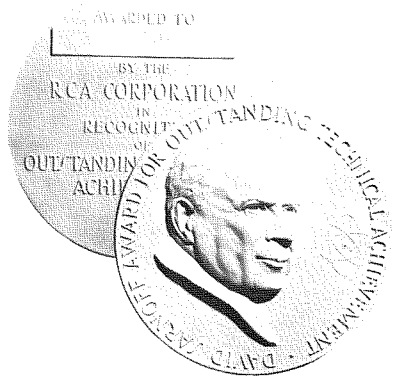


1981 David Sarnoff Awards for Outstanding Technical Achievement

"In my years of association with scientists and engineers, I have acquired a deep respect for their creative faculties, their constant search for knowledge and facts, and their integrity of purpose. I have tried in my small way to stimulate and encourage them in their work, to share with them their dreams and disappointments, and to rejoice in their triumphs."

— David Sarnoff

At a golden anniversary dinner held on September 30, 1956, to commemorate David Sarnoff's fifty years of service to radio, television and electronics, Dr. Elmer W. Engstrom, Senior Executive Vice-President, announced the establishment of what has become David Sarnoff Outstanding Technical Achievement Awards.

The first award was made for the year 1957. Since then, RCA has given outstanding scientists and engineers over 330 gold medals that resemble the embossment on our cover. After a quarter of a century, the award still stands for high ideals espoused by a man who had visionary faith in long-term technological solutions to "impossible" problems. He combined this faith in science and engineering with a practical business sense. Though not an engineer or a scientist, he was an industrialist with a brilliant understanding of technical work, and the motivating ways in which the creative aspirations of the human spirit are fundamentally expressed in technological achievement. He delineated this "philosophy" in many speeches throughout his career.

Many younger engineers at RCA may not have been born in 1953 when Sarnoff addressed the graduating class of the Drexel Institute of Technology, in Philadelphia. "The principles it [science] uncovers are taken over by engineers who proceed to fashion them into instrumentalities for mankind to enrich our everyday life," he said.

"For some, engineering will remain merely a trade, like any other trade," he continued. "But for others, the more imaginative and courageous, it can be a noble and satisfying dedication . . .[These engineers] will assume its responsibilities in a spirit of mission, in the awareness that they are starting out on a great adventure. It is this difference in approach, believe me, that will determine whether engineering will be just a

(Continued on page 11)

For key contributions to the development of the CED VideoDisc System.

Achievement

Todd J. Christopher
Manager,
Electrical Design,
SelectaVision VideoDisc
Operations

Jon K. Clemens
Director,
VideoDisc Systems Research,
RCA Laboratories

Pabitra Datta
Member Technical Staff,
VideoDisc Materials and
Diagnostics,
RCA Laboratories

Leonard P. Fox
Head,
VideoDisc Applied
Process Research,
RCA Laboratories

Jerome B. Halter
Member Engineering Staff,
Signal Generation
Systems Development,
SelectaVision VideoDisc
Operations

Eugene O. Keizer
Staff Scientist,
VideoDisc Systems Research,
RCA Laboratories

Marvin A. Leedom
Director,
Manufacturing Systems and
Technologies Research,
RCA Laboratories

Michael E. Miller
Manager,
Stylus Cartridge Design,
SelectaVision VideoDisc
Operations

Frederick R. Stave
Manager,
Mechanical Design,
SelectaVision VideoDisc
Operations

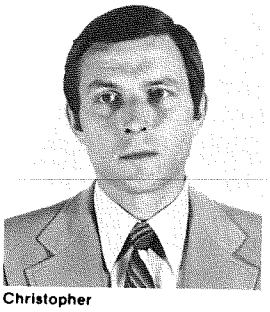
On March 22, 1981, RCA introduced the SelectaVision® VideoDisc Capacitance Electronic Disc (CED) System. In many ways, the achievements of the large group of engineers and scientists working on the project are obvious and need little introduction. The VideoDisc system is an engineering and scientific feat on the broadest scale. A project on this scale is successful only if everyone is performing superbly.

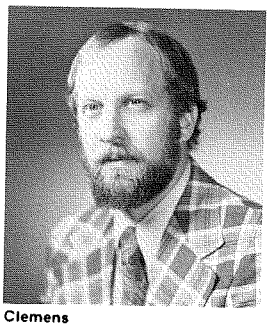
But within any group, some individuals must stand out. The awards committee selected the following nominees on the VideoDisc team for their particularly outstanding performance.

Personalities

Todd J. Christopher

Mr. Christopher has been a key technical participant in the VideoDisc project since 1973. His principal contributions have been in the development of practical electronic circuits for the player. In addition, he has contributed to the development of the signal encoding standards for the system. Twelve patents have been issued in his name, three of which are applicable to the VideoDisc system.


Christopher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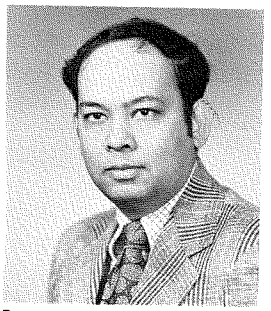
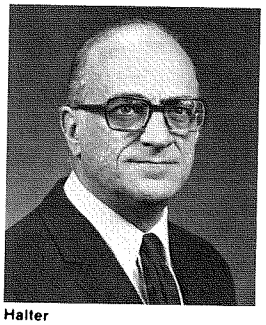
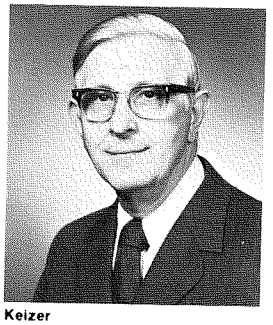
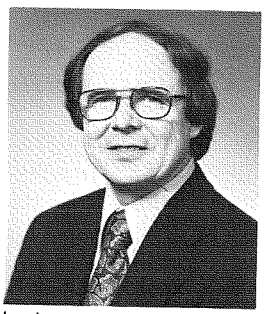

Datta

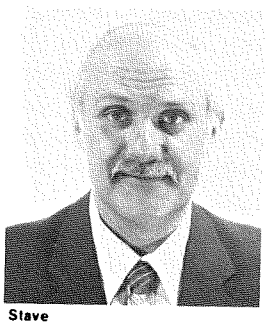

Fox


Halter


Keizer


Leedom


Miller


Stave

Jon K. Clemens

Dr. Clemens has devoted essentially his entire professional career to the development of the RCA CED VideoDisc system. He is one of the key architects of the system as a whole, and he played the principal role in selecting the method used to encode the picture and sound information. In the latter phases of the project, Dr. Clemens managed a group at Princeton which helped solve many of the difficult problems encountered in bringing the VideoDisc system to a commercial reality. Dr. Clemens received the prestigious Rhein Prize for his contributions to video disc technology.

Pabitra Datta

Dr. Datta has been involved in the VideoDisc program for about six years, working on surface characterization and control, and compound formulation of the disc. His discovery of the efficacy of a special carbon as a conductive filler led to a practical demonstration of the viability of the conductive disc concept. This breakthrough provided the direction for developing a manufacturable disc technology which is employed in the present product.

Leonard P. Fox

Mr. Fox has been actively engaged in VideoDisc research for approximately ten years and has contributed to various materials developments. His major contribution was to continually champion the non-coated, conductive disc concept — he kept this technology alive through a series of feasibility demonstrations which contributed to its adoption in 1977. In addition, he has made technical contributions to matrix development and to compounding technology.

Jerome B. Halter

Mr. Halter has been on the VideoDisc project since the late 1960s. His principal contribution to the program has been the development of electro-mechanical cutting heads capable of operating at frequencies in the video band. During the early 1970s, when RCA's major video disc effort was directed at electron beam recording, he was essentially a one-man development team on high-frequency cutterheads. His work led to the development of a recording method that was more reliable, easier to operate and gave a better signal-to-noise ratio in finished discs than electron beam recording. Our present disc recording system is an outgrowth of his work. He has four patents, all used in the introductory system.

Eugene O. Keizer

Mr. Keizer has been a major contributor to the RCA VideoDisc System for over sixteen years. His work centered on the making of disc masters and on the design of the diamond playback stylus. A key concept developed by Mr. Keizer is that of the keel-lapped stylus — the method used today in production to obtain long stylus life. During the final two years of the VideoDisc project, Mr. Keizer played an important role in transferring the technology from Princeton to Indianapolis. Mr. Keizer received the prestigious Rhein Prize for his contributions to video disc technology.

Marvin A. Leedom

Mr. Leedom has been associated with the VideoDisc project for more than twelve years, and during that period he has made significant technical contributions to several elements of this system. His patent record includes one for player electronics, seven for player mechanical design, six for cartridge/stylus design and manufacture, and one for disc replication technology. Four of these fifteen patents apply directly to the introductory system, and Mr. Leedom is credited with the original concept of the caddy, which is an essential component in the VideoDisc system. During the most recent phases of this project, he has made general technical contributions through the management of several technical activities engaged in mechanical and manufacturing technologies.

Michael E. Miller

Mr. Miller has been a technical catalyst in advancing the stylus/cartridge art from feasibility to a production reality. He defined the architecture for the stylus/cartridge and associated mechanism, and he provided the technical guidance and insights to transform those components from the early concepts to production designs. He has eight patents, of which four relate to the VideoDisc system.

Frederick R. Stave

Mr. Stave has been a technical contributor to the VideoDisc program since 1973. He has been responsible for much of the technical development of the mechanical design of the player and for the disc/caddy interface with the player. He has been issued eight patents, seven of which are related to the VideoDisc system.

For the development and implementation of a CCD comb filter integrated circuit in color TV receivers.

Achievement

James E. Carnes
Director,
New Products Laboratory,
RCA Consumer Electronics

Jack S. Fuhrer
Manager,
Baseband Signal Processing,
RCA Consumer Electronics

Walter F. Kosonocky
Fellow of Technical Staff,
IC Technology Research,
RCA Laboratories

William A. Lagoni
Senior Member
Engineering Staff,
Baseband Signal Processing,
RCA Consumer Electronics

Peter A. Levine
Member Technical Staff,
IC Technology Research,
RCA Laboratories

Dalton H. Pritchard
Fellow of Technical Staff,
Consumer Electronics
Research,
RCA Laboratories

Donald J. Sauer
Member Technical Staff,
IC Technology Research,
RCA Laboratories

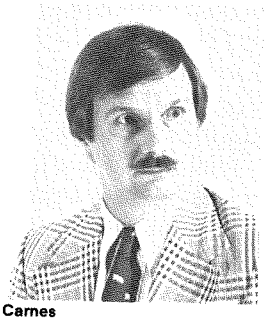
This team developed the first charge-coupled device (CCD) comb-filter integrated circuit to be used in a mass-produced color television receiver. The circuit produces a cleaner picture with significantly improved resolution. In addition, this development has made possible a new, unique feature called vertical peaking that adds a new dimension to the sharpness of the picture produced by a color television receiver.

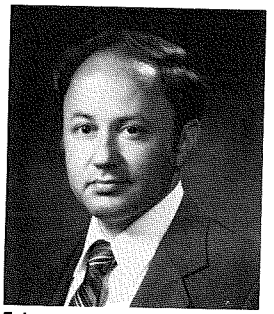
Most competitive television receivers having comb filters do not have RCA's vertical peaking feature and have performance inconsistencies that result from classical glass delay line approaches. The CCD comb filter IC has provided RCA with a performance feature which will allow the company to maintain industry leadership in a time of strong demand and in the face of severe competitive pressures.

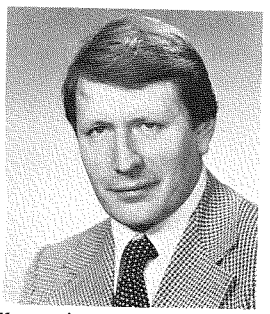
The development by the RCA Laboratories of an advanced *n*-channel process that combines high-performance buried-channel CCDs with digital and linear NMOS circuitry was the groundwork for a system suitable for consumer electronics. The practical embodiment of the comb filter IC in a color television receiver by the Consumer Electronics Division was a notable achievement. A unique, patented nonlinear processing circuit optimized the vertical peaking feature to provide maximum picture enhancement while minimizing undesirable interference patterns.

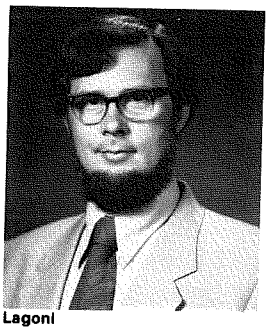
The comb filter in a television receiver permits increased luminance bandwidth and minimizes luma-chroma interference effects found in conventional TV receivers. The effects include erroneous colors in picture scenes having luminance information at spatial frequency near the 3.58 MHz color subcarrier — known as "cross color" or the "umpire shirt effect" — and chrominance dot crawl on the luminance edge transitions.

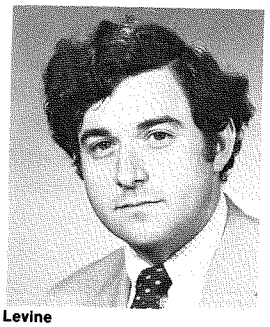
The RCA comb filter was first used in the 1979 RCA Limited Edition TV receivers and was marketed commercially as the Dynamic Detail Processor.


Carnes

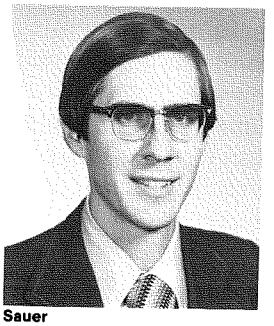

Fuhrer


Kosonocky


Lagoni


Levine


Pritchard


Sauer

Overall, horizontal resolution is increased to at least 330 TV lines, compared with 280 lines in TV receivers without comb filters. This improvement, combined with the vertical peaking feature, resulted in significantly improved picture quality and sharpness.

This receiver was recently included in a group of top-of-the-line console receivers evaluated by a leading consumer magazine. The CCD set was rated the best and special mention was made of the comb filter.

Personalities

The CCD comb filter IC described here is the culmination of over five years of research and development at RCA Laboratories and Consumer Electronics. During this period, many people have made important contributions to the success of this project but the seven people nominated for the 1981 David Sarnoff Outstanding Technical Achievement Award have made outstanding individual contributions in the following manner.

James E. Carnes

Dr. Carnes was overall project leader for the development of the CCD comb filter IC. In addition to project leadership, he was primarily concerned with the application of special CCD video signal processing techniques which involved device development, device layout, device testing and evaluation. This work led to directly applicable pending patents on the comb filter IC.

Jack S. Fuhrer

Mr. Fuhrer contributed significantly to the success of the comb filter project in both an engineering and management capacity. As an engineer, he was responsible for identifying many of the early pitfalls which were associated with the new vertical peaking feature. He suggested and helped implement solutions which made this feature practical in a television receiver. He was instrumental in coordinating the integration of the comb filter function into the rest of the television receiver. He contributed significantly to early demonstrations to marketing management and helped formulate our Dynamic Detail Processing advertising strategy. His leadership was a key factor in the successful completion of this project.

Walter F. Kosonocky

Dr. Kosonocky has been involved with the research and development of CCDs for signal processing applications. This work has led to contributions in basic device performance limitations such as interface trapping, fringing field drift, free-charge transfer and device noise. In addition to his basic work on CCDs, he was the principal architect of the buried-channel, double-level polysilicon-gate NMOS CCD wafer fabrication process. This high-performance, state-of-the-art, *n*-channel process is essential for the production of CCD comb filter ICs.

A number of patented inventions made by Dr. Kosonocky alone and some made jointly with others, are incorporated in the comb filter. These include the so-called "fill and spill" input circuit to the CCD, CCD structures for charge addition and subtraction, and others.

William A. Lagoni

Mr. Lagoni was the key engineer responsible for the product design of the comb filter function in the television receiver. His many long hours were instrumental in the eventual success of the project. He has several innovative patents which were key to the success of the project. Since this was a new TV function, there was no prior art on which to rely for guidance in formulating these exacting specifications. He solved severe interference (RFI) problems resulting from the use of on-chip clock drivers required by the comb filter IC design. He has several issued patents and pending patent applications concerning a nonlinear vertical detail signal processing system used in the receiver.

Peter A. Levine

Mr. Levine was instrumental in the development of innovative and novel techniques for the measurement of device and circuit performance of CCDs in video signal processing applications. These unique circuit evaluation techniques played a key role in the rapid evaluation and improvement of the circuits incorporated in the comb filter IC. Patent applications were filed covering a number of inventions incorporated in the comb filter made solely by Mr. Levine or in which he is a joint inventor, and many have now issued as patents. These include the gain control circuit at the input to the CCD, a charge limiting circuit and a number of others.

Dalton H. Pritchard

Mr. Pritchard was principally responsible for the development and evaluation of analog techniques for employing the CCD comb filter technology in the color TV receiver signal processing system. This work on the video processing system implications of the comb filter was essential to the successful incorporation of this filter in TV receivers. He has several issued patents and pending patent applications concerning inventions applicable to the use of the CCD comb filter IC in the receiver. The subject matter of these inventions relate to generating and properly synchronizing the comb filter timing signal, structuring the CCD comb filter system to achieve predictable signal delays, and restoring vertical image detail information to the luminance signal.

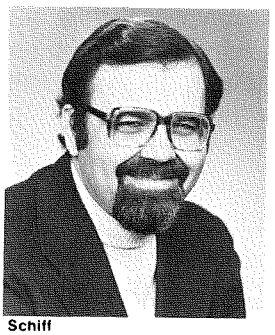
Donald J. Sauer

Mr. Sauer had a leading responsibility for the exact circuit designs and implementations that were incorporated in the comb filter IC. In this role, he was responsible for detailed circuit analysis, design, layout and characterization of the CCD and the other sub-circuits required in this video signal processing application. Mr. Sauer's contributions include a number of inventions which are incorporated in the comb filter IC and a number of patent applications were filed, some for Mr. Sauer alone and some jointly with others, covering these inventions which have issued as patents. These include the automatic bias control circuit for the comb filter, a differential amplifier circuit and a number of others.

For achieving dramatic increases in the capacity of the RCA domestic satellite system.

Achievement

Jonnalagadda



Schiff

Walter H. Braun
Director,
Systems and Advanced Technology Engineering,
RCA American Communications, Inc.

Marvin R. Freeling
Principal Member Engineering Staff.
Regulatory Technical Support,
RCA American Communications, Inc.

Krishnamurthy Jonnalagadda
Member Technical Staff,
Communications Analysis,
RCA Laboratories

Leonard Schiff
Head,
Communications Analysis,
RCA Laboratories

This team increased the transponder capacity of the RCA Satcom satellite from 1992 voice-grade-equivalent channels to 2892 channels, thus permitting concomitant growth in revenues per transponder.

The loss of the RCA Satcom F3 spacecraft in December, 1979 immediately jeopardized the 1980 Business Plan for RCA Americom's Commercial Services by essentially halting the expansion in private leased-channel service because of transponder shortages. The cited program was conceived and commenced immediately following this catastrophic loss. An accelerated development program moved from initial theoretical analyses to empirical verification of analytical design, manufacture of high-performance earth-station ground communications equipment, and final field installation and operation within nine months. As a result, the Commercial Services product line actually exceeded their Business Plan for private leased-channel services, despite the loss of the F-3 satellite.

Specifically, the installation of compandors into RCA Americom's voice-channel transmission plant resulted in fundamental changes in basic FM transmission theory and enabled the creation of a new industry standard. The team recognized that frequency deviations could be increased well beyond the bandwidths previously used by all major carriers under the well-known Carson's (tradi-

Braun Freeling

tionally referred to as the occupied bandwidth). Since compandored channels are rendered relatively insensitive to distortion noise introduced by non-linearities of transmission channel filters, it was believed that the technique of *overdeviation* could help to increase system capacity. Given this premise, the team undertook an extensive analytical and test program to evaluate the feasibility of this approach. New ground communications equipment with bandwidths and performance superior to that of previous generations was developed, tested and proved prior to preparation of detailed specifications for quantity production by selected vendors. The realization of this new generation of earth station equipment involved use of recently available hybrid solid-state circuitry and was accomplished on an accelerated program.

Concomitant with the effort on overdeviation techniques, other approaches which offered promise were pursued and eventually implemented. The program used simple, effective and clever techniques requiring very modest capital investments but resulting in dramatic increases in system capacity.

Personalities

Drs. L. Schiff and K. Jonnalagadda were basically responsible for the initial theoretical analyses and predictions, and Messrs. Braun and Freeling were responsible for the empirical verification efforts, the development of the new equipment, and operational deployment of the system, as described in greater detail below.

Walter H. Braun

At the outset, Mr. Braun evaluated the initial theory behind the attempt to expand the transponder capacity via changes in deviation from Carson's Rule, and made the key finding that additional channels could be added with changes in peak factors and the development of new pre- and de-emphasis networks. He also made the important program decision that the predicted results could be achieved within a tight cost/schedule envelope and recommended to his management that appropriate funds be committed. He directed the test programs conducted at Comtech Laboratories and Scientific Atlanta, Inc., and at the two Americom earth stations containing their respective equipments, Vernon Valley and Atlanta, to determine their characteristics with respect to the planned expansion. He performed all the management aspects with respect to liaison among three groups: Americom Engineering, Purchasing, Law Department and Profit Center; and the David Sarnoff Research Laboratories. He directed the design review that resulted in the necessary earth station modifications. He personally saw to it that Americom Engineering and the vendors accelerated their efforts to assure the shortest possible delivery time for the modifications, then turned the program over to the Americom PMO. Finally, he supervised the field tests conducted on the first new equipments located at the Lake Geneva, Wisconsin, Earth Station.

Marvin R. Freeling

Mr. Freeling was given the assignment to determine the maximum capacity of a single satellite transponder for transmission in the FDM-FM mode. In this context, capacity connotes the number of one-way voice-grade channels. He performed a study and analysis of six capacity expansion techniques: companding; overdeviation; assumption of average-talker power of less than the conventional -15 dBmo; group delay equalization; use of peaking factors other than the conventional 10 dB; and use of unconventional pre- and de-emphasis networks.

Although a body of literature exists for the first four techniques, to his knowledge no one had previously reported on the latter two for channel capacity expansion. The results of his analysis led to the conclusion that transponder capacity could be expanded to 2892 channels, possibly as high as 3012 channels (the work leading to this analysis had indicated that a maximum capacity of only 2700 channels could be achieved for the Satcom system).

Companding had already brought the capacity up from a base of 1092 channels to the existing 1992 channel capacity. He designed non-standard pre- and de-emphasis networks, designed in-orbit NPR and group delay tests for determining transponder capacity, determined the characteristics of the Comtech-equipped Americom earth station at Vernon Valley, New Jersey, conducted tests of the existing characteristics of this equipment at both Vernon Valley and Comtech Corporation, and then devised the specifications for the required Comtech modifications. Following the equipment modifications, he performed iterative in-orbit tests at Vernon Valley from which were derived the optimum parameters for 2892 channel capacity. He then repeated these tasks at the Scientific Atlanta-equipped Americom earth station at Atlanta, Georgia.

As a result, Comtech and Scientific Atlanta made final modifications to the tested prototypes and retrofitted the Lake Geneva Earth Station equipment. It was at this site that the final live-transmission tests using production equipment were performed successfully, leading to the implementation at all Americom earth stations.

Krishnamurthy Jonnalagadda

Dr. Jonnalagadda developed the analytical tools vital to the proof of the theoretical advancements being proposed. Existing analytical techniques developed to predict capacity were too inaccurate to give proper answers to the question of increase in distortion noise as channels were added. In addition, the then available computer simulations took too much time to run. A timely analytical proof was necessary if the program was to commence at all.

Working under a time constraint, Dr. Jonnalagadda developed the algorithm that significantly cut running time on the computer, which enabled all the worst case conditions to be run. The initial capacity predictions were substantiated analytically.

Dr. Jonnalagadda also developed the analytical simulations for improvements in equalization settings and predicted the proper setting for maximum efficiency.

Leonard Schiff

As part of the continuing joint Americom/David Sarnoff Research Laboratories advanced development programs, Dr. Schiff has been heavily involved in increasing traffic capacity through Americom's system. When it became clear to him that the two-for-one capacity program was going to be successful, he continued his efforts to develop other techniques to increase capacity even beyond the then projected 1800 channels per transponder. It was at this stage that Dr. Schiff made the perception that use of a conventional Carson's Rule design in a companded system was inefficient.

He realized that some additional channels could be added with enough deviation to maintain tone-to-thermal noise ratios up to the point when distortion noise increased to a reasonable level (tone-to-distortion noise in the low 40s). The unknown at this time was how fast distortion noise increased as channels were added. It was in this area that Dr. Jonnalagadda made his contribution as noted later.

Dr. Schiff also participated in the study to determine what capacity could be gained by altering equalizer settings as part of the joint effort. He directed the analytical simulations which showed that for worst case operation (that is, adjacent transponders on but carrying no, or very low-power, traffic with worst-case delay) possibly a few hundred more channels could be carried.

(Continued from page 4)

treadmill — or a fascinating highway to knowledge and achievement. In this, even more than in other areas of effort, the more you put into it — in terms of work and devotion — the more you will get out of it."

Sarnoff knew the nature of creative minds — they form new combinations and conceive new applications. He knew the ways these creative people could be stimulated — through encouragement and exposure to a variety of intellectual disciplines. And he recognized creative characteristics among the fraternity of doers — constant-inquiry, problem-solving ability, and wide interests. Members of the selection committee for this year's award looked for many of the same kinds of abilities as they chose the winners.

As in the recent past, members of the engineering staffs of RCA Divisions and subsidiary companies, and members of the research staffs of the RCA Laboratories were eligible. No specific limitation on the number of awards was made. The Selection Committee considered both individual and team efforts. Originally, in 1956, two awards were announced — an "engineering" award for outstanding achievement, and a "science" award for outstanding research achievement. A fuller recognition of the role of manufacturing engineering and a closer bond between RCA Laboratories and the other business operations contributed to the elimination from the award in 1973 of the distinction between science and engineering. At the same time, efforts to recognize personal technical excellence redoubled.

Generally, the Chief Engineer, Research Laboratory Director, or the equivalent submits nominations from an activity. The Selection Committee, consisting of the following people, then determines the Award Winners: W.C. Hittinger, Executive Vice-President, Research and Engineering; G.H. Fuchs, Executive Vice-President, Industrial Relations; J.V. Regan, Staff Vice-President, Patent Operations; H. Rosenthal, Staff Vice-President, Engineering; and W.M. Webster, Vice-President, Laboratories. The award consists of an engraved medal, a citation certificate, and a monetary award for each individual or team member.

With mighty help from his scientists and engineers, David Sarnoff's driving personality and pervasive influence dominated the electronics industry for more than 50 years. This year, the cited Achievements and the Personalities that merited the Sarnoff Award show that RCA's scientists and engineers continue to build on achievement.