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The Radio Club of America, Inc.

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Founded 1909

THE RADIO CLUB OF AMERICA, INC.
c/o Fred Shunaman, 324 South 3rd Avenue, Highland Park, NJ 08904

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

The Radio Club of America, Inc.

324 SOUTH 3rd AVENUE, HIGHLAND PARK, N.J. 08904

Price $2.50

Organized for the interchange of knowledge of the radio art, the promotion of good fellowship among the members thereof, and the advancement of public interest in radio.

TREASURER'S REPORT FOR 1983

(Prepared by Thomas J. Catanio, Jr., CPA NJ)

RECEIPTS

Dues	$ 6,595
Contributions	12,940
Interest and dividends	8,281
Advertising	1,883
Sale of pins and plaques	1,265
Total Receipts	$30,964

DISBURSEMENTS

Grants	$6,000
Editorial consulting fee	3,000
Publication expenses	2,767
Rent	600
Printing and Stationery	421
Addressograph and office supplies	362
Office service and telephone	337
Postage	601
Meeting	1,889
Pins and plaques	326
Newsletter and balloting	833
Total Disbursements	$17,136

Excess Receipts over Disbursements $13,828

GRANTS-IN-AID
116 Contributors donated a total of $6,930 in 1983

A new Memorial Fund has been started to honor Alan Biggs, who passed away just after he had been made a Fellow last November. Donations in 1983: $225.

THREE CLUB AWARDS

Edwin P. Felch, *right, receives the highest award of the Club, the Armstrong Medal, awarded to "any member of the Club, who shall have made, in the opinion of the Board of Directors, an important contribution to radio art and science," from Club Director Jerry Minter. Mr. Felch's early contributions included the first all-electronic frequency-following remote receiver. He obtained the basic patent on signal-seeking receivers. A later contribution was the development of airborne recording magnetometers, used for such widely different operations as submarine detection by the U.S. Navy, mapping petroleum fields in Alaska and prospecting for iron in New York. Mr. Felch has been a member of the Club since 1939, a Fellow since 1942, and became a Life Member in 1971.*

William J. (Bill) Halligan, Sr., *left, receives the Sarnoff Citation, for "Significant Contributions to the Advancement of Electronic Communication," from Master of Ceremonies Stuart Meyer. Almost a lifelong amateur (he got his ham license at age 15) Bill became famous as the developer of the Hallicrafters line of amateur receivers, whose low cost and excellent operation convinced many beginners of the ease and joy of amateur radio. Bill is still an avid ham, operating from Chicago in the summer and Florida in the winter. He joined the Club in 1960, became a Fellow in 1964 and a Life Member in 1979.*

David Talley *receives the Henri Busignies Memorial Award "for the Advancement of Electronics for the Benefit of Humanity" from Mrs. Busingies. Mr. Talley was a telephone engineer with NY Telephone Co. 1923/1946 (except for war leave 1940/1945), and with ITT or Federal from 1946 to 1959. He was an amateur in 1915 (W2PF in 1919) and has worked in radio organizations since 1920, when he helped found the Brooklyn Radio Club. In 1926 he helped organize the Army Amateur Reserve System. In 1940 he continued his AARS work as a Major in the Signal Corps Reserve, and was on active duty throughout the war, afterward helping reorganize the AARS nets as MARS (Military Afilliated Radio Systems). In civil organization, Talley has helped found or actually written the constitutions of several radio associations, including the Club, and has taken an active part in them. Dave joined the Club in 1949, was Fellow in 1957, Life Member in 1970 and Director Emeritus in 1977. He served on the Executive Committee 1971-79 (Treasurer 1971-77) and currently serves on the Scholarship Committee.*

MORE AWARDS TO

Fred Link, *right, receives the Allen B. DuMont Citation, given for "Important Contributions to the Science of Television," from Dr. P.S. Christaldi. Fred built the world's first commercial television transmitters under the direction of DuMont, then Chief Engineer of de Forest Radio. The transmitters were for Jenkins Television, a subsidiary of de Forest. Still working closely with DuMont after de Forest Radio folded, he constructed some of the earliest modern-type TV transmitters, and after World War II built for DuMont Labs all the VHF transmitters that company used or sold. Mr. Link joined the Club in 1968, and has been its President since 1969.*

Joseph R. Pavek, *right, accepts the Ralph Batcher Memorial Award, given to "a member who has assisted substantially in preserving the history of electronic communications," from Stuart Meyer. An amateur (W0OEP) for 60 years, he became interested in the history of radio about 1947, collecting old wireless sets and radio equipment while traveling in connection with his business, and displaying them at electronic trade shows. This led to the Museum of Wonderful Wireless in Minneapolis, with some 4,000 feet of floor space, plus working and storage areas. Mr. Pavek has been an active participant in other historical groups, notably the Antique Wireless Association.*

Delbert E. Replogle. *right, accepts the first Lee de Forest Award, given "in memory of the many contributions of Dr. de Forest to the radio communications industry," from President Link. A wireless pioneer, who in 1916 established the farthest north radio station on the American continent (inside the Arctic Circle) Mr. Replogle became associated with Dr. de Forest in 1929 as Executive Vice President of Jenkins Television Corp. a de Forest subsidiary. Later he became de Forest's Chief Engineer and worked with him in designing high-power transmitting tubes. He was also an early writer on television. Mr. Replogle joined the Club in 1928, becoming a Fellow the same year, and was made a Life Member in 1971. He was a Director of the Club in 1932.*

LUB MEMBERS

Paul Dane, left, Fellow of the Radio Club and Awards Chairman of the Society of Wireless Pioneers (SOWP) presents **Fred Link,** *President of the Club, with the Society's Wireless Achievement Award, for "his outstanding leadership in the field of FM technology." Mr. Dane, acting as representative of William Breniman, President and Executive Director of SOWP, also presented Mr. Link with an Honorary Life Membership in the Society of Wireless Pioneers.*

Stuart Meyer, *left, receives the President's Award, given "for unselfish dedication to the support of the Radio Club of America," from President Link. A member from 1956 and Fellow since 1967, he served as Papers Committee chairman in 1972, was on the Board of Directors from 1973 to 1976, and on the Executive Committee from 1977 to date. He is now Executive Vice President of the Club. Stuart has dedicated much time to the Radio Club in many different, unofficial ways. His most recent activity is setting standards for the newly proposed Senior membership. Stu has been a ham since 1933 and is extremely active in amateur affairs.*

Mr. F.X. Rettenmeyer, recipient of the Pioneer Award, "given annually to long-time members of the Club who have contributed substantially to the success of the Club or to the art of Radio Communications," reports that though he would have liked to attend the Banquet, his family would not let him travel because of poor health. He started his radio career in 1922, with Bell Laboratories. Later he helped develop the famous FADA neutrodyne, as Chief Engineer for F.A.D. Andrea. Mr. Rettenmeyer has been a member since 1928 and a Fellow since 1929. He was a Director of the Club in 1929, 1931 and 1932, Recording Secretary in 1933, and Vice President in 1935. He became a Life Member in 1971.

Dana Atchley

32 MEMBERS BECOME FELLOWS

Thirty-two members *were elevated to the status of Fellow in 1983. Twenty-six of them were photographed at the Annual Meeting and Banquet,* **Left to right, standing,** *are Keith Wycoff, Reach Electronics; Jai Bhagat, MCCA; Ulrich Rohde, RCA Government Systems; Kenneth Hopper, Bell Labs; Joseph Gallelli, New York State Police; William Kelly, WNEW-TV; Larry Hollingsworth, Ohio Edison; Phil Cook, Mobile Radio Technology; Paul McKenney, Orlando, FL; Graham C.K. West, Pye Telecommunications; William Bailey, Garden City, NY; Reed Fisher, Bell Labs; Harry Mayo, Tektronix; John Goeken, Airfone, Inc.; Victor Clark, President ARRL; David Ferrell, Midland Land Mobile Radio; David Bondon, Prodelin, Inc.* **Seated,** *E.R. Durham, Radio Inc., Tulsa, OK; Alan Biggs, Horse Shoe, NC; August Gabriel, Gabriel Communications; Hazard Reeves, Reeves Sound Systems; Karl Engle, Chicago, IL; Benji Hara, Boynton Beach, FL; Dana Atchley, Lincoln, MA; Paul Dane, University of California, and Bob Hertzberg, Boca Raton, FL. William A. Breniman, John A. Bryant, Jack M. Janicke, Judy Lockwood, Frederick Macklin and Charles "Brower" McMurphy were unable to be present.*

Five members have passed on

Ralph G. Maddox (M 1980) died last December at the age of 80. Mr. Maddox, as a staff member of the Signal Corps Development Laboratory, designed the communication system for the Burma Road, and the engineering of the Alcan Highway carrier telephone system. In more recent years he designed extensive systems in mid-U.S., California, Brazil and other areas, working with Federal Telephone & Radio Co., the Telephone Equipment Co., and San Diego Gas & Electric Co. He had a large collection of antique radios, as well as classic cars.

William B. Gould, K2NP (M 1975) died August 15, 1983, at age 82. A retired electronics engineer, his experience dated back to Radio WTAG, Worcester, MA, in 1925. He was with the Signal Corps Engineering Labs from 1940 to 1970.

Bertram G. Marshall, K2JAQ/TI2-JAQ (M 1980) died December 23, 1983. He was 48 years old. An antique radio enthusiast and member of the Antique Wireless Association, he had a collection of old broadcast receivers.

Edwin E. Crane, W2EF (M 1980) died January 17, 1984. He was born in 1896. Mr. Crane had been a member of the Club in the period between 1914 and 1931. He had held the call 2EF continuously since 1920, and was Charter Member No. 11 of the QCWA.

Victor Clark (M 1982, F 1983) President of the American Radio Relay League, died November 25, 1983, of a massive heart attack. His death occurred just a week after attending the Jubilee Banquet of the Club, where he was made a Fellow and addressed the meeting.

Before becoming President of the League he had served as Vice President six years. In 1979 he was extremely active in the World Administrative Radio Conference (WARC). He was one of the three persons to receive the Hiram Percy Maxim award. He was Director of the U.S. Coast Guard Electronics Engineering Laboratory in Alexandria, VA, for 11 years, and earlier had served as Chief of the Navigational Aids Section of the Civil Aeronautics Administration Agency.

William T. Bishop (M 1973, F 1982) Kansas City, MO, died early in April, aged 75. Mr. Bishop was a pioneer, having worked for de Forest in 1928, when Allen DuMont was de Forest's chief engineer.

CSSB - ACSB

THE PROGRESSION OF NARROW BAND VHF/UHF TECHNOLOGY

BY FRED B. CHILDS

Conservation of the radio spectrum has gained priority with the persistent demand for additional mobile radio channels. Such demand prompted action by the F.C.C. through the efforts of Drs. Wilmotte and Lusignan to bring forth a compandored single sideband system with pilot tone replacing carrier and 5 kHz bandwidth replacing 20 to 30 kHz bandwidth, termed Amplitude Compandored Sideband or ACSB.

ACSB, however, is not the only form of VHF/UHF narrow band technique because in 1961 Mr. Leonard Kahn of Kahn Research Laboratories, now Kahn Communications, Inc., patented a full carrier, single sideband system termed CSSB or Compatible Single Sideband presently being employed in the pending 900 MHz Airfone and Railfone systems being implemented by the E.E. Johnson Co. for the Western Union-Goeken Communications joint venture. At 900 MHz doppler shift and multipath phenomenon are a much greater communications deterrent than at 150-170 and 450-470 MHz. Through a combination of balanced modulators and phase differential networks the single sideband has distortion reduced to 1% and the full or nearly full carrier serves as a lock-on or synchronizing agent to provide a stable and high quality 900 MHz system.

In the Airfone system, household type cordless telephones at the passenger seats are coupled via a leaky coaxial cable to base units, FIG 1. Each handset transmits in the 49-50 MHz range and receives in the 1-2 MHz range. The individual base units employ an audio bandwidth of 6 kHz and are integrated by an airborne control unit which up converts to the 900 MHz region. All circuits transmit to the ground facility in a 200 kHz slot, FIG. 2. Transmissions received by the aircraft are in another 200 kHz slot 45 MHz removed for duplex operation. A total of 31 voice channels and one pilot channel are available in each 200 kHz slot, ground stations constantly transmit an FSK pilot enabling an aircraft to identify and select a ground installation that would permit a call duration of 15 to 20 minutes. Range is anticipated to be 200 miles at 33,000 feet with about 50 ground stations. Railfone will have approximately the same configurations, but will be oriented toward certain forms of surface transportation; namely, mass transit.

Although CSSB is better suited for 900 MHz operation because it requires somewhat less stability as a result of carrier synchronization, it is more complex and requires slightly more bandwidth because of the carrier.

In the VHF highband of 150-174 MHz,

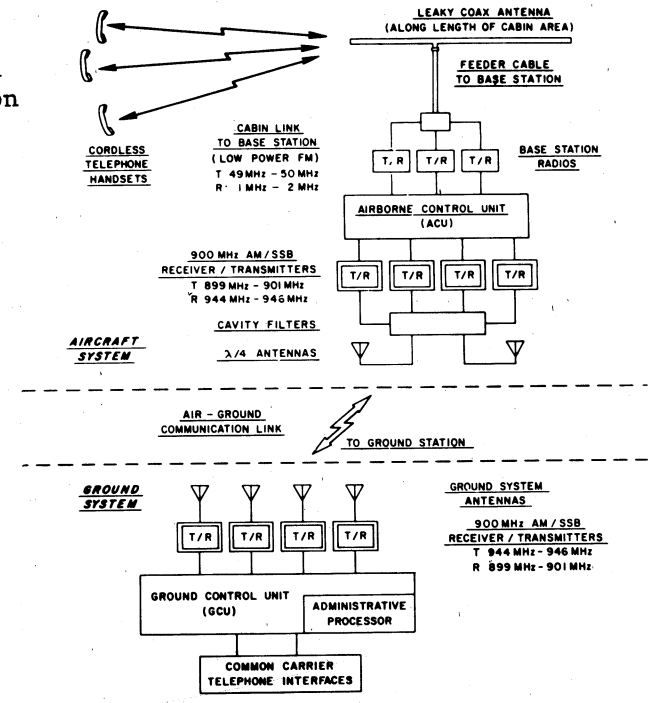

FIGURE 1 AIRFONE SYSTEM BLOCK DIAGRAM

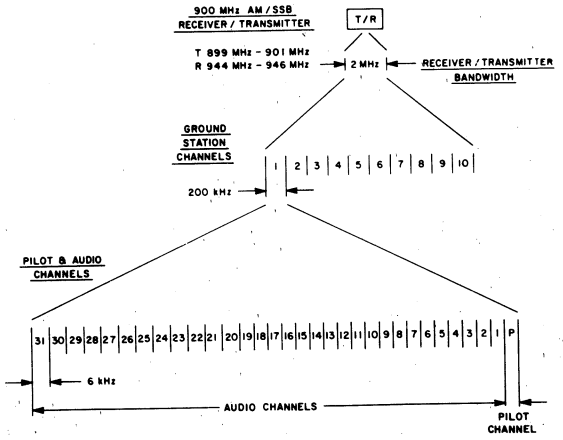

FIGURE 2 AIR-GROUND LINK TRANSMISSION
FREQUENCY SPECTRUM DIAGRAM

The Radio Club of America celebrated three quarters of a century of progress at the *Diamond Jubilee* Meeting and Banquet held at the famous *New York Athletic Club,* November 18, 1983. This was the first time the Radio Club's annual affair was held at the NYAC, and based on the flood of enthusiastic comment of members and guests, the Banquet Committee, headed by Jack Poppele and his loyal staff, have already started plans for the 76th affair to be returned to NYAC—*November 16, 1984.* The comment was universal in its reaction to the excellent food, superb service, excellent facilities of NYAC, and the very cooperative handling of our needs by the NYAC staff headed by Banquet Manager Nick Radnai and Captain Nelej. Fortunately, President Link is a long-time member of the NYAC, which made it possible to benefit from the facilites of the Club for our need.

The turnout was complete and the roughly 300 who were present represented all we could effectively handle. In turn we have to believe that everyone who was fortunate enough to be present both enjoyed the affair as well as being totally satisfied that they were able to be a participant.

While the keynote thought was our wish to recognize the Radio Club's 75 years of existence, we featured recognition of thirty-two of our members by electing them to Fellowships. This was a bit larger group than average in the past, but the Board wished to make the elections this year symbolic, and something worthwile for those elected to remember. A total of twenty-six of the new Fellows were present to receive their Certificates and be honored. (A photo of the new Fellows is on Page 8).

Nine major Awards, as noted in detail on pages 3, 4 and 5 were also

presented to the honored members, and all of those to be honored were on hand to receive the award except one recipient. Who was limited by a health problem and was unable to be on hand. In addition, the Society of Wireless Pioneers, whose Executive Director and Founder, William A. Breniman through his Awards Chairman, Paul N. Dane (both of whom are themselves Fellows of the Radio Club), made a special award of both Honorary Membership in the SOWP as well as a Wireless Achievement Award to President Fred Link as part of the activity. Also, as part of the 75th Anniversary program the Board of Directors had cited four of our famous members to the status of Honorary Life. They are: **Dr. Harold Beverage, Harry Houck, William Offenhauser** and **Dr. Harold Wheeler.**

An important and noteworthy situation was the presence and participation in this 75th anniversary affair of one of our two surviving founders, Frank King, the first president of the Radio Club of America. Frank and his charming wife Mary received a standing ovation from those present. It was a heartwarming experience for all of us later day members, and it was just unfortunate that the other founding member, W.E.D. Stokes, who was the President of the Junior Wireless Club that was founded in 1909 and later became the Radio Club of America, had planned to be present and in fact had tickets for the affair, only to have health problems combined with the weather situation make it impossible for him to be on hand with his family, as had been planned. It was great to have founder Frank King present, but it would have been fantastic if W.E.D. Stokes could have joined us as well. These two surving founders of our Club represent what it is all about, and we have reason to be

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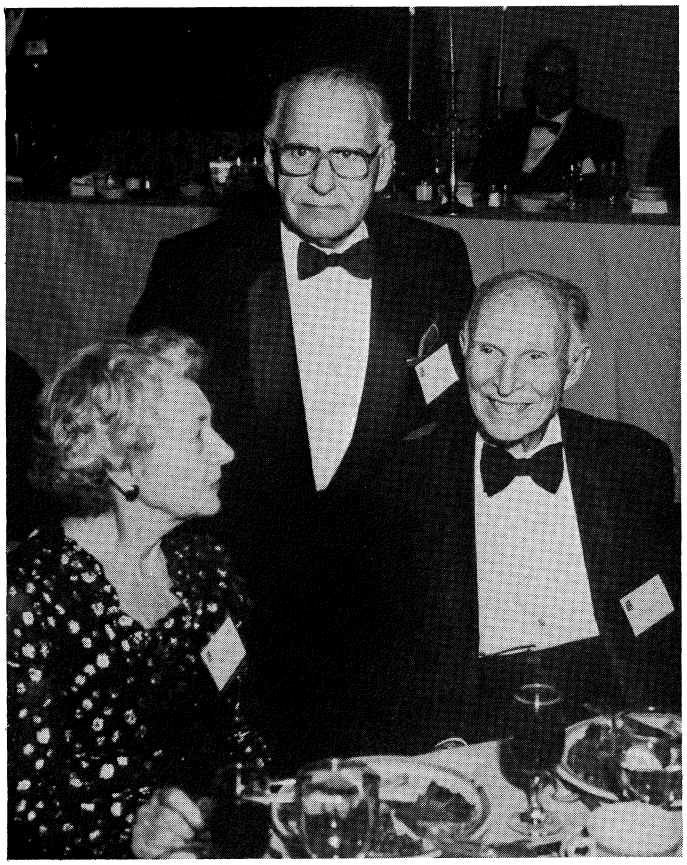


Fred Link with founder Frank King and his wife, Mary

proud of their early efforts and contributions to what we have today.

A major highlight of the banquet was the introduction of two now well known radio amateurs, Mark Barettella, KA20RK-J3, and Dr. Steven Lomazow, N2DRA, the "Grenada link" for the initial 36 hours of the rescue mission by US military forces to Grenada a matter of weeks earlier. President of ARRL, and himself a Radio Club Fellow, Victor Clark (W4KFC) introduced the two historic amateurs and presented them with special awards from the Club as well as Certificates of Membership. Chairman Vivian Carr assisted Victor Clark in the presentations. The fascinating story of the Grenada episode, as told personally by Mark Barettella and Steve Lomazow, is given in detail on page 6. This definitely was a high spot in the program of the evening.

Several of our key members contributed to the success of the banquet meeting in ways that must be recognized and thanks given. Our Director and Fellow member, Loren McQueen of San Jose, CA, contributed ten cases of select California wine, which was made available to all tables in more than adequate quantity—and unquestionably that went a long way to help make the evening a memorable effort. I might add that the cooperation of the NYAC banquet management in authorizing us, as a tax-exempt organization, to bring into the club this sizeable quantity of wines went far in making it possible for the committee to meet expenses.

So, again our thanks and vote of appreciation to Loren McQueen for this costly gesture. Other club members, such as Fellow Leonard Kahn, a key figure in the important current AM Stero Broadcast activity, gave a number of AM Stereo/FM Stereo receiving units for door prizes, and we are certain the lucky winners appreciated them. Also, Ramsey McDonald, Fellow and important contributor to the current pioneering work in automatic mobile radio common carrier activity that led up to the Cellular explosion of the recent years, provided a quantity of novelty electronic "Xmas carol" music boxes which were in great demand as prizes. All guests were given a special luxite paperweight with the Diamond Jubilee date and Club information to be retained as a rememberance of this important date.

Last, but certainly not least, one more time we wish to extend our vote of thanks and appreciation to Jack Poppele, the Poppele family, his great secretary, Connie Conte, and the Tele-Measurements Inc. organization for their unselfish and tremendous contribution in time, money and effort in handling all the detail and arrangements that made this 75th Anniversary Banquet the greatest in the long history of Radio Club of America activities. Without the total effort of Jack Poppele, Director Emeritus, and Connie Conte, this story could never have been told. *And one final thought,* let us not overlook the important support and financial contributions of our many members, friends and industry associates who have made this 'Diamond Jubilee' Banquet, as well as the 'Diamond Jubilee' Book both major success stories.

The two newest members receive their certificates from membership chairman Vivian Carr

Ulrich Rohde Replies for Fellows

Dr. Ulrich L. Rohde, DJ2LR, a recipient of the Grade of Fellow at this year's Anniversary Dinner, and respondent for the 1983 Fellows, is a Business Area Director at RCA, Camden, NJ. He is also a partner of Rohde & Schwarz, West Germany. Born in Munich, West Germany, Dr. Rohde was first licensed as a radio amateur operator in 1956. He holds a Swiss call sign, HB9AWE. His prime interest in the radio activity is the pursuit of new communication principles and technology, and he enjoys discussions with friends in America and Europe during his weekend activities on the ham band, dealing with combinations of radio communication techniques and computer-aided design. His response follows:

Mr. President, fellow members, ladies and gentlemen:

I am honored to be invited to join the illustrious fraternity of Fellows in the Radio Club of America. It is even a greater honor to stand here tonight as the spokesman for this year's outstanding roster of 1983 Fellows.

Since I first became licensed in 1956, I have always enjoyed exchanging technical information and making friends over the air. And like many of you, I combine my professional activities in the radio business with my hobby as a radio amateur. Our interests in being radio amateurs may differ. Some of you enjoy long distance communications, while others are excited by the opportunity to participate in contests. My personal interest lies in radio technology, specifically in the area of reliable communications.

In 1903, the invention of radio made it possible to communicate over great distances. And while radio is sometimes considered unreliable as compared to cable, it is a medium which has not yet, after 80 years, been fully understood or researched. As part of my activities at RCA, I am developing adaptive HF communications systems that will allow us to choose the right frequency, the right propagation path and the right power for the link, while at the same time minimizing disturbance to other users.

The impact of computers in this area is substantial. But computers, as you know, are programmed by men and only execute commands that are man-programmed. Computers have no intelligence and only perform assigned tasks.

We transmit more than just cold facts. We also transmit hopes, fears, frustrations and joy. Beyond the realm of high technology, radio communications embraces a wide spectrum of human relationships. Typically, the lack of communication is responsible for misunderstandings, political difficulties and ultimately strained conditions between persons and nations. Using our radios, we communicate with friends around the world to expose our emotions and personalities and solicit the same from our partners. In this open communications forum, we exchange ideas for peace and progress.

To improve the reliability of radio communications, we must continue to explore new technologies with the same enthusiasm as the pioneer who first discovered radio waves. And to become successful, we must examine both the technical and the human aspects of communications. I feel our work in radio technology is an important assignment. We have been given the challenge of pushing back the barriers of knowledge to benefit new users and to provide hope for peaceful communications in the future.

I am certain I speak for all of this year's Fellows when I say we are happy to work in our specialized fields to develop new innovations in the radio industry. We are proud to receive this honor. And there is a great deal of work ahead for all of us.

Thank you very much.

Bob Tall Joins APCO

Robert E. (Bob) Tall (M 1970, F 1971) founding editor of the weekly nonbroadcast newsletter *Industrial Communications,* has been named Executive Director of the Associated Public Safety Communications Officers, Inc. (APCO). The post has been vacant for over a year, being previously occupied by Club Fellow Ernest Landreville.

Bob Tall leaves *Industrial Communications* after 34 years, and will remain a consultant to Phillips Publishing, the present publishers, where he expects to continue to lend his expertise in the mobile radio field.

Club Members Honored by IEEE

The Institute of Electrical and Electronics Engineers (IEEE) celebrating its 100th year, has issued 1,984 Centennial Medals to outstanding members in recognition of their "loyal and dedicated service to the Institute and the profession." Among this group, selected from the Institute's more than 250,000 members, are 26 members of the Radio Club:

William F. Bailey
Vivian A. Carr
Arthur Collins
Donald G. Fink
Bernard E. Kaiser
Fred M. Link
William W. Mumford
John Neubauer
John D. Ryder
Ruel P. Samuels
James F. Scoggin, Jr.
Jerry Stover
John J. Tary
Harold H. Beverage
Martin Cooper
Lloyd Espenschied
Arthur Goldsmith
John J. Kelleher
Arthur V. Loughren
George F. McClure
Alvin Reiner
Chandos Rypinski
Neal Shepherd
Benj. E. Shackelford
Fredrick G. Suffield
Harold A. Wheeler

The list is possibly inexact—it may well be that we have not discovered all the Club members who have been so honored, or that one or more on the list are no longer Club members.

Risse Retires from ICS

Joseph A. Risse, P.E. (M 1965) for many years connected with International Correspondence Schools as Director, School of Electronics and later, Manager, Electronics Programs, ICS-Intext, has retired from ICS and is now residing at Dunsmore, PA.

He will carry on in the immediate future with some selected ongoing projects for his former employer, plus consultative work in industrial training in electrical and electronics technology and related fields.

system. The normal operating range of the human voice in communications is approximately 30 db. In a single stage compandor, audio is compressed to half its range.

On the receive side, the expandor de-amplifies the compressed wave and places the system noise below the original speech level. In a two stage companding system the basic audio is compressed twice to a narrow transmission window in terms of modulation level as shown in FIG. 7. Conversely, upon de-modulation the expandor de-amplifies, bringing the ambient noise far below the transmission level. When applied to ACSB transmission, this action produces the same effect as the capture effect of FM transmission with regard to lower level signals as well as noise.

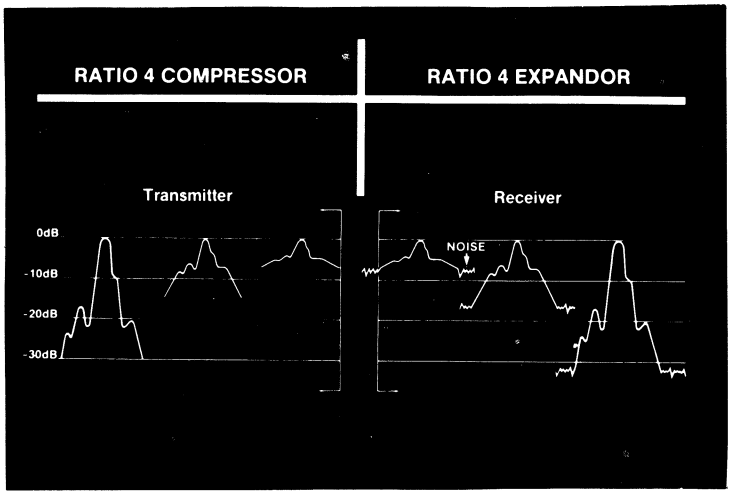


FIG. 7 Two Stage Compandor

The following block diagrams of transmitter and receiver circuits were, for the most part, supplied under federal grant through the F.C.C. by Dr. Lusignan and the circuits are not under patent. Sideband Technology has employed most of them and has made modifications and additions, including the squelch circuitry, which are under patent.

FIG. 8 indicates that the microphone audio enters the transmitter at the first compressor which functions at a syllabic rate to feed a pre-emphasis network, a limiter and a low pass filter. The output of the low pass filter feeds the second compressor in combination with the 3.1 kHz pilot tone oscillator. The second compressor, which also functions at a syllabic rate, samples the combined levels of the pilot tone and audio.

If the audio level is below the pilot tone level, the second compressor will not compress. If, however, the audio level exceeds the pilot tone level, the compressor will change its gain. For example, if the audio level raised 10 db the compressor would reduce it to 5 db. It not only reduces gain inversely with the audio level but also with pilot tone level. As the audio level exceeds the pilot tone level, the pilot tone level decreases in favor of the audio level. Such decreases in pilot tone are monitored at the distant receiver and automatically indicate the level of compression applied in the transmitter at that instant. In this manner the receiver expansion system can act in reverse order to the transmitter second compressor. The final block represents a conventional SSB transmitter with an automatic level control (ALC) network to maintain constant output power.

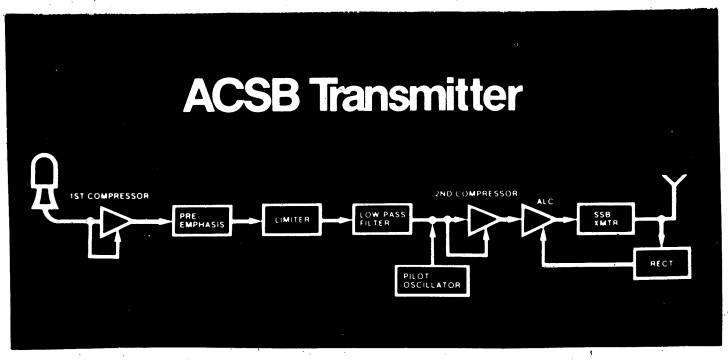


FIG. 8 Basic ACSB Transmitter

The receiver block diagram represents a conventional receiver through the RF amplifier, mixer, channel oscillator, frequency multiplier, IF filter, IF amplifier and product detector, FIG. 9. The composite audio and pilot tone signal from the product detector is routed through a 2500 Hz low pass audio filter and a 3.1 kHz bandpass filter, FIG. 10. The audio passes through a delay network to the variable gain first expandor. Simultaneously the 3.1 kHz pilot tone passes through a rectifier and filter to place a DC control voltage on the first expandor. The audio delay network time constant is adjusted to the time constant of the rectifier/filter combination in order to have the audio and DC control voltage act at exactly the same instant on the first expandor to provide feed forward correction of multipath fading. This first expandor action reverses the action of the second transmitter compressor. If a fade occurs, both the audio and pilot tone levels will drop equally such as 10 db. The rectified pilot signal will also drop 10 db allowing the variable gain of the first expandor to increase 10 db. The first expandor gain is inversely proportional to the incoming RF signal and thus holds the audio at a constant level. The rectified pilot tone also controls the RF and IF gain in a slow manner through another rectifier/ filter network with a long time constant.

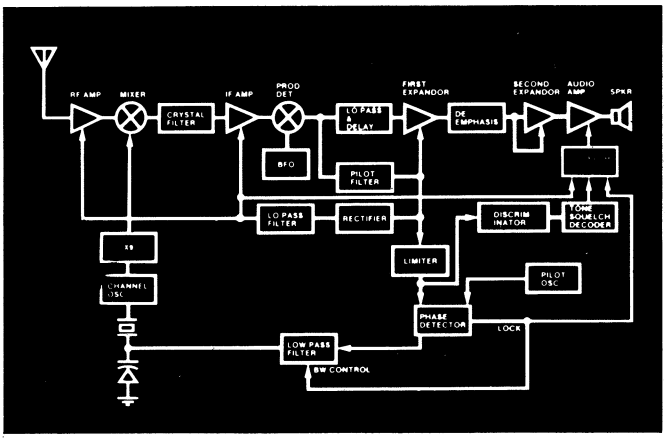


FIG. 9 Basic ACSB Receiver with AGC, AFC, TCS and Squelch Logic Circuits

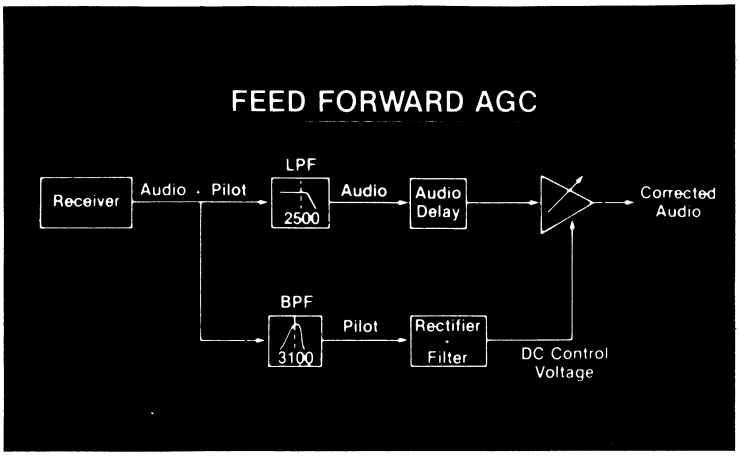


FIG. 10 Feed Forward System

De-emphasis is added before the second expandor which in turn feeds the audio amplifier and loudspeaker. FIG. 9 also addresses the tuning problem showing the pilot tone passing through a limiter and a phase detector to combine with the input from a local pilot oscillator identical to that in the distant transmitter. The differential feedback passes through a low pass filter to correct the channel oscillator to the distant transmitter frequency. The lock circuit between the phase detector and the low pass filter adjusts the filter bandwidth between search and lock conditions which is 15 Hz in search and 0.1 Hz in lock.

FIG. 11 addresses the tone coded squelch showing a TCS generator and a phase lock loop

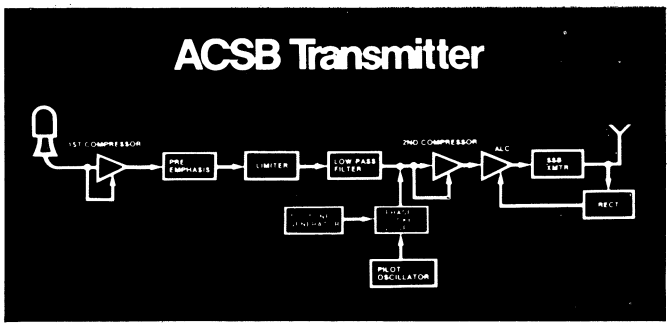


FIG. 11 ACSB Transmitter TCS

added to the transmitter to FM modulate the pilot tone oscillator at a very low level of deviation. This circuitry is necessary since the audio bandpass cuts off above the TCS tones. Referring again to FIG. 9, the limiter also feeds a discriminator which activates a conventional tone squelch logic which is activated by the lock signal from the phase detector-low pass filter loop to provide squelch action when tone squelch is not employed. The lock signal establishes that the signal is valid and complete with pilot tone at proper level to activate the squelch logic. An input from the AGC network is also available for manual squelch operation.

FIG. 12 is the first of a series of spectral diagrams illustrating the differences in bandwidth characteristics between FM and ACSB.

The upper left diagram is of a Motorola Mitrek FM unit adjusted to a 25 watt output and shows the unmodulated carrier on a scale of 5 kHz per division horizontally and 10 db per division vertically. The apparent modulation is noise from an open microphone during key-up.

The upper right diagram is the Mitrek unit with 1000 Hz modulation showing sideband distribution within an 18 kHz bandwidth at 30 db down from peak and approximately 25 kHz bandwidth at 60 db down from peak.

The lower left shows the Mitrek under normal voice modulation with about 17 kHz bandwidth at 30 db down from peak and 27 kHz bandwidth at 60 db down.

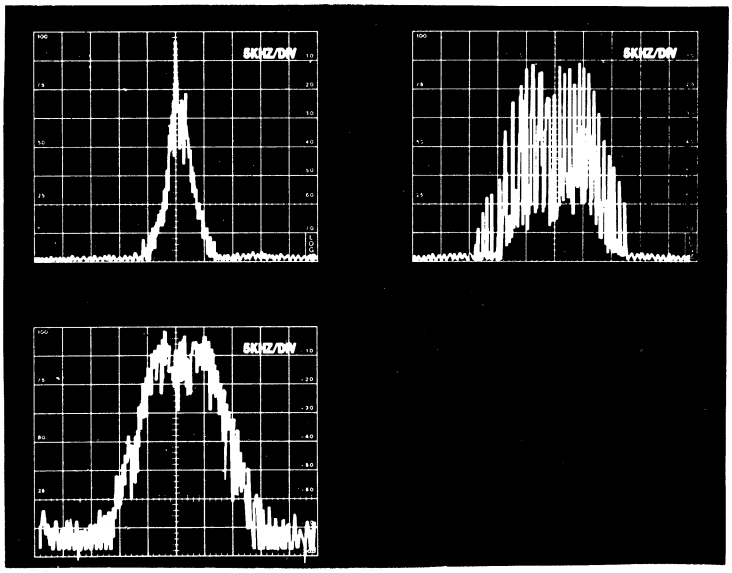


FIG. 12 Motorola Mitrek FM Unit Unmodulated and Modulated

FIG. 13 again illustrates the Mitrek with 1000 Hz modulation in the upper diagram and compares it on the same scale with a signal from a 25 watt ACSB unit with 1500 Hz modulation. The pilot tone amplitude is shown approximately 18 db below the modulation peak and the bandwidth is within 5 kHz at 30 db down from peak modulation and within 10 kHz at 60 db down. FIG. 14 repeats the ACSB diagram at the top in the 5 kHz/division form and shows the same diagram on the bottom enlarged to 1 kHz/division on the horizontal to illustrate certain characteristics including the third order IM products at 1.6 kHz right of

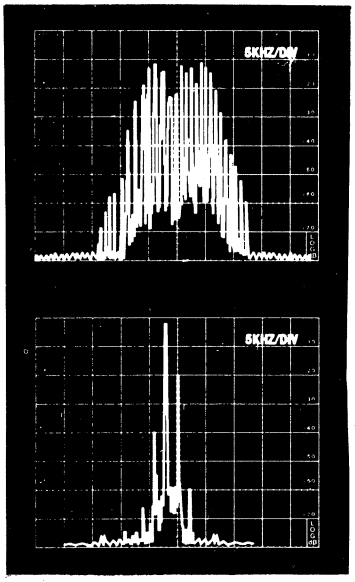


FIG. 13 Mitrek Vs ACSB Unit Tone Modulated

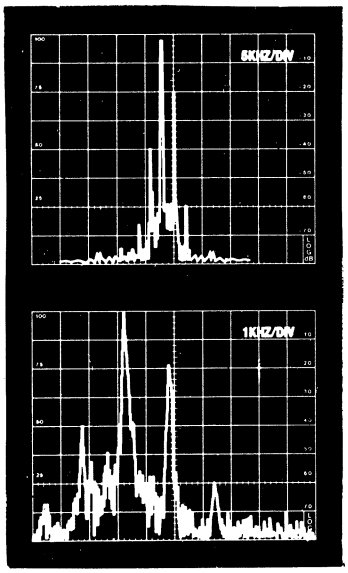


FIG. 14 ACSB Unit Tone Modulated on 5 kHz and 1 kHz Scales

the pilot tone and 3 kHz left of the tone. As information, in the ACSB waveform, the center of the wave is considered to be 1.3 kHz down from the pilot in the direction of the suppressed carrier.

FIG. 15 shows an ACSB unit in preamble condition in the upper left. At the beginning of each transmission, a 250 millisecond burst of pilot tone at full power of 25 watts is transmitted to net or lock in all receivers in the system that are within range. At the end of 250 ms the pilot tone drops 10 db in the vicinity of 2.5 watts as shown in the upper right diagram. This assumes that the operator has not begun to modulate. The apparent modulation shown to the left of the pilot tone is noise from an open microphone that has been acted upon by two stages of compression.

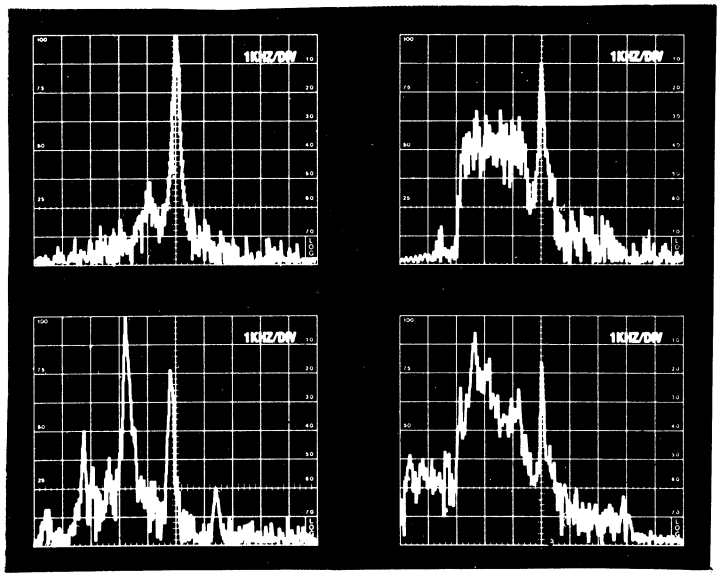


FIG. 15 ACSB Unit Showing Preamble, Noise Modulation, Tone Modulation And Speech

The lower left diagram shows the ACSB unit being heavily modulated by a 1500 Hz tone which develops 25 watts peak power. Since the modulation is heavy, the pilot tone has dropped almost 20 db to around 250 milliwatts by action of the second compressor. The third order IM product 3 kHz left of the pilot tone is down 40 db and the product 1.6 kHz right of the pilot tone is down 60 db from peak modulation. Inasmuch as the best solid state power amplifier is linear to only 33 db at VHF highband frequencies, the third order products are not equal in amplitude. This is offset by the fact that the pilot tone level decreases measurably as the modulation reaches peak power output resulting in an effective IM performance much greater than the IM capability of the power amplifier. The lower right diagram illustrates the action of voice modulation with the pilot tone down roughly 10 db from the audio peak with the IM products down around 40 and 60 db respectively.

In connection with voice modulation, FIG. 16 illustrates the word "five" as transmitted through a 30 watt Motorola Mocom unit. The bandwidth at 30 db down from the peak is 15 kHz and at 60 db down is 24 kHz. In contrast, FIG. 17 shows the word "five" through a Sideband Technology 25 watt unit to have 3.2 kHz bandwidth at 30 db down from peak and 8.3 kHz at 60 db down.

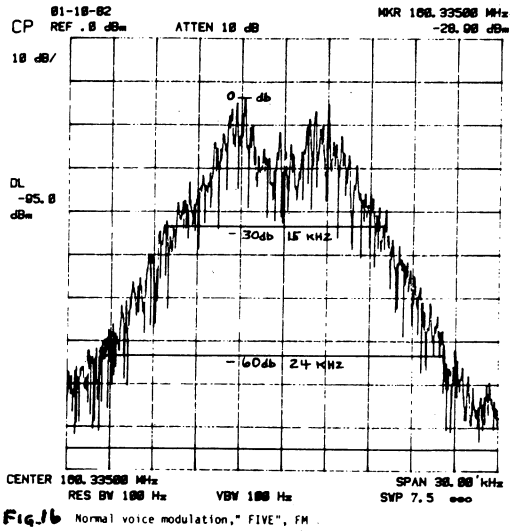


Fig.16 Normal voice modulation," FIVE", FM

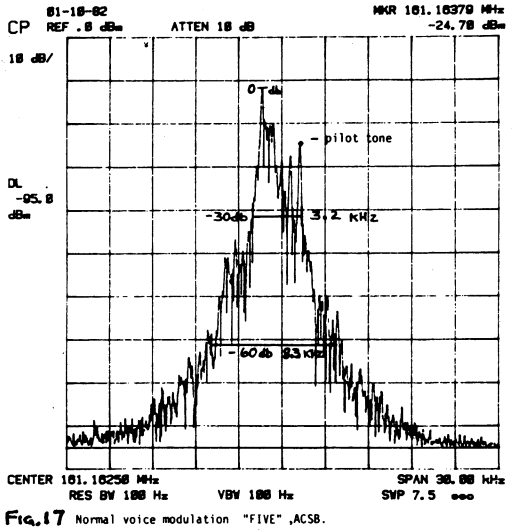
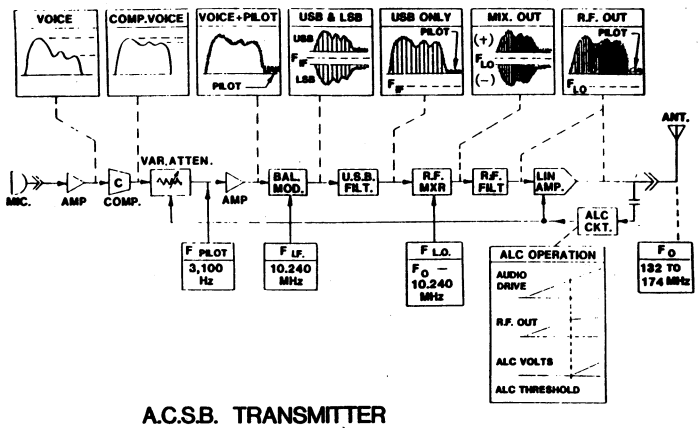


Fig.17 Normal voice modulation "FIVE" ,ACSB.

So far the information has been derived from Sideband Technology equipment. The other current supplier, Stephens Engineering Associates, provides a synthesized transceiver rather than crystal controlled in the regular sense. Consequently the Stephens approach is somewhat different but with the following similar results.

FIG. 18 illustrates the sequence of transmitter stages. In this case the microphone pre-amplifier feeds a compressor that normally has a 4:1 ratio where a 40 db change in input results in a 10 db change in output. Such output is fed to a variable attenuator which is controlled by the final linear amplifier and its automatic level control (ALC) circuit. The attenuator output along with 3.1 kHz pilot tone is fed to the balanced modulator via an isolation amplifier which mixes with the input from the IF oscillator to generate upper and lower sidebands. Only the upper sideband passes through the filter to the RF mixer where it mixes with the local oscillator input to arrive at the final operating frequency. The output of the RF mixer contains the sum and difference of the modulated upper sideband and the local oscillator frequency which are separated by the RF filter which passes the sum to the linear amplifier. The ALC circuit samples the linear amplifier output for momentary peaks as well as faults of operation that cause the output to exceed rated power output. The ALC circuit is adjusted to provide the proper DC control voltage at the variable attenuator as well as the linear amplifier to restore rated output and assure linear operation.

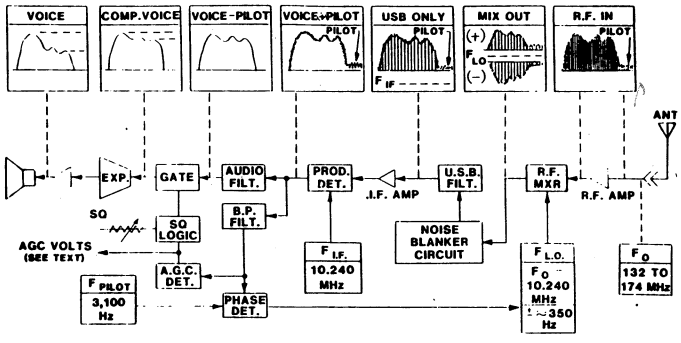


A.C.S.B. TRANSMITTER
FIGURE 18

FIG. 19 illustrates the sequence of receiver stages. Input to the RF amplifier passes to the RF mixer where the local oscillator input causes down conversion to the IF refquency. Once again sum and difference components exist which pass through the noise blanker and the upper sideband filter. The upper sideband component passes through the IF amplifier to the product detector where the original IF oscillator frequency is reinserted. At the product detector output the audio between 300 and 2600 Hz is passed to the audio filter. The 3.1 kHz pilot tone is routed to the phase detector via a band pass filter. At this point the 300-2600 Hz audio will not go beyond the gate unless the squelch logic opens the gate.

In order to open the gate the pilot tone level must be adequate for the AGC detector to generate sufficient voltage to operate the squelch logic. At this point the audio will feed the expandor, which also has a 4:1 gain characteristic in reverse order, which will ultimately feed the isolation amplifier and loudspeaker.

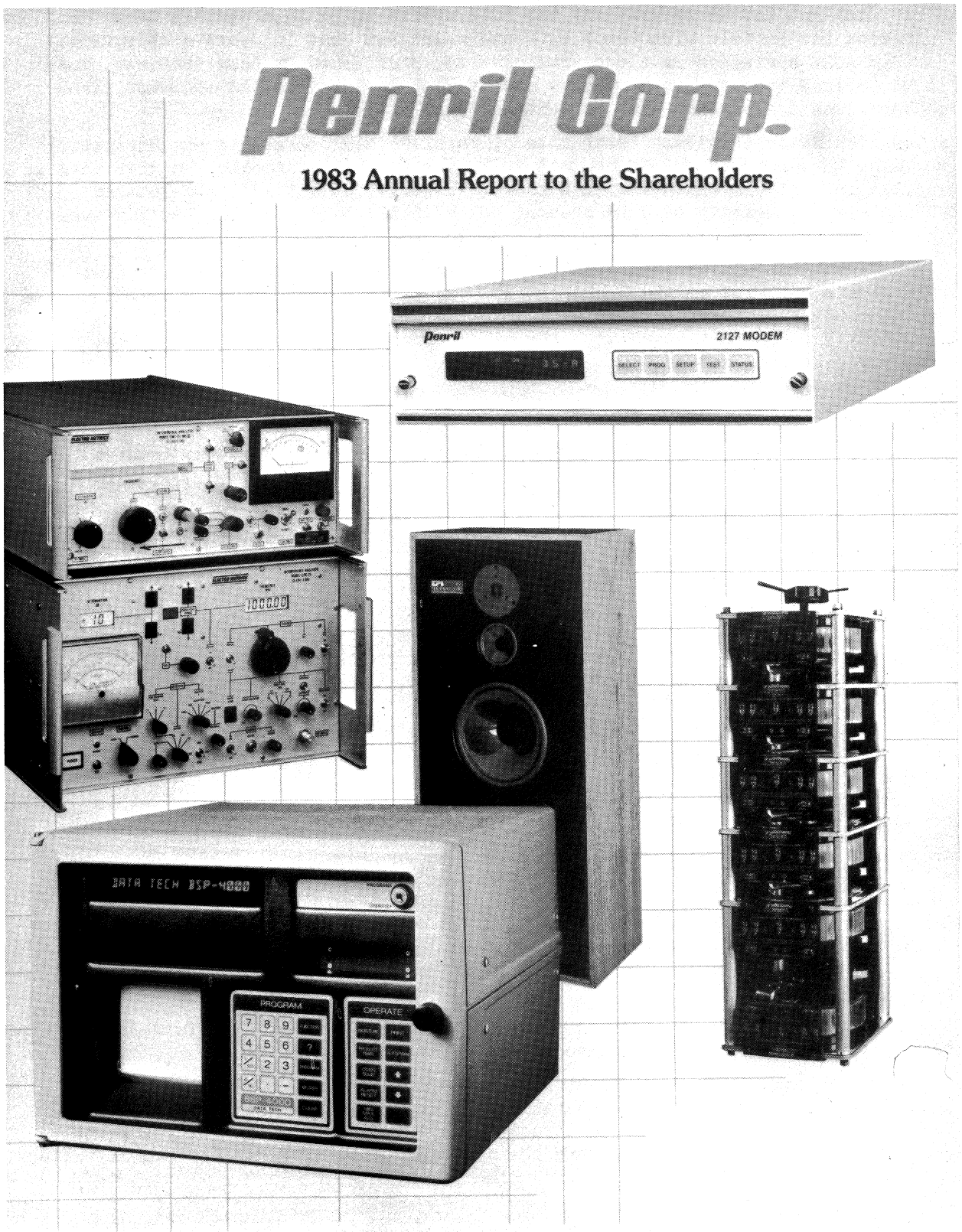
The phase detector compares the 3.1 kHz pilot tone with a 3.1 kHz pilot tone generator in the receiver. The resultant of this comparison is a differential voltage which controls the receiver local oscillator within ±350 Hz to bring the receiver in precise synchronization with the distant transmitter.



A.C.S.B. RECEIVER
FIGURE 19

Penril Corp.

1983 Annual Report to the Shareholders



Penril Corp. (AMEX-PNL) designs, manufactures and markets a diversified line of high technology electronic equipment, at nine profit centers in the United States and in Switzerland, Mexico and Japan.

Bolstered by the recent acquisitions of Triplett Corporation and Concord Systems Inc., the Company is currently generating revenue at an annualized rate exceeding $70,000,000. Fiscal 1983 revenues were $38,715,869, producing net income of 72 cents per share, marking 41 consecutive profitable quarters. The first quarter of fiscal 1984, ended 31 October 1983, continued this trend with revenue of $10,497,000 (up 16% over the like quarter of 1983) and net income of 23 cents per share (up 53% over the like quarter of 1983).

Penril has made thirteen acquisition during the past ten years and continues to seek acquisition candidates in the $10,000,000 to $50,000,000 revenue range. The Company has in excess of $20,000,000 cash available for this purpose, but is also willing to consider other financing media.

Inquiries may be addressed to: Kenneth M. Miller, President and Chief Executive Officer, Penril Corp., 5520 Randolph Road, Rockville, Maryland 20852-2676, (301) 881-8151.

The E.F. Johnson Co. is progressing the ACSB system which Contemporary Communications Corporation has on file with the F.C.C. and which has some innovative aspects with regard to ACSB operation in close proximity to established FM base stations. Much will be learned from the Contemporary system when implemented. In addition, Kahn Communications is contemplating an ACSB design.

The Canadian Pacific Railway tests made at Vankleek Hill formulate an interesting comparison between ACSB and FM operation. They are interesting because they were conducted on a middle channel with a center frequency of 161.1575 MHz located 12.5 kHz above a heavily used FM channel and 17.5 kHz below another heavily used FM channel.

FIG. 20 shows ACSB and FM transmission profiles between mobile units over flat rural terrain centered at the Vankleek railroad station. The FM units were Motorola 30 watt Mocoms and the ACSB units were Sideband Technology Pioneer 1000's which generated 2.5 watts peak power with the pilot tone alone, 5 watts with normal voice, 10 watts with strong voice and 25 watts peak power with a very strong voice. Both mobile units used one-quarter wave whip antennas.

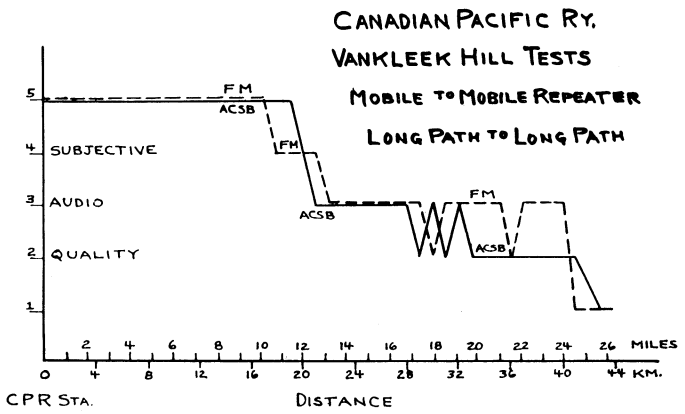


FIG. 20 Canadian Pacific Vankleek Hill Test

Field strength measurements were not made, but an index of voice transmission quality was established as shown on the vertical axis where 5 was excellent, 4 very good, 3 good, 2 usable and 1 unusable.

These are profiles using FM and ACSB repeaters at the station employing a common switchable 8.5 db gain antenna atop a 60 foot pole. The FM repeater had a 4 watt output and the ACSB repeater had a peak power output of 3 watts.

Both vehicles moved over a 24 mile path running roughly a mile apart. FM degraded first from excellent to very good, but ACSB degraded sharply from excellent to good in a mile or two. FM then dropped to good and both held equal to about 17 miles where they both became cyclic to 24 miles at which point they both fluttered out. In the last 7 miles, however, the ACSB was steady without flutter but with some noise while the FM was with flutter but less noise.

Along with speech, DTMF, tone coded squelch, and 2 or 5 tone sequential signaling, ACSB units have comfortably handled 600 baud PSK and 1200 baud FSK. To date no higher baud rates have been requested.

It is apparent that CSSB is applicable in the 900 MHz range and that ACSB is a viable mode for the VHF highband operation. Continuing effort must be exerted by user and vendor groups alike to effect permanent liscensing of both narrow band techniques in the interest of meeting the pressing demand for spectrum conservation.

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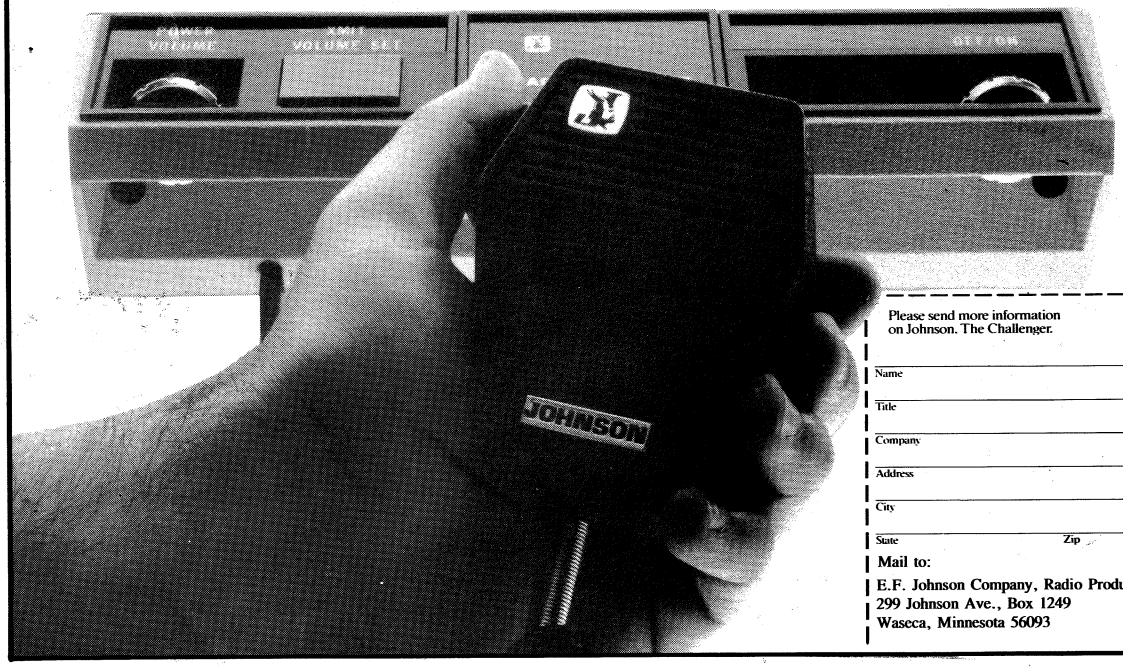

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