powerful) as the signal received by a single antenna. Simply adding

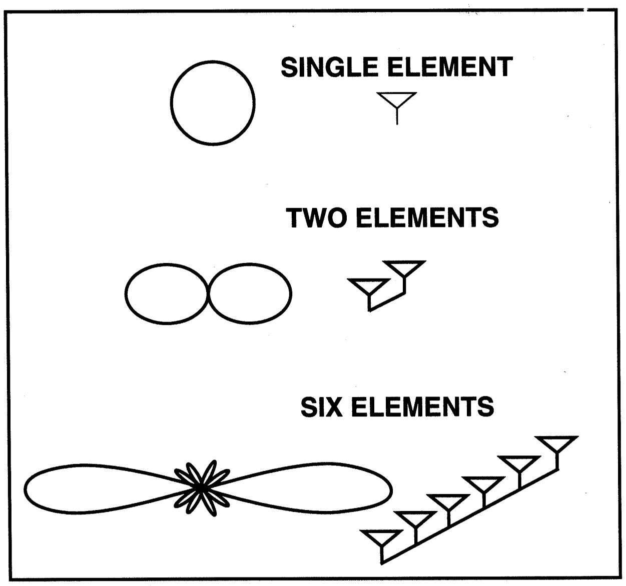

Figure 1. Broadside antenna patterns for arrays with different numbers of elements.

the outputs of the m element array therefore results in an amplitude gain of m for signals arriving from broadside.

Figure 1 depicts the effective antenna pattern resulting from the above strategy for linear arrays consisting of a single antenna, two antennas and six antennas (omnidirectional element patterns and half-wavelength spacing in all cases). The radius of the pattern on the diagram is proportional to the gain or strength of the signal at the output of the array. The increased gain in the broadside direction and the increases in gain with the number of array elements are evident, as is the existence of certain directions in which the effective antenna has reduced sensitivity, or nulls.

Classical phased-array antenna systems have gain patterns or beam patterns that look much like the one in the figure, except that the direction of maximum gain might not be the broadside direction. More advanced systems have patterns that are optimized to enhance a particular user's signal while simultaneously rejecting interferers. Another differentiator of antenna array systems is whether the beam patterns can change with time.

Antenna arrays can be built with combining strategies that are fixed. From an operational standpoint, this sort of array is no different from a conventional antenna with the same directional sensitivity. Alternatively, arrays can be equipped with combining hardware and software that make it possible for the pattern to be changed over time and adapted to the current operational scenario.

Because radio reception and transmission are reciprocal, directive transmission with gain is also possible from an array. Any directivity pattern achievable for reception is also achievable for transmission.

Switched-Beam Antennas

It is possible, using array antennas, to create a group of overlapping beams that together result in omnidirectional coverage. For example, one might design overlapping beam patterns (combining strategies) similar to the ones in Figure 1 but pointing in slightly different directions so that the patterns' main lobes are adjacent like the petals of a flower. Every so often, the system scans the outputs of each beam and selects the beam with the largest output power. If the signal/user moves from one beam to another, the antenna switches to the new beam. Only a single beam pattern is employed at any given time; on average its gain will be slightly less than the factor of m described above.

Switched-beam antennas are normally used only for reception of signals because ambiguity can be in the system's perception of the location of the received signal. The consequences of transmitting in the wrong beam are evident. Switched-beam antennas offer range extension as their primary feature but also suppress interference arriving from directions away from the active beam's center.

Adaptive Array Antenna Systems

Adaptive array antenna systems continually monitor their coverage areas, attempting to adapt to their changing radio environment, which consists of (often mobile) users and interferers. In the simplest scenario—that of a single user and no interferers—the system adapts to the user's motion by providing an effective antenna pattern that follows the user, always providing maximum gain in the user's direction. The base station component of spatial division multiple access (SDMA) is an advanced adaptive array system, described below in greater detail. The principle of SDMA is quite different from the beam-forming approaches described above. In fact, SDMA's operation is analogous to that of human hearing.

Consider the following analogy: If you close your eyes and listen to a sound source, you can identify the direction from which the sound is coming with remarkable accuracy. You accomplish this by using your ears as an array of acoustic sensors, not unlike antennas that are sensing radio energy. Each ear receives the sound at a different time, depending upon the direction from which the sound is coming. Your brain processes the information from both ears (now not sound at all but rather some form of neural signal) and computes the direction from which the sound is coming. Your brain then combines the sounds, coming from the direction you selected, constructively. Sound from other directions adds together incoherently. The net effect is that you can hear the sound you have decided to listen to twice as loud as sounds from other directions, and you know from what direction the sound is coming.

Of course, the radio frequency array is not limited to two "ears" (array elements) and can thus "hear" with even greater gain and selectivity. Further, the radio frequency array can respond with multiple "mouths" (array elements) and achieve the reciprocal advantages.

The following sequence of events occurs many times each second in an SDMA system:

1. A "snapshot," or sample, is taken of the signals coming from all of the antenna elements, converted into digital form and stored in memory.

2. A computer, the SDMA processor, then analyzes the sample to obtain an estimate of the radio environment, identifying users and interferers and their locations.

3. The processor calculates the combining strategy for the antenna signals that optimally recovers the users signals. With this strategy, each user's signal is received with as much gain as possible and with the other users' and interferers' signals rejected as much as possible.

4. An analogous calculation is done to allow spatially selective transmission from the array. Each user's signal is now effectively delivered through a separate communications channel—a spatial channel.

5. The system now has the ability to both transmit and receive information on each of the spatial channels, making them two-way channels.

The net result of the above process is that the SDMA system can create a number of two-way spatial channels on a single conventional channel, be it frequency, time or code. Each of these spatial channels enjoys the full gain and interference rejection capabilities of the array. In theory, an array with *m* elements can support *m* spatial channels per conventional channel. In practice, the number is somewhat less and depends on the environment.

The benefits of an SDMA system include the following:

❏ Range extension—the coverage area of the array is greater than that of any element as a result of the gain provided by the array. When a system is constructed using SDMA, the number of cells required to cover a given area can be reduced substantially. A 10-element array offers a gain of 10, which typically doubles the range of the cell and thereby quadruples the coverage area.

❏ Interference from other systems and from users in other cells is reduced significantly. In "noisy" areas where range is limited by interference, spatially selective transmission and reception result in range extension.

❏ The destructive effects of multipath signals—copies of the desired signal that have arrived at the antenna after bouncing from objects between the signal source and the antenna—can often be mitigated. In certain cases, the multipath actually can be used to reinforce the desired signal.

❏ The capacity of the system is increased in two distinct ways:

a. Channel reuse patterns in cellular systems can be significantly tighter because the average interference resulting from co-channel signals in other cells is markedly reduced (e.g., moving from a seven-cell to a four-cell reuse pattern nearly doubles capacity).

b. Separate spatial channels can be created in each cell on the same conventional channel. In other words, intracell reuse of conventional channels may be possible in certain operational scenarios.

❏ Because SDMA employs spatially selective transmission, an SDMA base station radiates much less total power than a conventional base station. One result is a reduction in network-wide RF pollution for the downlink. Another is a reduction in power amplifier size. First, the power is divided among the elements, and then

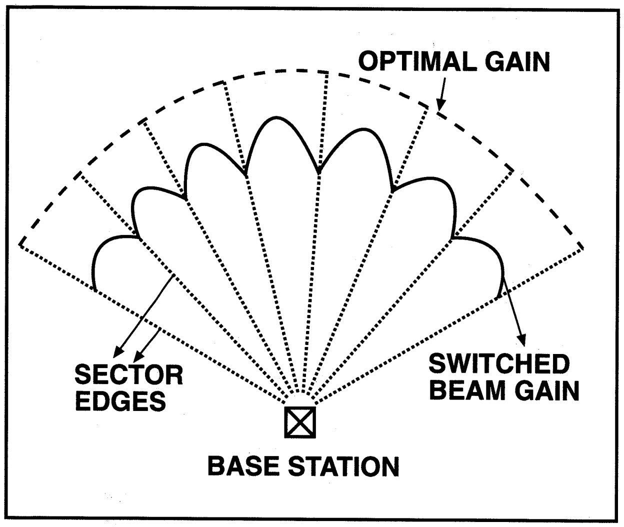

Figure 2. Gain patterns for switched-beam and ideal systems.

the power to each element is reduced because the energy is being delivered directionally. With a 10-element array, the amplifiers at each element need only transmit one-hundredth the power that would be transmitted from the corresponding single antenna system (Broadcast control channels require special treatment).

❑ The direction of each spatial channel is known and can be used to accurately establish the position of the signal source in many environments, a prerequisite for location-based services.

❑ SDMA is compatible with almost any modulation method, bandwidth, or frequency band including AMPS, GSM, PHP, DECT, IS-54, IS-95 and other formats. SDMA can be implemented with a broad range of array geometries and antenna types.

Designers of a communications system will avail themselves of the benefits described above in different ways and in different mixtures as each system matures. When a communications system is initially constructed, costs can be minimized and roll-out can occur more rapidly by using the range extensions available from SDMA. Because the cells are large, better channel reuse is possible than would be with small cells. It is unnecessary to add sites and reduce cell size until required by subscriber demand and then only after the benefits of spatial channels have been absorbed. The major benefit of SDMA is in the flexibility offered to the implemented system.

Switched-Beam, SDMA Antenna Systems

In clean environments with little or no interference, switched-beam antennas can provide range extension. Because the effective pattern of a switched-beam antenna is scalloped (Figure 2) and because the peak gain provided by the switched-beam antenna is generally less than that provided by SDMA, the range extension provided by switched-beam systems will be less than that provided by SDMA, assuming comparable antenna arrays.

Switched-beam antennas do not offer significant capacity increase because they are customarily used only in the receive direction for range extension. In high-interference areas, switched-beam antennas are further limited because their pattern is fixed and they lack the ability to adaptively reject interference.

Conclusion

It is unlikely that new personal wireless systems will be built a few years from now without the use of some form of smart antenna. Smart antennas, properly applied, can substantially reduce the initial cost of such systems. Additionally, intelligent antenna systems such as SDMA can improve signal quality and increase system capacity. Most importantly, SDMA technology offers system designers the tools to create communication systems that are continually and automatically optimized.

End Note

1. More precisely, when we speak of direction, we are generally referring to azimuth. It is impossible to build a truly omnidirectional antenna and, for a number of good reasons that are beyond the scope of the present discussion, base-

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By Robert H. Welsh, N3RW

Gentei Sato, Engineer and Gentleman

Any communications system is limited ultimately by its antenna system. Antennas are a strange mixture of art and science. The art comes from their intrinsic beauty and the empirical methods often used to produce a working device, whereas the science comes from the application of Maxwell's equations, laws of geometric optics and the arcane task of impedance-matching.

In the 100-year history of radio science, many names have become familiar to American radio engineers. Men such as Yagi, Kraus and Jasik have each in their own way contributed to our understanding of the operation of antennas as launchers of the electromagnetic wave so elegantly described by Maxwell.

In this essay, I would like to present to the members of this club a gentleman, a scientist and a radio engineer who has picked up the mantle of Yagi and carried it into the second half of the 20th century: Gentei Sato of Japan. Sato was born in Miyagi Prefecture, Japan, on 15 March 1926. In the month prior to Sato's birth, Shintaro Uda, Yagi's student at Tohoku Imperial University, Sendai, Japan, published "Projector of the Sharpest Beam of Electric Waves" in the *Proceedings of the Imperial Academy of Japan*. The Yagi-Uda antenna was about to make its entrance into the world of radio science. In the month of Sato's birthday, Uda published a description of the experiment that was performed using parasitic rods in close proximity to a halfwave driven dipole. This article was published in the *Journal of the IEE of Japan*. Later that same year, Yagi applied for a U.S. patent on the parasitic antenna.[1]

As a young man in 1944, Sato entered the Communication Engineering Department of Tohoku Imperial University seeking a degree in engineering, but in 1944, the war between Japan and the Western powers was beginning to come to a close. During his student days, he worked on a torpedo-homing device. He was also trained as a glider pilot, a skill that he has maintained to this day. Sato completed his studies in electrical engineering, earning a bachelor of engineering degree in 1947. Among his teachers were Professor Yukichi Nomura, a physics professor who was an early expert on antennas; Professor Hidetsugu Yagi, Professor Shintaro Uda; and Assistant Professor Yasuto Mushiake.[2] In 1954, Tohoku University published the textbook *Yagi-Uda Antenna* by Doctor Shintaro Uda and Doctor Yasuto Mushiake. This text is still considered the standard work on parasitic antennas. Sato enjoys piecing commentary from Chinese philosophy in his writing. An example of this is a brief passage that he inserted in an address given at a university alumni meeting in 1995:

Learning to the same teacher are fellows
Sharing the same ambition are friends[3]

Sato believes that "studying theories by Faraday, Maxwell and Hertz, we are all fellows. Ambitious to contribute to the electric industry with achievements remaining in history, we are all friends."

After his graduation from Tohoku University, Sato remained on staff there as a research assistant, working primarily on transmission lines and antennas. As part of his transmission line studies, he analyzed the effects of supporting insulators on long, parallel transmission lines. As a result of this research, he developed a design method for long feeders with minimal loss. As part of this study, he looked at the possible use of long feeders in tunnels for use in railroad communications. This system was later put into use by the Tokaido Express Railway so that trains passing through tunnels could still be in radio contact with dispatchers. Another major research study was on multi-element beam (Yagi-type) antennas, in which he analyzed the effects of a tail-wire attached to the director element. He developed a design method for this antenna, also. As a result of this research, Sato was promoted to assistant professor.

In 1957, Sato left Tohoku University to take a position as senior engineer with Yagi Antenna Co., Ltd., the president being none other than Professor Hidetsugu Yagi. At that time, Japan Broadcasting Corporation, as well as other commercial broadcasting companie, was developing plans to introduce television broadcasting throughout the Japanese islands. Yagi Antenna's initial task was the development of VHF TV transmitting antennas. Sato developed a high-gain turnstile antenna for transmitting, as well as a number of modified Yagi antennas for receiving.

While employed at Yagi Antenna, Sato presented his doctoral thesis to the Department of Electrical Communication Engineering, Tohoku University, for which he was awarded the degree of Ph.D. in 1961. His dissertation was titled "Study on a Transmission System in Ultra High Frequency Band."

Sato worked at Yagi Antenna until 1964 when he took the position of professor in the Department of Electrical and Electronic Engineering at Sophia University, Tokyo. He retired from Sophia University in 1992. During his 28-year tenure there, he lectured in courses titled "Electromagnetic Application Engineering," "Electric Transmission Engineering" and "Ultra High Frequency Engineering." His research interests in antenna theory did not suffer as a result of his teaching load. During his years at Sophia University, he developed variable phase-shifters and attenuators used in direction-finding and signal intelligence antennas. In aviation systems, he developed new antennas for instrument landing systems (ILS), collision-avoidance systems and radar identification systems (IFF or identification, friend or foe). He continued his earlier research on TV transmitting antennas by improving the turnstile antenna that he worked on while at Yagi Antenna. His continued research on the latter type of antenna led to a complete mathematical analysis of the turnstile, something that had not been done before.

During the 1970s, Sato performed much original work on a very unusual antenna, the Wullenweber.[4] The Wullenweber antenna system consists of a large number of vertical antennas symmetrically located in front of a "reflecting" screen. Each of the individual antennas is capacitively coupled to a rotating switch in a goniometer arrangement. The signal from each vertical antenna is fed through delay lines (acting as phase-shifters), such that the combined signal from each antenna element arrives at the receiver in phase. The received signal has a narrow beamwidth, allowing a precise location of the source of the received signal. The Wullenweber design has been primarily used for signal intelligence purposes. Having worked on an array of this type, I can attest to the difficulty in installation and adjustment for best directional performance. Sato's research on the Wullenweber led to its first use in Japan as a signal intelligence antenna. Through his efforts, the Wullenweber antenna was later applied to electronic scanning radar (also known as phased array radar) and collision avoidance systems.

Early in his tenure at Sophia University, Sato founded Antronics Laboratory Co., Ltd. The name he chose was coined from the words "antenna," "transmission" and "electronics." Shortly thereafter he founded Antenna Giken Co., Ltd. with the purpose of specializing in antennas. "Giken," a Japanese word, translates as "research and development." After 30 years, this company is still in business. Its primary research hasmoved up in frequency to the microwave part of the spectrum. As technical companies go, Antenna Giken is a bit different. It is an antenna research, development and manufacturing business founded by a scholar who is willing to say "I don't like the term 'management.'" It has no executives, that is, neither president nor managers nor directors. Considering the rigidity of the Japanese corporate structure, there is much openness and freedom of thought within the company.[5]

Sato was elected a Fellow of IEEE in 1984, having joined the IRE in 1963. He is a member of the Institute of Electrical and Communications Engineers (IECE) in Japan. He published more than 20 papers in the journals of both organizations spanning a period of 30 years. Additionally he is an Expert Member of a number of commissions and foundations in Japan that are devoted to scientific and engineering pursuits.

Gentei Sato is now retired from Sophia University but maintains a lively interest in Antenna Giken, as well as continuing his lifelong interest in antennas. As a student of Confucius since his primary school days, Sato includes Chinese philosophy in his writings. I would like to close this biography with a poem penned by Professor Li Chun-bao of Dalian Marine University, Dalian, China:

Do you know what Gentei Sato's approach to antenna really is?

So it belongs to a cause originated by Yagi, ever prosperous.

Just as the great Yangzte, carrying immense surges,

Advances wave upon wave ceaselessly eastwards.

References

1. R.H. Welsh, "Yagi: The Man and His Antenna," *QST,* Vol. 78, No. 10, October 1993.

2. S. Uda and Y. Mushiake, *Yagi-Uda Antenna,* Saski Printing and Publishing Co., 1954.

3. Imperial Rescript on Education as written in the ancient Chinese book *Liji.*

4. H. Jasik, Editor, *Antenna Engineering Handbook,* McGraw-Hill Book Company, 1961.

5. Hiroshi Matsuo, *Men Who Create Antennas,* Sogo Electronics Publishing Co., Ltd., 1992.

About the Author

Robert H. Welsh (M) has a diploma in radio engineering from Philadelphia Wireless Technical Institute (1961). He is a graduate of the U.S. Army Signal School (Radar and Electronic Warfare). He received a B.A. in history and electronic physics from LaSalle College (1972) and an M.S. in science education from Temple University (1977), both in Philadelphia. He completed additional graduate work in radio astronomy at the National Radio Astronomy Observatory in West Virginia.

Welsh formerly worked as an electronics technician and laboratory engineer for such employers as the Radio Corporation of America, American Electronics Laboratories and the University of Pennsylvania for 12 years. He has taught electronics technology, and he currently teaches physics for the School District of Pennsylvania. He is a lecturer in the Department of Physics at LaSalle.

Welsh has been a licensed radio amateur since 1959. His original station call sign was K3JHE. Since 1977, his station call sign has been N3RW. Using vacuum tube equipment, he operates CW more than any other mode.
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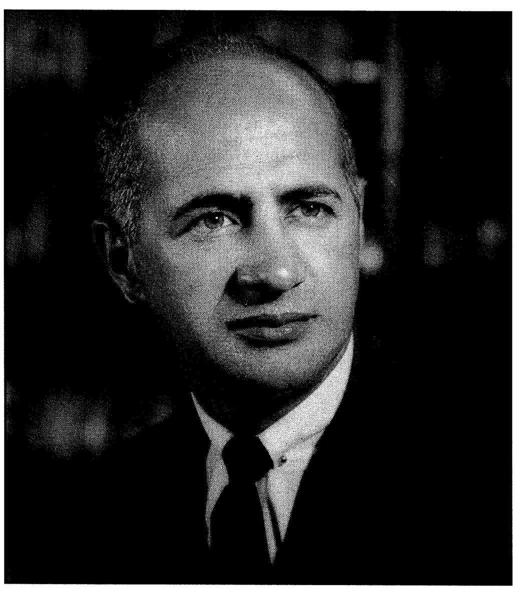
By Gaetano (Tom) Amoscato

President's Welcoming Speech

Good evening ladies and gentlemen and distinguished guest at the dais. Welcome to the 87th annual awards banquet dinner of the Radio Club of America. I would like to dedicate our 87th annual awards banquet to Fred Link.

We have an exciting program with 20 new Fellowships being awarded and two new special awards being presented for the first time to men who are well-known in the industry for many years for their many contributions in a broad range of electronics and who have helped create some of the standards as we know them today.

At this time we have the honor of extending a special welcome to a guest in our audience, a woman who has been in communications for 15 years. She was a communications division commander for the Orlando, FL, police department who helped to enhance the 9-1-1 emergency system, and she was a member of the task force for the Association of Public-Safety Communications Officials (APCO) who addressed the Federal Communication Commission on the issue of widening the spectrum for public safety.



Maurice Zouary provides the calligraphy on award certificates.

Ladies and gentlemen, I'm pleased, honored and privileged to present the first woman president of APCO, Ms. Marilyn Ward.

I would also like to acknowledge and to give special thanks on behalf of the entire Radio Club membership to Maurice Zouary (LF), the recipient of the Lee de Forest Award in 1986 and the Special Service Award in 1991, for his continued contribution with extraordinary talents in calligraphy, which is evident in all of our awards over the years and with the interesting articles and books that he has published. Maurice, your mention of the Radio Club of America and Jack Poppele with additional credits in your new special documentary, *First Sound of Movies*, to be narrated by movie actor Gregory Peck when it airs, is greatly appreciated. We sincerely hope your longtime efforts will be justly rewarded. Our best, always, Maurice, and good luck.

I hope that I contributed a little in the forward movement of the club as president, especially in these explosive times of wireless and electronics that we all have been experiencing.

I'm grateful for the

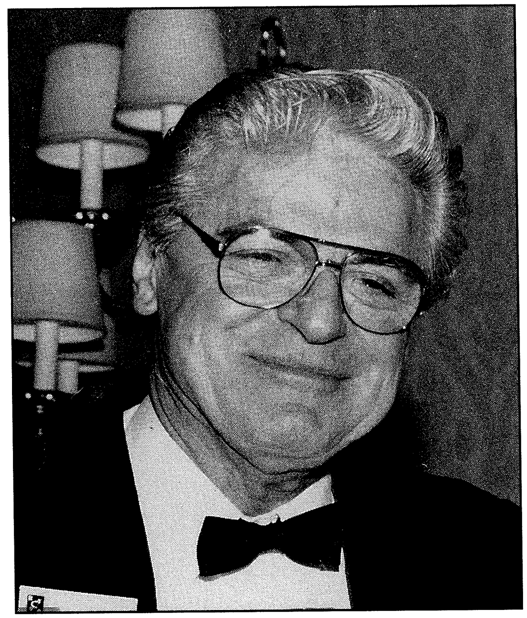
support I received from the directors, the officers, the executive committee, Gerri Hopkins and Howard Henry of Meredith & Henry, the editing and publishing of *Proceedings*—thanks to Don Bishop and Jane Bryant, the *Newsletter* we receive from Darren Sextro and, of course, behind the scenes, Mercy Contreras, group publisher for Intertec, who has made up our banquet program that is placed at each table.

Thanks to the banquet committee, namely Connie Conte, Maxine Carter-Lome, June Poppele and staff at the door, who always have made the banquet arrangements so pleasurable and successful with their professionalism, year in and year out.

I must say, I realize the executive committee and directors had an extraordinary amount of patience with me. I guess they figured God wasn't quite finished with me yet.

I still have a number of former Link employees in my organization. I was asked by one employee a number of weeks ago, "It's almost 50 years since you started Amtol; when are you going to retire? You are up in years." I had to respond like "Lefty" Grove, the New York Yankee pitcher, when he was asked the same question. I told him I was in the twilight of a mediocre career at this point in my life.

Thank you all very much for your continued support. Enjoy the evening.



Tom Amoscato.

By Dennis F. Strigl

Keynote Speech

Thank you, Mal, for the gracious welcome, and for inviting me to join all of you on this special evening.

It is indeed an honor—and a bit humbling—to address the pioneers of this great industry. You really are pioneers, having literally shaped radio communications in this century from its frontier era into the advanced science it is today.

In a sense, I feel like the sequel to last year's keynote, when Princess Elettra Marconi-Giovanelli eloquently chronicled her father's invention. An invention that has so profoundly defined life and history over the last 100 years.

Through war, fireside chats, the development of aviation and modern-day seafaring, the introduction of television, Sputnik and space travel, radio has been a defining factor—perhaps *the* defining factor.

Radio's discovery has no less of an impact on thousands of amateur ham operators, a generation of kids tinkering with crystal radio kits and the three young boys fascinated by radio controlled planes who went on to found this organization, the Radio Club of America. Radio-controlled planes: Now there's a picture of Americana!

The fact that this Club, this institution, has endured so long is itself testimony to the social impact of radio technology. I wonder if Mr. Marconi fathomed the depth and breadth of the impact his invention would have?

And now, in continuation of the boundless turns and applications this technology has taken, my industry—the wireless telephone industry—will help lead radio technology into its second century.

It's interesting to note that Marconi named his great invention the "wireless," and after a time that word went out of vogue in favor of the higher-tech term, "radio." I understand even this club changed its original name from the Wireless Club.

It seems we've come full-circle in resurrecting the term "wireless," this time as a nickname for cellular communications—the direct descendant of the original wireless and that other great invention of the same era—the telephone.

Mal asked me to talk about the future of this next generation of "wireless" and its place in the exploding telecommunications industry.

Well, I don't do long-range predications, not with the pace of technology moving at the speed of light. But I will predict that the "new wireless" will continue in radio's legacy of having a profound, defining impact on the way we work, play and live throughout the next century.

To understand this trend requires a brief primer, for perspective, on the dynamics of the telecommunications industry these days. I'm sure you have seen the headlines.

Mergers, consolidations and a creative array of partnership agreements are changing the size and scope of the entire telecom industry:

- Long-distance companies are acquiring wireless companies.
- Wireless companies are looking to partner with long-distance or specialized local phone companies.
- Local phone companies are merging with other local phone companies.
- Heretofore separate industries are cross-pollinating. Cable is getting into telecom;

telecom is getting into cable.

We've not been wallflowers in this dance. In the last five years, my company has been center stage in two of the largest cellular mergers ever.

The circle gets smaller and smaller, in some ways.

In other ways, the circle gets bigger and bigger. In my particular subset of telecom, there have been two cellular carriers in each market until recently. Now that the FCC has auctioned off additional licenses for another chunk of the spectrum they call PCS, there could be up to seven wireless telephone carriers in each market.

The third major industry event is the historic Telecommunications Act of 1996, which was signed into law earlier this year. I use the term "historic" not in reference to the bill's substance, but to the fact that there was a change at all. Rather than having to operate by 60-year-old rules, the telecom industry finally can get its marching orders as all other industries do—from the marketplace and customers, rather than the mandates of judges and regulators.

For Wall Street and wireless industry insiders, these events translate into one of the great growth opportunities of the decade and perhaps well into the next century.

In this regard, I expect the mating game of partnerships will continue as long as huge amounts of capital continue to be invested and the industry maintains healthy growth, all of which is likely for a long time to come.

But while the dance card in this telecom waltz is ever-changing, the technology is not dependent on who marries whom. The technology evolution has a life of its own, limited only by the imaginations of researchers and developers in the laboratory, and our customers in the marketplace. I'm happy to report the evolution is well underway.

I'd like to spend the next few minutes on what's coming off the drawing board not in the long range, but now or in the very near future.

I said earlier that two-way wireless voice and data communications will have a profound impact on the way we live, work and play in the 21st century. There are two "megatrends" behind this prediction:

The first big trend is that wireless will have an increasingly larger role in the overall communications pie.

It's already happening.

• One in every three new phone numbers is for wireless.

• A new wireless customer signs up every 2.8 seconds.

• And while it took 70 years to reach 30 million landline telephones, it took only *ten* years to reach the same number of cellular phones. So wireless communications are coming into the mainstream.

The second megatrend is that this untethered access to information and communications literally anytime, anywhere, will actually increase personal freedom.

I realize that this seems like a contradiction: You're thinking, "How can I be accessible anytime, anywhere, and have any personal freedom at all?"

It's true that the ability to communicate from a car, to send faxes from a plane or to access a database walking down the street frees us up to frenetically manage ever-increasing volumes of—what? More worry? Not solely.

The answer lies in our comfort with two things:

1. Our comfort with the added dimensions of mobility—of acting not like we're virtually there—but like we're *actually* there.

2. Our comfort-level with less, of productively *choosing* what information to pay attention to and what to pass on in this information explosion.

The technology will help with both.

If the last ten years saw corporate America—and to lesser extent the consumer—start to get comfortable with wireless communications technologies, the next ten will see Main Street get downright "at home" with them.

Clearly, there will be exponential growth in wireless data applications, which will help us to be highly selective in the data we choose to receive. This growing popularity of wireless data is due largely to the fact that we're finally able to do it cost-efficiently and make it easy to use.

This is a "smart phone." It works with our service, called Cellscape. It gives you voice, paging, two-way messaging, email and access to corporate intranets and the Internet. And it's here. It's on the shelf today.

It's easy to use, easy to carry, and very cost-efficient. It can be programmed to deliver selective information from databases, like stock quotes of your favorite list of companies so you don't have to wade through reams. In our company, we have our sales results available on our intranet database.

With Cellscape, information is sent to and from the phone via our CDPD network, which stands for cellular digital packet data. Wireless web browsers, which reside in the smart phone itself, allow the phone to provide not only voice and two-way messaging. These browsers open up access to a virtually unlimited number of information services, such as the stock quotes or airlines updates, all at the touch of a button.

The particular model that I just showed you is a mobile data terminal and phone all in one. It replaces many of the devices we all carry and has a price tag in the neighborhood of $750, which is already coming down. We're working with several manufacturers on similar smart phone models.

Here in New York, a delivery company called Walsh Messenger this month will give 150 of its messengers smart phones instead of pagers. This will give them real-time access to dispatch information on the company's intranet and other pertinent data, like delivery times and package details, that will improve productivity and customer service.

Some other applications we envision are for:

- visiting nurses, who might use the device to receive emergency calls or access information while making their rounds;
- insurance claims adjusters, who could enter claims from on-site;
- financial analysts, who could receive real-time market headlines, stock quotes and high/low alerts, and then use that information to make inquires and transactions right from their keypad;
- building inspectors, who could report findings right from on-site;
- business travelers, who could book and check flights and check weather reports.

This is but a glimpse of the potential. Given the vast resources of the Internet, the huge variety of software available and the ease of developing new software, we see virtually unlimited potential applications.

Smart phones and wireless-modem laptops are tools that allow us to be there and to be selective.

Although data is hot news, it's not the only exciting news in wireless. I'm sure you've heard all the buzz about digital cellular features, and the religious wars over which digital standard is best, GSM, TDMA or CDMA.

While I'm probably speaking from a somewhat biased viewpoint, I strongly believe that CDMA, which as many of you know had its roots in World War II with the development of frequency hopping, is the way to go. In fact, two-thirds of cellular carriers in this country have opted for CDMA.

Bell Atlantic Nynex Mobile is currently operating a first-anywhere commercial 13-kilobit CDMA system in Trenton, New Jersey, and Bucks County, Pennsylvania, and we're fast deploying it throughout our footprint.

The result is reduced background noise, inherent privacy and longer battery life, and the quality is superb—virtually the same voice quality as landline.

Add to these benefits five hours of talk time on your battery, short-messaging service, and caller ID that lets you accept the calls you want, and the others go straight to voice mail.

It's all about providing products and services that let you manage your calls and data to fit your schedule and your lifestyle, about giving you more control. Remember what I said about being selective?

This year we've gone back to the drawing board to simplify even the basic act of making a phone call, by introducing voice-activated dialing that's highly accurate and user-friendly. With digital, we're going to take it one step further.

You'll be able to use your voice to navigate your way through voice mail, leaving your hands free to safely navigate traffic. Rather than "press one" to hear your messages, you can say "play."

If you like the smart phone, you'll love the smart car. Unfortunately, I don't have one in my pocket!

OnStar, a new division of General Motors, has just introduced such a system that turns an ordinary set of wheels into a starship. OnStar integrates on-board advanced vehicle electronic architecture with GPS satellite technology and a cellular phone. The result is real-time directions, emergency services, stolen vehicle tracking and notification of airbag deployment.

Have you ever come out of a mall or airport and couldn't find your car amid the sea of vehicles before your eyes? OnStar will find it for you and then command it, via a cellular phone, to flash the lights and blow the horn so you can't miss it.

OnStar will even unlock your door remotely. You can tell your grandchildren how in the old days people locked themselves out of their car. In fact, the adventure of running out of gas or having a flat in the middle of nowhere will be a thing of the past!

Finally tonight, I'd like to reflect on some advice of Will Rogers. Commenting on the value of real estate, he once rendered the opinion that land was in limited supply, saying there's only so much of it.

Like land, there's only so much of it when it comes to spectrum, even considering the science of frequency splitting, hopping and boosting.

As with traditional radio, the pioneers of radio's next generations of descendants have the same serious responsibility in using our franchise of airwaves to responsively, creatively and optimally serve the public.

One of the most poignant things Princess Giovanelli shared last year was that, in her father's development of the radio, he wanted to improve the life of everybody.

My hope is that 100 years from now, the keynote speaker will stand here and pay tribute to the wireless telecommunications industry for upholding Marconi's legacy—and the Radio Club of America's long tradition—as guardians of the spectrum.

Thank you very much.

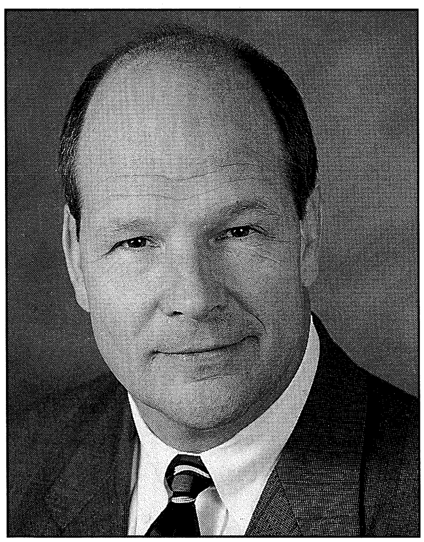
Dennis Strigl is chairman and CEO of Bell Atlantic NYNEX Mobile and chairman of the Cellular Telecommunications Industry Association.

By C. Meade Sutterfield

Response for Fellows

President Amoscato, President-Elect Trott, Mr. and Mrs. Strigl, distinguished members and their guests, good evening. I am greatly honored to be the respondent for the 1996 Fellows of the Radio Club of America.

As I looked back at the history of the Radio Club of America, it was founded only 14 years after Marconi's first experimental radio transmission, as a society to further the art of radio communications. In the ensuing 30 years, de Forest, Armstrong, Link and others developed the technical underpinnings for most radio communications. Practical application of two-way radio communications first occurred in 1909 for ships at sea, and the first commercial radio and television stations were started in 1920 and 1939, respectively. The first 45 years of radio communications, ending with the outset of World War II, concluded with most of the technical principles and applications established. However, general exposure to radio communications was listening to Jack Benny on an Atwater Kent console.



C. Meade Sutterfield.

WWII kicked off a second period for radio communications. Many people, including most of the older members of the Radio Club, were pulled into the war effort to refine technical concepts and produce reliable, lower-cost radio communications. Hundreds of thousands of people in the armed forces became familiar with two-way radio communications.

A second effect from that war came at its end, when these pioneers were unleashed on civilian needs. The application of technology to lower product cost and changes in American business practice assured the success of broadcast services and fueled the deployment of land mobile services for public safety, private networks and, finally, commercial networks.

In the period since WWII, radio and television broadcasting have full penetration, and two-way, paging and cellular services are fully embraced by business users. The deployment of paging and cellular systems more recently has brought communications to the broader consumer as well.

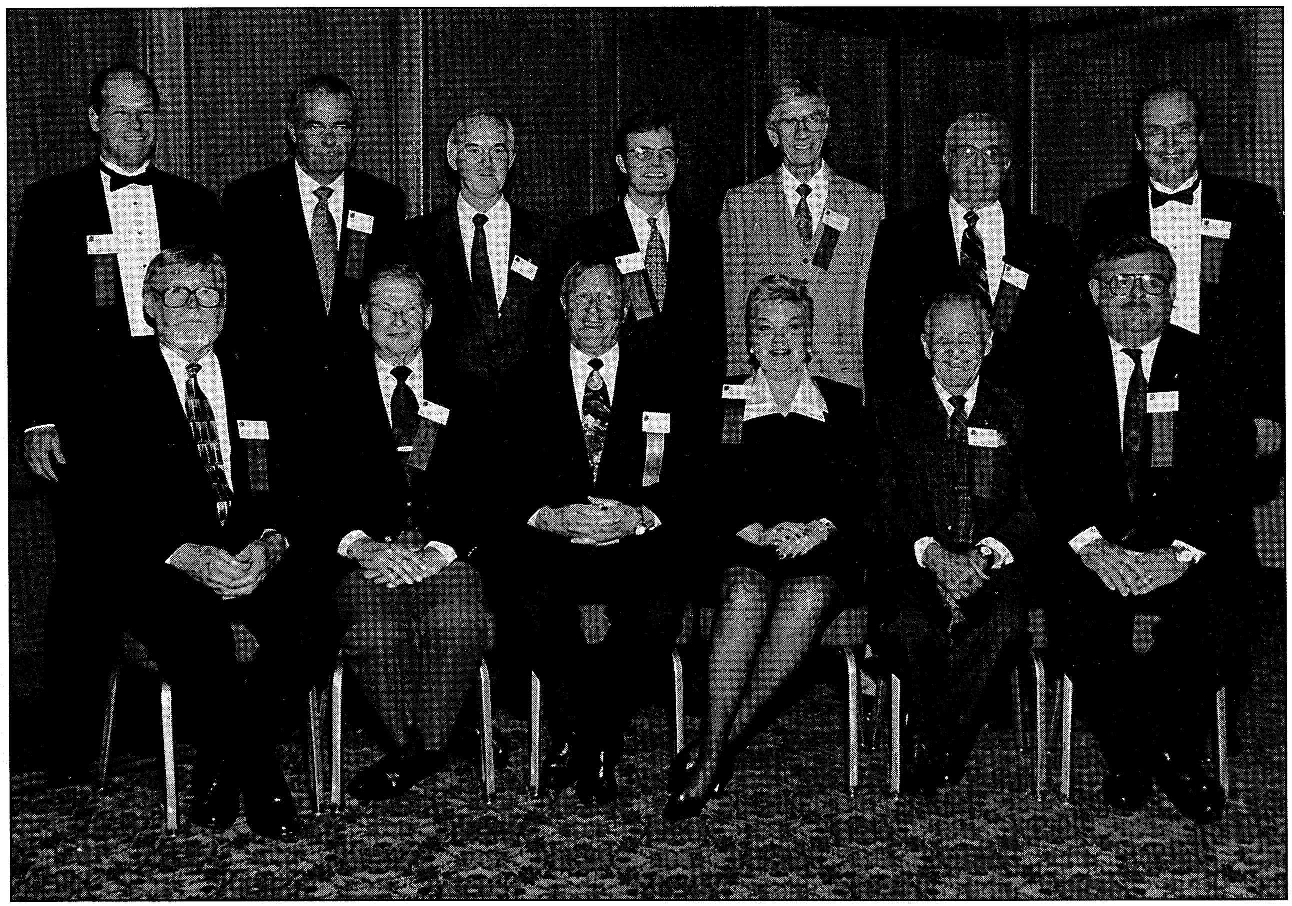
This second period is the legacy of the current Radio Club members and your new Fellows. Most of us have careers that include designing, producing and selling new products or implementing and operating commercial, government and private systems. Most of us have engineering degrees, and there is a generous flavor of ham in this group. Our role has been to bring "plug and play" communications to the ultimate consumer, whether that user works in the same organization or proves his or her satisfaction each month with a check for services.

As practitioners, we are most successful when our users never think about our services, just use them to catch the bad guys, solve their problems or find their children. Our work is still technical but focused on the nuances of filling the user's needs rather than the broader strokes of creation.

Today, this world's first radio communications society remains true to its mission of furthering the art of radio communications by providing a forum among those who provide the myriad component products and services that culminate in productive, satisfied users for radio communications.

The 1996 Fellows gratefully accept the honor of being included in the distinguished roll of the Fellows of the Radio Club of America. We share the bond of pride that comes with recognition by the members of this society for our work. We also accept the dual duties inherent in such an honor: furthering the art of radio communications and furthering the reputation of the Radio Club of America.

C. Meade Sutterfield



Present to receive their Fellow certificates during the awards presentation ceremony were (front row, from left): Loyce Hurley, Hans Meurer, John Capone, Carolyn Servidio, Warren Weldon and Richard Chocolate. In the back row, from left: C. Meade Sutterfield, Frank M. Gunther, Anthony Bonney, Darren Sextro, Kendall Pinion, Tolbert Prowell and Jim Stafford.

By Gaetano (Tom) Amoscato

Presentation of President's Award to Fred M. Link

I have the distinct honor and the greatest pride and pleasure of my life to present the President's Award to a dynamo of a man, Fred Link. "Dynamo" is the name I gave Fred when I joined the Fred Link Corp. in 1940.

The forerunner president emeritus for the Radio Club of America and past president for close to one-quarter of a century, from 1968 to 1992, Fred has had an impressive list of credentials over the years, including assistant engineer, De Forest Radio Co., 1927-28; founder of Link Radio Co., 1931-1950; and director of the Allen B. DuMont Mobile Radio Division. Related activities include director of public safety, 1940-41; mayor, 1942-1952, borough of Westwood, New Jersey; IEEE Fellow, 1973; board of governors, 1980; IEEE/VTS charter member; APCO honorary life member; QCWA life member; Society of Wireless Pioneers; Old-Timers Club; IEEE Centennial Medal, 1984; and the list goes on and on.

President Emeritus Fred M. Link (LF) holds the President's Award certificate (mounted on a plaque) as his wife, Mildred, looks on.

Fred, it goes without saying, has inspired more people in all walks of life and was mostly responsible for the growth of over 70% of our Radio Club membership with the most distinguished professional individuals in all aspects of wireless communications, broadcasting and technical publications. Many of the pioneers have had several patents, which add to our standards and technology as we know them today.

It is no wonder, Fred, being at the helm of the Radio Club of America, the course that was set through

Continued on page 29

87th ANNIVERSARY DINNER
And
AWARDS PRESENTATION
NOVEMBER 22, 1996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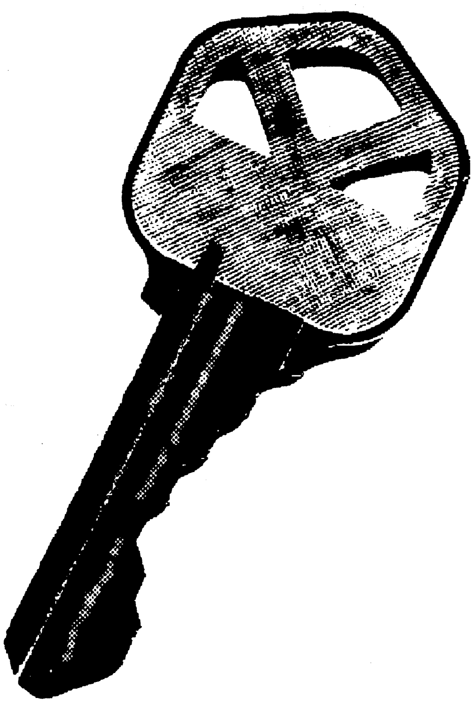

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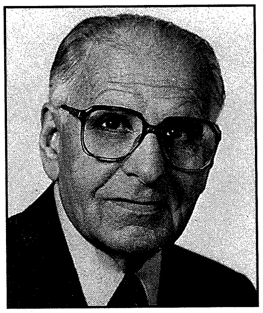
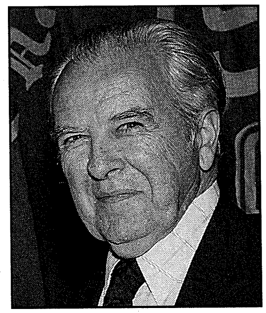
1996 Honors & Awards



President's Award
Fred M. Link

In recognition of pioneering achievements in FM land mobile radio manufacturing and for his energetic leadership of the club as president from 1968 to 1992.

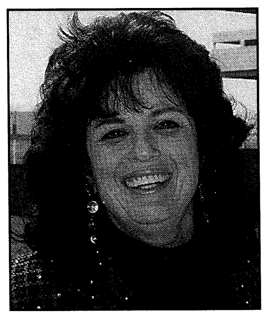


Jerry B. Minter Award
Jerry B. Minter

For significant contributions to the electronics art through innovation in instrumentation, avionics and medical electronics.

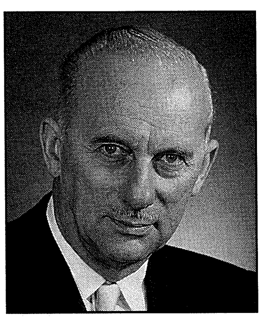
Special Services Award
Mercy S. Contreras

For outstanding support of club meetings and publications.



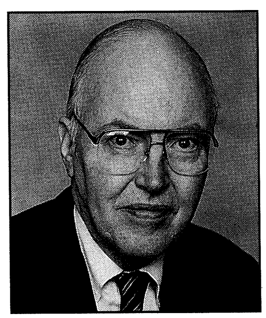
Barry M. Goldwater Award
Carole J. Perry

For devotion to teaching young students the great values of amateur radio communications.



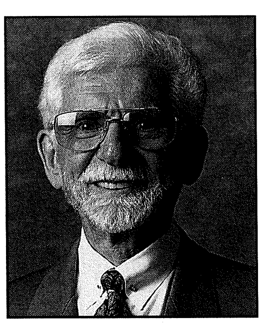
Frank A. Gunther Award
Frank A. Gunther

For active support of the club and for major contributions to the advancement of military electronic communications systems.



Allen B. Dumont Citation
Renville H. McMann, Jr.

For major contributions to television including the rapid development and construction of the lunar landing color television camera system.



Fred M. Link Award
Martin Cooper

For substantial contributions to the advancement and development of land mobile radio and communications.

Sarnoff Citation
Emmett B. Kitchen, Jr.

For major regulatory and business contributions to the wireless industry.

By Kenneth M. Miller

Grants-In-Aid Committee Report

Once again it is a pleasure to present to you our Grants-In-Aid (GIA) scholarship grants report.

At our Nov. 22, 1996, board of directors meeting, your board unanimously approved our committee's recommendation to provide 13 financial aid grants totaling $11,500 to 10 organizations.

These funds are provided by the interest earned from the investment of more than $194,000 in our GIA capital pool.

As provided in our Club's constitution, these grants are given to needy and worthy students pursuing the study of technical communications. In fulfillment of this objective, grants were approved by our board of directors for the following 10 organizations:

From the GIA general fund to:
- Southern Methodist
- Capitol College
- Polytech University
- Stevens Institute of Technology
- Virginia Polytechnic Institute
- Georgia Institute of Technology
- Embry-Riddle University

From the Poppele, Grebe and Somers funds to:
- The Foundation For Amateur Radio

From the Poppele Fund to:
- Ranken Technical College

From the Finch Fund to:
- University of Cincinnati

Each of these 10 organizations has in place carefully structured criteria to award 100 percent of our grants to individual college students in need of financial assistance to help in paying for their tuition and related college expenses.

We wish to give special recognition to just a few of the generous donations provided this past year.

Among these are Richard G. Somers, with whom I had the pleasure to be associated during an early period in our careers at Lear Inc. and who is president of Sigma Telecommunications. We have named a special Grants-In-Aid fund in honor of Mr. Somers and his contribution.

Next, our excellent and dedicated club president this past year and president of Amtol Radio Communications Services, Tom Amoscato.

Also the internationally known antenna manufacturer, the Celwave Division of Radio Frequency Systems, which has donated thousands of dollars in recent years.

Plus the former chief of the Cartography Section at the Natural Resources and Energy Division at the United Nations, Max C. de Henseler, Ph.D., from Montreux, Switzerland.

Also, we must not forget the significant contributions spanning many years made by members of the family of Jack Poppele, who have supported our Grants-In-Aid program in memory of their father, Jack Poppele.

In addition, the sizable contributions made by the family of Alfred H. Grebe Jr. have made an important and positive impact on our program.

Just recently, Mercy Contreras has made a sizable contribution to the Fred Link Fund in our GIA program.

And Mr. and Mrs. Hans Meurer presented their contributions to be added to our GIA program.

To summarize, these contributions and others are what have made this program one of the finest and most successful in our electronics industry in offering an outstretched hand to assist the youngsters about to enter our profession. In 1996 our Grants-In-Aid Fund has grown 23 percent.

This completes our 1996 Grants-In-Aid report.

About the author

Kenneth C. Miller is co-chairman of the Grants-In-Aid Committee, along with John E. Dettra, Jr.

Presentation of President's Award to Fred M. Link . . . *continued from page 26*

uncharted tomorrows has brought us into the most explosive changes in wireless. The fax machines, high usage, the birth of the Internet and email, to name a few, have truly diminished the size of the world from what it was when the Club began.

Fred, I speak for the entire Radio Club membership, who have known you personally and through business entities over the years and because of these occurrences, they have become better human beings due to your thoughtfulness and concerns as a friend and a colleague.

From the entire Radio Club of America and all your friends throughout the world, we wish you Godspeed and the best always down life's road. We need your dynamic drive.

I will present this award to you, Fred. The President's Award citation reads as follows:

"In recognition of his pioneering achievements in FM land mobile radio, manufacturing and for his energetic leadership of the Radio Club of America, serving as its president from 1968 to 1992."

Fred, congratulations; we salute you.

Intelligent Antennas: Spatial Division Multiple Access . . . *continued from page 10*

station antennas typically are designed to have a small window of elevation angles over which they operate efficiently.

Copies of *Worldwide Wireless Communications,* ISBN 0886-229X and ISBN 0-933217-17X, are available from International Engineering Consortium, 303 E. Wacker Drive, Suite 740, Chicago, IL 60601-5212; tel. 312-938-3500; fax 312-938-8787; e-mail publication@iec.org.

About the authors

Martin Cooper is chairman, and Marc Goldburg, Ph.D., is GSM engineering manager at ArrayComm Inc.

The Radio Club of America 1996 Banquet Contributors

We acknowledge with thanks the support of the following people and companies for their generous contributions, and to Fred M. Link, whose assistance was instrumental in obtaining them.

Amtol Radio Communications Systems
Allen Telecom Group/Decibel Products
American Mobile Systems/Nextel
Aurora Marketing
Cellular Business
Cellular & Mobile International
Celwave RF
Communications & Control
Arch Doty, director
Decibel Products/Dr. P. Mailandt
Ericsson
Fred M. Link, president emeritus
Glenayre Electronics
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Wireless Product News
WirelessWorld magazine

By Jerry B. Minter

Comments on the Human Eye Response to Video Staircase Tests

Around 1943, my staff at Measurements Corporation, Boonton, New Jersey, built some specialized video test equipment, including a wide-band oscilloscope, flat to about 50 MHz, a TV sync generator and a video test pattern generator that included a staircase that was generated electronically, not optically. Of course, these were monochrome signals—color was not yet standardized. Our model 90 Standard Signal Generator was later used to develop the National Television Standards Committee (NTSC) color system by RCA, Philco and others.

A surprising effect occurred: At each transition from a darker to a lighter shade of gray scale, there appeared to be an overshoot just as the electrical waveform of the staircase had an electrical overshoot present.

I demonstrated this to Heinz Kallman, Ph.D., during his visit to our lab, and he suggested that this effect was due to the nystalmus (minor random motion) of the human eye. As it scans a sudden change in gray scale, the eye automatically emphasizes it—a sort of built-in differential response.

To prove his point, Kallman took a small white card and slowly aligned it vertically to obscure the darker side of the transition on the cathode-ray tube (CRT). Lo and behold, the overshoot effect *virtually disappeared.* This nystalmus response also is linked to the human ear, because nerve impulses from both the eye and the ear go through the eighth nerve to the brain. For example, a serious shock to the normal right ear will produce a nystalmus movement in the right eye.

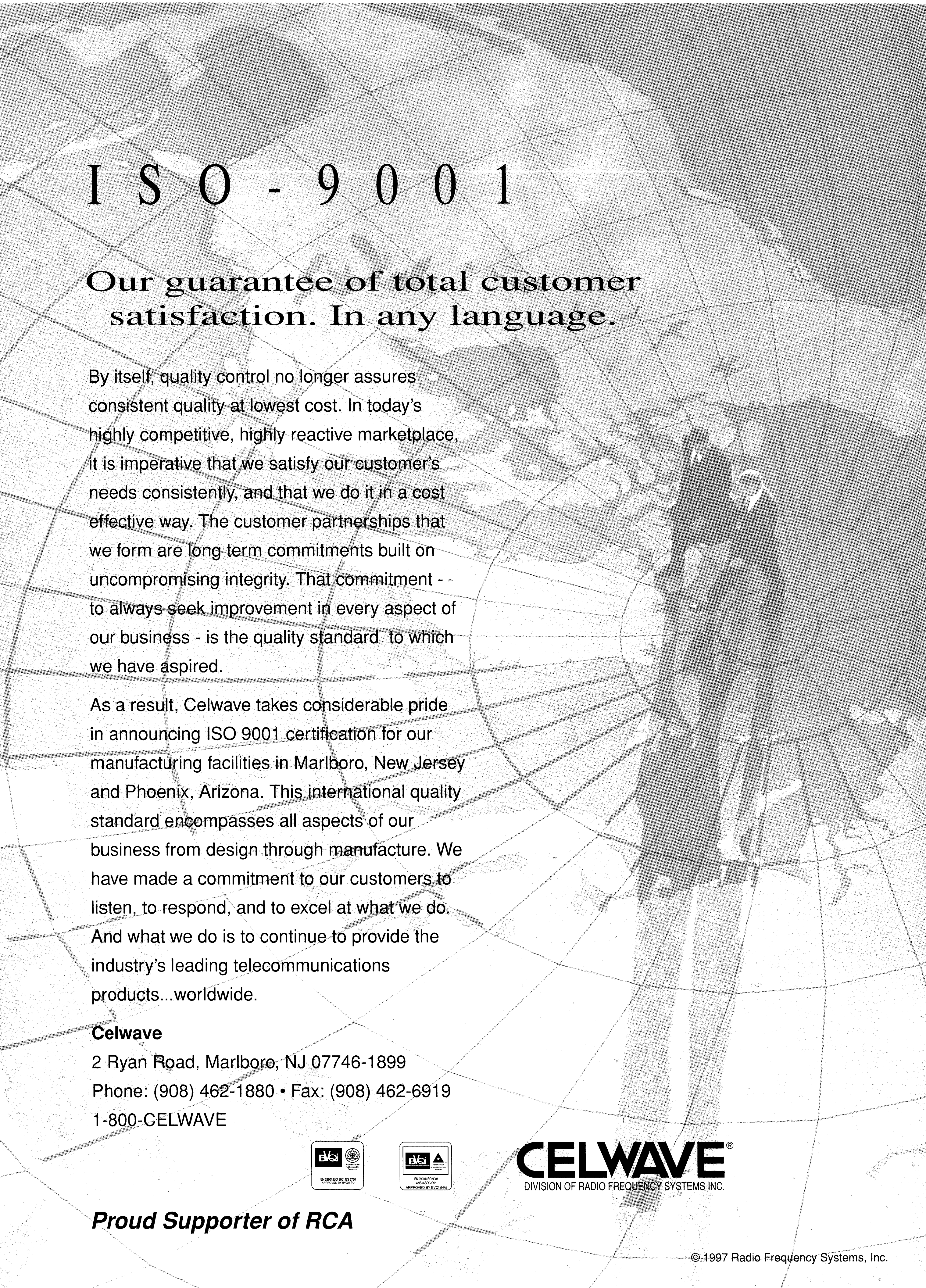
Kallman, by the way, wrote a technical paper for the Institute of Radio Engineers in about 1941 that became famous. It disclosed a new filter theory using tapped delay lines, which became known as the "Kalman Filter"—his name having been misspelled. Many high-quality TV sets use these filters to take out the 3.5 MHz color carrier because they do so without phase shift. I consider Kallman to be a most unusual engineer. He later published a detailed description of a walking cane with a built-in ultrasonic radar for use by blind people.

It is important to know about this built-in overshoot when looking at rapid transitions of gray scale on a CRT.

This built-in property may be important when we attempt to process video data for direct input to the eighth nerve as a substitute for the defective retina and fovia.

About the author

Jerry B. Minter (LF), president emeritus, was chief engineer of Measurements Corp., Boonton, NJ, from 1939 to 1953.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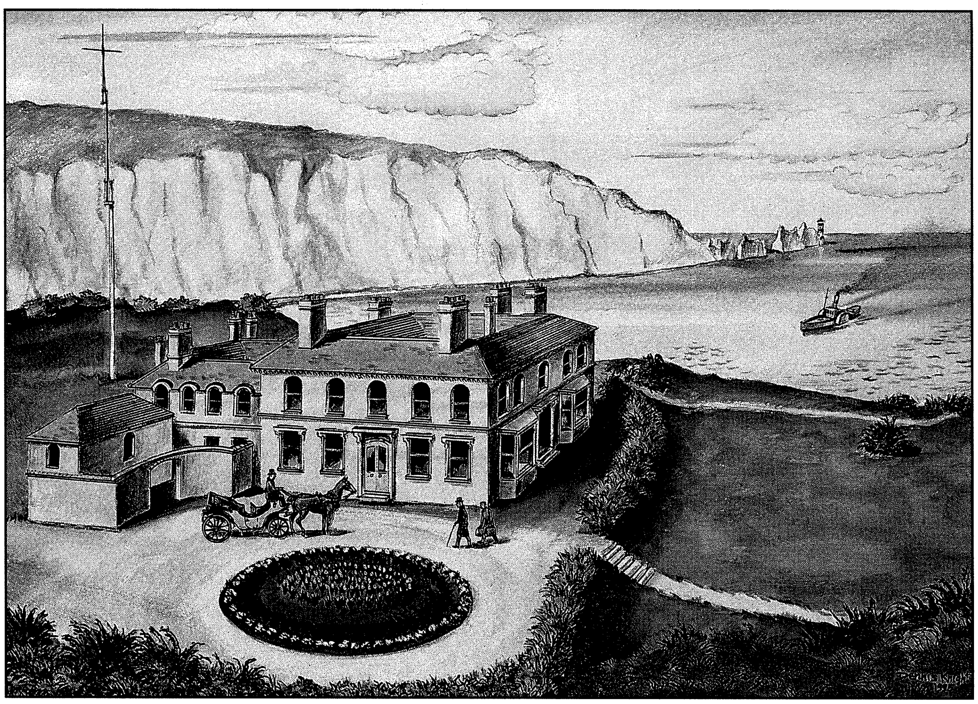
Marconi First Day Cover of UK stamp

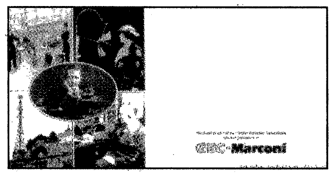
One of the Radio Club of America's members from the United Kingdom, Rowland G. Shears (F), G8KW, sent a first-day cover of his country's stamp issue commemorating the 100th anniversary of Guglielmo Marconi's demonstration of wireless communications. He sent the cover to Fred M. Link, president emeritus, in November 1995.

Rowley had hoped to present the first-day cover to the club library or museum during the November dinner and awards presentation, but he was unable to attend. "The cover is not of great value at today's price," Rowley points out, "but as the enclosed advertisement indicates, it is a 'collector's item,' and one purchases it as an investment. Beyond this, it is of historical interest, which future directors and officers of the Radio Club of America may wish to preserve. Had I been able to attend the banquet, it would have given me great pleasure to have delivered this package into your hands as the special envelope and Christmas card would no doubt have been of particular interest to Princess Giovanelli." Marconi's daughter, Princess Elettra Marconi-Giovanelli, was the principle speaker at the 1995 banquet.—*Don Bishop*



In November 1897, Marconi established his wireless station at the Royal Needles Hotel at Alum Bay on the Isle of Wight. The 120-foot aerial he erected in the grounds was stout enough to withstand gales from the Channel and consisted of a lower and a top mast that had been purchased in Southampton. The lower mast required 13 men and a boy to haul it up the Chine to the top of the cliff. From this station, on June 3, 1898, Lord Kelvin sent the first paid telegram sent by wireless. Marconi transferred his station to another site on the island in 1899, and in 1909, the hotel was destroyed by fire. (From a card published by GEC-Marconi Limited and the Radio Society of Great Britain, "The Royal Needles Hotel" by Dennis Knight, Copyright 1995, GEC-Marconi Limited.)

MARCONI FIRST DAY COVERS



This Limited Edition First Day Cover is the first amateur radio cover to be over-printed with an RSGB cancellation mark, and will undoubtedly become a collectors item to amateur radio operators and philatelists alike. This is not a purchase but an investment.

COST IN SEPTEMBER 1995

Members Price £7.50 (plus P&P) = $13·00

The Marconi first-day cover advertisement.

The front of the Marconi first-day cover.

Nº 235 of a limited edition of 500 produced for the Radio Society of Great Britain.

Guglielmo Marconi

A.G. BRADBURY FIRST DAY COVERS

Top Left: By August 1895 Marconi had succeeded in transmitting signals over a distance of nearly two miles. This picture shows tests taking place on Salisbury Plain in the following year.

Top Right: On15 June 1920, in Britain's first advertised public broadcast programme, Dame Nellie Melba broadcast a song recital from Marconi's works in Chelmsford.

Bottom Left: In 1936 the Marconi-EMI system was adopted by the BBC for its public high definition television service - the first in the world. The photo shows the aerial at Alexandra Palace.

Bottom Right: Although head of a world-famous commercial enterprise, Marconi's consuming interest lay in scientific experimentation, and he was never happier than when, as shown here, he was at sea on his yacht, investigating new methods of communication and navigation by wireless.

Printed by A. T. Shelley (Printers) Ltd., Leicester

The reverse of the Marconi first-day cover.

TREASURER'S REPORT FOR FISCAL YEAR 1996

(October 1, 1995 — September 30, 1996)

REVENUES

Dues Collected & Applied	$14,586
Other Member Fees	1,534
Banquet - net	844
Advertising Sales	10,640
Pins & Plaques Sales	1,674
Interest on General Funds	3410
Publications Sales & Misc.	504
TOTAL Revenues	$33,192

EXPENSES

Publications	
Printing & Supplies	$7,700
Mailing Expenses	1,919
Meeting Expenses	3,760
Office Expenses	
Printing & Stationery	1,946
Postage	1,296
Office & Computer Expenses	240
Executive Secy & Other Admin Fees	10,901
Legal & Accounting	1,100
Officers & Directors Liability Insurance	2,454
Pins & Plaques - net	1,702
Miscellaneous	431
TOTAL Expenses	$33,449
NET Revenues less Expenses	($258)
Other Adjustments (net) (see note -->)	$40,582
NET Increase in Fund Balance	$40,324

BALANCE SHEET

ASSETS

Inventory & Receivables	$6,844
Section & Banquet Funds	21,656
Cash in Bank - Operating	42,415
Investments - Securities	65,832
GNMA Certificates	39,997
Fed Home Loan Mtge	87,083
Fed Natl Mtge Assn	30,000
Putnam Fund	42,841
TOTAL Assets	$336,668

LIABILITIES

Prepaid Dues	$12,580
Fund Balances:	
Scholarship Funds - Principal	194,090
For Distribution	13,401
General Funds - Oprt'g Balance	44,798
Reserve for Oprt'g Deficits	20,116
Life Member Fund	25,412
Legacy Fund	10,347
Other Assets & Liab-Net	15,920
TOTAL Liabilities	$336,668

N.B. Other adjustments include contributions to funds, scholarships and grants awarded, earnings on funds and changes in values of investments. Interest rate sensitive investments increased in value by $28,480 during the fiscal year.

SCHOLARSHIP & GRANTS FUNDS

	Capital	Available for Distribution	Totals
Opening Balance Oct. 1, 1995	$157,395	$13,238	$170,633
Contributions	36,395		
Interest Earned		11,666	
Scholarships & Grants Awarded		(11,500)	
Ending Balance Sept. 30, 1996	$194,090	$13,405	$207,495

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Engineering the Wireless Spectrum

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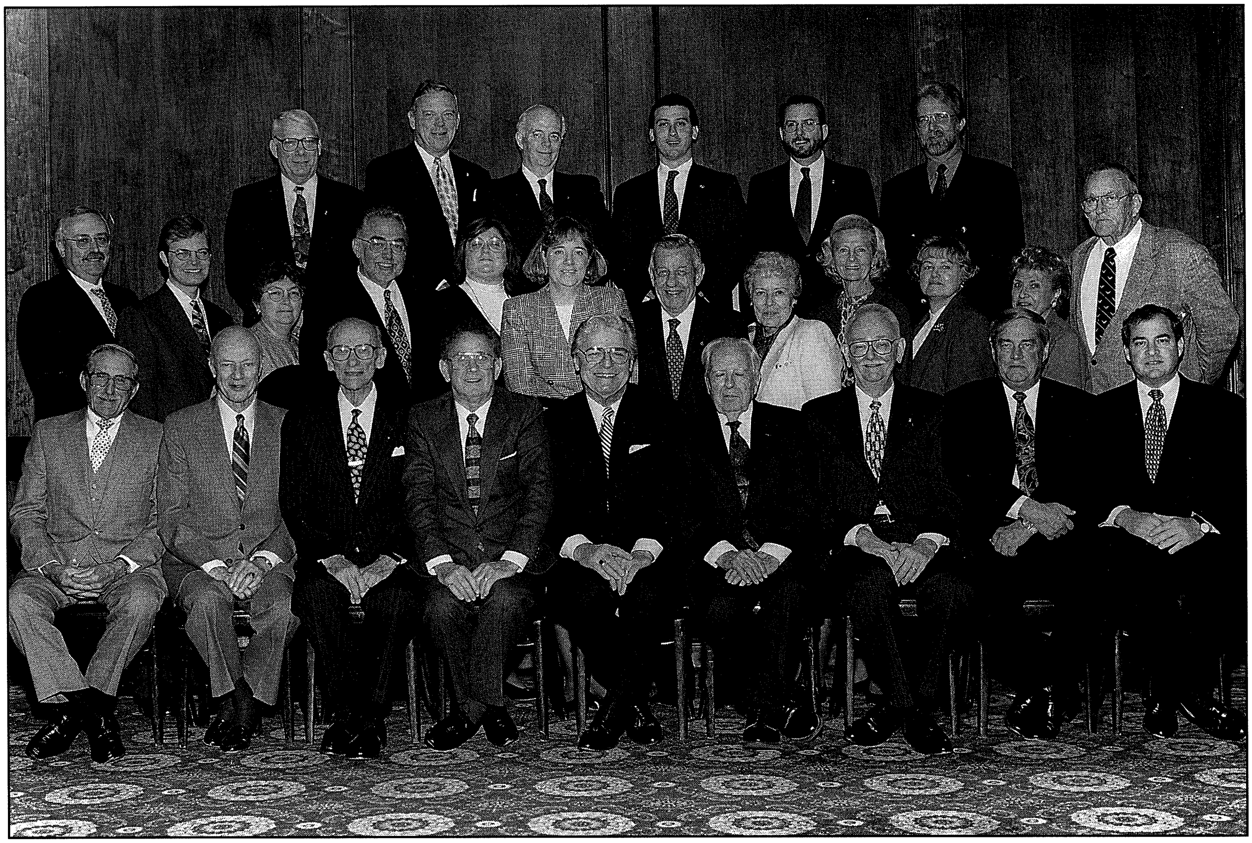
Raymond C. Trott, P.E., President

Radio Club of America leaders for 1996



This photograph represents the club leadership from Jan. 1 to Dec. 31, 1996. Included are officers, directors (D), executive committee members (E), the Newsletter *editor (N) and the executive secretary (ES), whose term began Nov. 22, 1996.*

Front row, from left: Joseph S. Rosenbloom, esq., vice president/counsel (E); Kenneth M. Miller (D); Frank A. Gunther (E); Mal Gurian (E); Gaetano J. Amoscato, president (E); Jerry B. Minter (E); Raymond C. Trott, P.E., vice president (E); William E. Endres, executive vice president (E); David E. Weisman, esq., vice president/co-counsel (E).

Middle row, from left: John E. Brennan (D,E); Darren D. Sextro (N); Mercy S. Contreras (E); Edward F. Weingart (D); Maxine Carter-Lome (D,E); Jane Bryant (D); Gilbert R. Houck, secretary (E); Vivian A. Carr (D,E); June Poppele (E); Gerri Hopkins (ES); Connie M. Conte (E); Loren R. McQueen (D).

Back row, from left: John E. Dettra, Jr. (D); Robert C. Gunther (D,E); Eric M. Stoll, Ph.D., P.E., treasurer (E); Theodore S. Rappaport, Ph.D. (D); Don Bishop (D); Emmett B. Kitchen, Jr. (D). Not pictured: John P. Hart, Jr. (D,E); Fred M. Link (E).

signs previously assigned to them. On July 22, 1996, the FCC began accepting applications from clubs seeking the assignment of a call sign previously held by a member now deceased. Finally, on Sept. 23, 1996, the FCC began accepting applications from clubs seeking any other available call sign, a category into which the Radio Club of America fit. Any individual with an Extra class amateur license could apply for an available call sign, too.

Frank prepared the necessary application, and club member Robert Johansen, WB2SRF, helped to make sure that it was delivered on the first day. Frank was concerned that someone else might request W2RCA, too—perhaps a former employee of the Radio Corporation of America, for example, or someone with the initials R.C.A. In fact, several thousand applications were submitted on Sept. 23. Processing of the first-day applications was conducted at random, so there was a chance that the club might not receive its choice. The result was gratifying, though, and the club was assigned W2RCA.

On Jan. 21, 1997, Frank came forward again, offering to designate his amateur station in Staten Island, New York, as a location for the club station. The station can be operated by club members and approved guests under his direction as the station trustee. Carole Perry, who teaches Staten Island middle school students about amateur radio, has said she wants to bring students to operate the station.

Actually, the club station already made its first appearance on the airwaves on Dec. 9, 1995, when Frank, using equipment set aside at his home for use as the club station, exchanged a message with W2ZM, a station operated by the Antique Wireless Association to commemorate the first transatlantic communication by shortwave. He sent the following message:

"To the members of Antique Wireless Association: Congratulations on your work commemorating the Radio Club of America's station 1BCG on its success during the 1921 ARRL shortwave transatlantic tests. Sincerely, Radio Club of America, Frank A. Gunther, trustee, KB2VHE."

The next year, the AWA made arrangements to position a replica of the 1921 transmitter near the original site in Greenwich, CT, and to use the call sign W1BCG to make contacts with other radio amateurs to commemorate the transatlantic contact once again.

On Dec. 11, 1996, Frank made the first contact with the station and sent the following message:

"To W1BCG, AWA: Congratulations to all at Antique Wireless Association for this 75th anniversary of the Radio Club of America's 1BCG transatlantic message and commemorating this, the first contact made by our club's new station license, W2RCA. 73, Frank A. Gunther, trustee, Radio Club of America."

After so many years, it is splendid that the Radio Club of America has its own amateur call sign and that initial steps have been taken to provide a club station. Congratulations to Raymond Minichiello, Frank Gunther and Robert Johansen for initiating the project and seeing it through. Details about the AWA's commemorative project appear in December 1996 *QST* in the article "Hams Span the Atlantic on Shortwave" by club lifetime member and Fellow, Bruce Kelley, W2ICE.

The Radio Club of America, Inc.

Founded 1909, New York, U.S.A.

WORLD'S FIRST RADIO COMMUNICATIONS SOCIETY

APPLICATION FOR MEMBERSHIP

TO: THE EXECUTIVE COMMITTEE

Date: ____________________

I hereby apply for ❑ Regular ❑ Retired ❑ Student (please check one) membership in THE RADIO CLUB OF AMERICA, INC. and certify that I meet the requirement for the grade selected. I further agree that, if elected, I will be governed by the Club's Constitution and By-Laws as long as I continue to be a Member.

____
Signature

Full Name: ____________________
(LAST) (FIRST) (INITIAL) (CURRENT AMATEUR CALL)

Home Address: ____________________
(STREET) (The above information is used for mailings and your membership directory listing.)

____
(CITY) (STATE) (ZIP CODE)

Business Address: ____________________
(ORGANIZATION) (DIVISION)

____
(STREET) (CITY) (STATE) (ZIP CODE)

Telephones: Home ____________ E-Mail ____________ Fax ____________

Business ____________ Ext. ______ E-Mail ____________ Fax ____________

Birthplace: ____________________ Date of Birth: ____________________

Education and memberships in other clubs and societies: ____________________

____

In what particular branch of the communications art are you most interested? ____________________

Present occupation: ____________________

In what year did you become interested in electronic communications? ____________________

Previous experience (indicate approximate dates): ____________________
(A current resume may be attached to the application.)

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Please list the name of a member to whom you are personally known and who will sponsor you.

Sponsor: ____________________

Mail this application to The Radio Club of America, Inc., 1620 Route 22, Suite 300, Union, NJ 07083, with applicable total due at initiation as indicated on reverse of form. All monies to be issued in U.S. funds, drawn on a U.S. bank. International money orders and traveler's checks are accepted in U.S. funds, payable in the U.S. Checks should be made payable to **The Radio Club of America, Inc.**

The Radio Club of America was founded in 1909 by a group of the industry's pioneers, and is the oldest active electronics organization in the world. Its roster of members is a worldwide *Who's Who* that includes many who founded and built the radio industry.

The Club's objectives include promoting cooperation among individuals interested in electronic communications and in preserving its history. The Club administers its own Grants-in-Aid Fund to provide scholarships funded by tax-deductible contributions from the Club's members and their business organizations.

The Club publishes and distributes its *Proceedings* twice a year.

ENTRANCE FEE AND DUES

Membership Category	Annual Dues Rate	3-Year Dues Rate	Initiation Fee	Total Due At Initiation
Regular	$35	$95	$40	$135 (includes 3 years' dues)
Retired	$20	$55	$25	$80 (includes 3 years' dues)
Student	$15	n/a	$7	$22 (includes 1 year's dues)

REGULAR member is a member not qualifed for **RETIRED** or **STUDENT** status.

RETIRED member is at least 65 years of age and fully retired.

STUDENT member is a full-time student at an accredited academic institution.

Recommendation of sponsor: (optional)

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Sponsor Signature: ____________________

Date: ____________________

FOR OFFICIAL USE

Date Application received: ____________________

Date and Amount of Dues Received: ____________________

Admitted to Membership: ____________________

Membership Certificate and Pin issued on: ____________________


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& Lightning
Protection
Solutions
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TO MICROWAVE 20GHz
BROADCAST & MILITARY
TO 80 kW
RACK PANEL PROTECTOR
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UNI-KIT COAX
CABLE GROUNDING
DATA/PHONE PUNCH
DOWN BLOCK
SOLAR/BATTERY
PHONE LINE/LAN/T-1
POWER PROTECTOR
120/240Vac,15-20A
1.2 TO 20GHz MICROWAVE
& DOWNCONVERTERS
IN-LINE POWER MAINS
COAX PROTECTOR
WITH SAMPLER PORT
SHUNT-TYPE
POWER MAINS
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