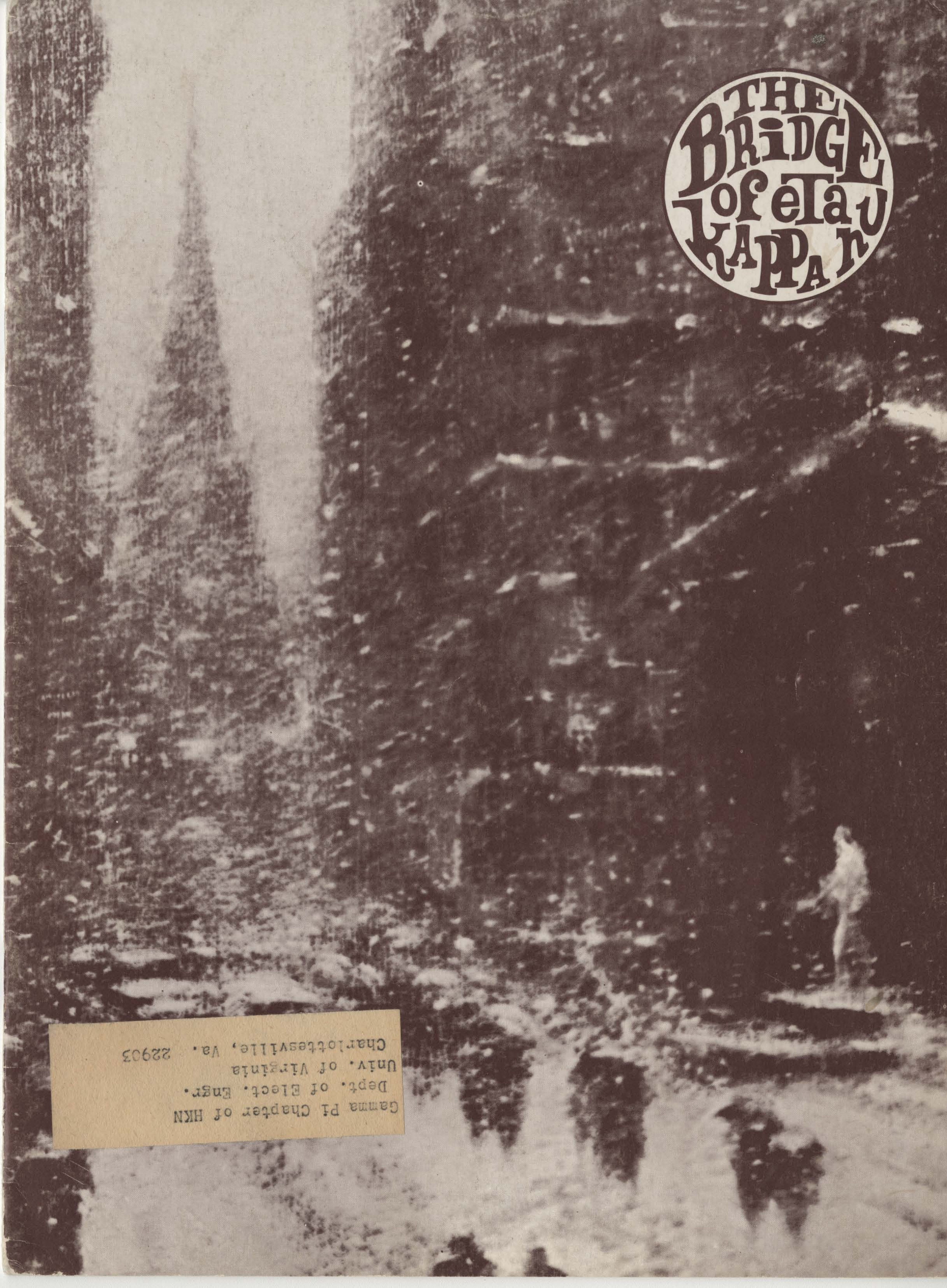
THE BRIDGE of Eta Kappa Nu



Gamma Pi Chapter of HKN
Dept. of Elect. Engr.
Univ. of Virginia
Charlottesville, Va. 22903

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ETA KAPPA NU

Electrical Engineering Honor Society

FEBRUARY, 1968, Vol. 64, No. 2

Editor and Business Manager
Paul K. Hudson

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OUR COVER

A cold day on Wall Street? In more ways than one? Maybe. This painting entitled **Wall Street** by Guy Wiggins (1883-) introduces our special supplement dealing with the investment markets. **"Don't stand up close — six feet is about right."** Courtesy Krannert Art Museum.

The BRIDGE is published by the Eta Kappa Nu Association, an electrical engineering honor society. Eta Kappa Nu was founded at the University of Illinois, Urbana, October 28, 1904, that those in the profession of electrical engineering, who, by their attainments in college or in practice, have manifested a deep interest and marked ability in their chosen life work, may be brought into closer union so as to foster a spirit of liberal culture in the engineering colleges and to mark in an outstanding manner those who, as students in electrical engineering, have conferred honor on their Alma Maters by distinguished scholarship activities, leadership and exemplary character and to help these students progress by association with alumni who have attained prominence.

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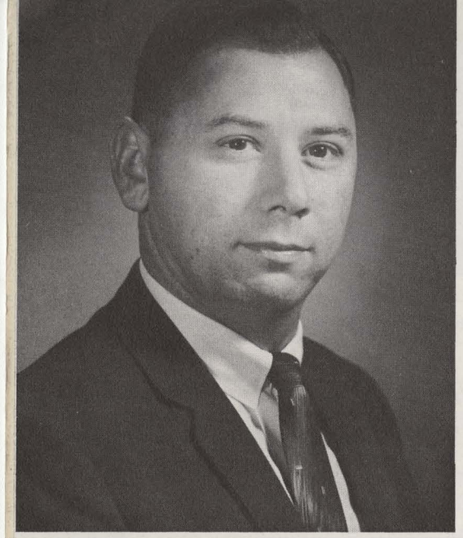

Robert F. Elfant

ROBERT F. ELFANT

Outstanding Young E E for 1967

HONORABLE MENTIONS
George H. Heilmeier — Robert W. Lucky

By virtue of his notable contributions to computer memory research, his inspirational leadership qualities, and his dedication to professional and community activities.

BIOGRAPHY OF DR. ELFANT
by Dr. W. L. Shevel, Jr.

At the age of 31 years, Dr. R. F. Elfant can look back to ten years of solid accomplishment since his graduation with honors from Southern Methodist University. The years ahead should result in an even greater impact in his chosen field and on his profession. Upon graduation in 1957, Bob Elfant joined Bell Telephone Laboratories in Murray Hill, New Jersey as a member of the technical staff in the area of data transmission. In addition to study and design of various solid state switching devices and circuits for communications application, Bob was pursuing his Masters Degree which was awarded him in 1959 from New York University. In 1959, Bob began full time graduate study at Purdue University, concentrating his research on the mechanisms of flux reversal in magnetic materials. Upon receiving his doctoral degree in 1961, he joined the IBM Research Center in Yorktown Heights, N.Y. with responsibilities in research in new magnetic devices and circuits. Demonstrating a thorough grasp of solid state device principles and a rare but required discipline in materials engineering, Bob was promoted to a manager of a group concerned with development of an electronically addressable bulk memory using magnetic storage media. His desire to achieve, to accomplish, to have impact, has been felt in every technical effort in which he has been involved. Satisfied only by productive results, a healthy discontent with past effort has kept his performance at an outstanding level.

Demonstrating capability for developing research efforts of the greatest potential, he was promoted to Manager of Memory Research in IBM. His efforts were principally responsible for turning sophistication in more conventional areas of research toward those of longer range importance. Examples of innovation in that area included the development of analytic techniques for memory system optimization, utilization studies such as memory hierarchies, unique approaches to Beam-Addressable Memories, and a determination of the fundamental limitations of different solid state technologies for memory. Dr. Elfant's significant achievements were recognized in those years such as in 1962 when he received an IBM Outstanding Technical Contribution Award.

Consistent with his drive to accomplish has been excellence in the publication of his work. He authored seven technical papers on his research in various professional journals, and he authored a larger number of key papers internal in IBM. In this area, his success in invention activity is a good measure of his assessment and understanding of long range needs and technology potential. More than a dozen patent applications have resulted from Bob's work with eight of these issued to him in the memory field. The significance of these efforts was recognized in 1963 and 1964 when Bob was the recipient of IMB Invention Awards.

As a member of IEEE, he has served the profession without sparing effort. His excellent service on various technical committees and his contributions to them resulted in his choice as Chairman of the Technical Program Committee of the International Conference on Magnetics (INTERMAG) in 1967. Here his leadership was evident in conference innovation as well as in development of an outstanding technical program. Following his significant efforts in such conference activities, Bob was elected to the Administrative Committee of the IEEE Magnetics Group in 1967.

Since completing his doctoral work at Purdue, Dr. Elfant has maintained a high level of activity in engineering education. Beginning with the contracting of a device research program at Carnegie Tech in 1962, he then served as an advisor to several graduate students there, and then formally on a committee in 1964. Similar activity was developed as well at Purdue and he afforded service as advisor to several graduate students and there again served on a doctoral committee in 1965. His involvement has extended to Iowa State, Lehigh, and his alma mater, Southern Methodist University.

Conscious of the broader, deeper aspects of man, Dr. Elfant contributed consistently and heavily in the establishment and development of Temple Beth Am in Yorktown Heights, New York. He was chairman of those two life-giving committees common and vital to all institutions—the Ways and Means Committee and the Membership Committee. Bob's efforts on the first of these cannot be overestimated. His task was to create a budget at the most critical stage in the congregation's history while the program was expanding and a new building was being purchased. At a time when pivotal problems demanded decisions, Bob's leadership steered a clear and certain course. As regards the Membership Committee of Temple Beth Am—that group of men who provide a continuing source of manpower, creativity, and financial support — the task of Membership Chairman demands time, effort, knowledge, tact, and awareness of organizational methodology. Bob did his job with great skill and his efforts show visible results. It should also be noted that he was instrumental in the establishment and direction of a Men's Club.

His activities in the Yorktown Heights area were not confined to his temple. He was an interested and involved member of the PTA, and was very active during political campaigns. He worked hard for both national and local aspirants.

As though the hours in the week were unbounded, Bob consistently found time in his schedule for his own personal development. In addition to attending lectures in his temple, he was a well informed and vigorous participant in a study series of an historical survey of biblical characters and a series on contemporary literature with application on the current Jewish scene. Bob has taken courses in Hebrew language instruction and has attended seminars and lectures on the disciplines of synagogal organization.

In the broader aspect of his interest, Bob has taken courses in the machinations of the stock market offered by a local board of education. His hobby has been photography, and his activities there attest to his high level of interest and capability in this recreation.

Bob takes great pride in his family and because of this he and his wife, Cecile, and two beautiful children enjoy a warm and close relationship. In an age that is producing severe familial strains, the Elfant's are a relaxed and close-knit family. There is evidence in the home of that difficult combination of love and respect, freedom and security. His children, Michael and Natalie, frequently enjoy family outings to historic sites, hikes, field trips, and a wide variety of other such activity as a family. In his home, there is evident mutual encouragement afforded between Bob and his wife Cecile. Her activities and responsibilities have complemented Bob's significantly in areas such as Sunday School, Cub Scouts, and in Jewish women's organizations.

At the core of his professional creativity, his leadership skill, and his organization ability, lies the man, Robert Elfant. In a world that seems to make every effort to hide its real self, to throw up a facade, to erect an unfeeling wall toward all things, he is refreshingly open, candid, honest and sensitive. He is unashamedly exuberant about those things that excite his interest and he is similarly unafraid to admit of being sensitively moved by a play or the like. He possesses a humor and ease and genuineness that puts one at ease in his presence. This openness, together with the confidence he displays, based on solid scholarship, are the ingredients of leadership. In the search for "engineers of great promise in the broadest sense" and based on the professional skills, character, abilities, potential and depth of the nominee, I heartily endorse the selection of Robert F. Elfant as Outstanding Young Electrical Engineer of 1967.

INTRODUCTION

by BERT SHEFFIELD
Chairman, Award Committee

The outstanding Young Electrical Engineer of 1967 was selected by Eta Kappa Nu's Jury of Awards on October 20, 1967 to be Dr. Robert F. Elfant. Dr. Elfant is at IBM in Poughkeepsie, N.Y., as Memory Advanced Technology Manager in the Systems Development Memory Department. The Jury honored Dr. Elfant for his notable contributions to computer memory research, his inspirational leadership qualities and his dedication to professional and community activities. He has authored technical papers in various technical journals and has more than a dozen patent applications issued to him, with eight of these issued in the memory field.

Honorable Mention was awarded to two outstanding young engineers. Dr. George H. Heilmeier of RCA Laboratories, Princeton, New Jersey, was awarded Honorable Mention for his study and application of new effects in solids and liquids, and his dedication to community and church activities. Dr. Robert Wendell Lucky of Bell Telephone Laboratories, Holmdel, New Jersey, was awarded Honorable Mention for his extraordinary contributions to the field of data communication and his dedication to community affairs.

Candidates for these awards are sought through nationwide circulation of Eta Kappa Nu Nomination Forms which are enclosed with the annual "Spring Letter" of the Award Organization Committee. (Forms are available also from Paul K. Hudson, National Secretary, HKN.) Requirements for nomination have been the BSEE degree held not more than 10 years, and age not over 35 years. Winners are judged on the basis of outstanding performance in electrical engineering, and also in activities in areas such as civic, social, cultural and aesthetic and other areas.

The award Organization Committee members are: Robin Beach, Emerson D. Callahan, Reed Crone, Larry Dwon, Irving Engelson, Anthony F. Gabrielle, Edward E. Grazda, Willard B. Groth, Everett S. Lee, Edgar W. Markard, John M. Montstream, Harlan J. Perlis, Sheldon J. Raiter, Frederick A. Russell, Robert W. Slade, Roger I. Wilkinson. Paul K. Hudson, and Berthold Sheffield, Chairman.

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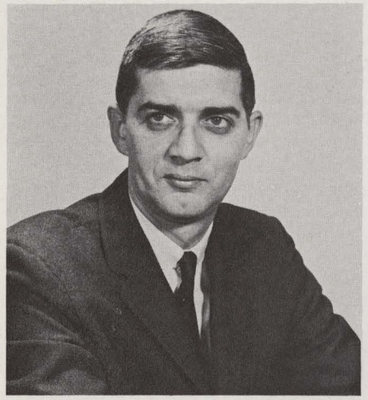


Robert W. Lucky

By virtue of his study and application of new effects in solids and liquids, and his dedication to community and church activities.

BIOGRAPHY OF DR. LUCKY
by Dr. W. O. Fleckenstein

Robert Wendell Lucky was born January 7, 1936, in Pittsburgh, Pennsylvania. He was the first child of Clyde A. and Grace L. Lucky. The family later grew to include a younger son and a daughter. Throughout Bob's elementary and high school period they lived in Mt. Lebanon, which was a quiet suburb of Pittsburgh. Clyde Lucky, Bob's father, was an accountant with the Aluminum Company of America.

At school he was a good student, particularly in the mathematics and science courses. He tutored for the high school and occasionally taught math courses as a substitute for the regular instructor. He won the annual national competition for French scholarship in 1952. He graduated with high honor in 1953 from Mt. Lebanon High School.

Bob entered Purdue University as a freshman in engineering in the fall of 1953. His grades were excellent and he was elected to Phi Eta Sigma, the honorary for freshman scholarship. At this point he had definitely decided upon majoring in electrical engineering and had chosen to pledge Triangle Fraternity, a social fraternity for engineers and architects.

During the summer after his freshman year, he worked at his first full time job as a summer employee in the corrosion engineering department of the Manufacturer's Light and Heat Company. The job involved the measuring of electrical potentials along gas pipelines with cathodic protection. When he was later elected to Eta Kappa Nu his paper on this subject won the chapter's paper competition.

After his sophomore year at Purdue he worked at the U. S. Steel Company's plant in Braddock, Pennsylvania. There he gained a brief, but educational, view of steel production and of life within a steel mill. In his job he helped with the construction of a new rolling mill for the production of rails.

The following year he spent the first of four summers with the Westinghouse Electric Corporation. This first summer was with the New Products Division where he worked with solid state inverter circuits. Out of this work came his first patent—an inverter whose output frequency was nearly independent of input voltage.

In 1957 he graduated from Purdue with a BS in electrical engineering, awarded with highest distinction. In addition to Phi Eta Sigma and Eta Kappa Nu, he had been elected to Tau Beta Pi. During his college career he had pursured his musical interests through the Purdue orchestra. He also participated in intramural athletics and served as treasurer of his fraternity.

Before returning to Purdue for graduate studies Bob worked a second summer with Westinghouse—this time with the Automatic Switchgear Division in East Pittsburgh. In graduate school he was employed as a teaching assistant and as a counselor in the men's dormitory. After achieving an MS in electrical engineering in January of 1959 he was awarded a fellowship for further study by the Consumer's Power Company of Michigan. About this time he had decided to specialize in statistical communication theory and began work on a thesis on signals which were simultaneously modulated in phase and amplitude.

He spent two further summers with the New Products Division of Westinghouse working on solid state inverters in 1958 and 1959. During these intervals he made important contributions to the practices of inverting and filtering for high loads using solid state devices. Several times he was given meritorious disclosure awards.

His last summer job was in 1960 with the Space Technology Laboratories where he was involved with the analysis of a control system for inertial guidance. In 1961 he was granted the PhD from Purdue. His thesis, entitled "Digital Phase and Amplitude Modulated Communication Systems", was done under the direction of Dr. John C. Hancock.

In August 1961 he was married to the former Miss Joan Jackson, also of Pittsburgh. He accepted a position in the Data Theory Department of Bell Telephone Laboratories, then located at Murray Hill, New Jersey, and began work in September 1961. Initially, his assignment involved the analysis of phase modulated digital communications systems. From this study he moved on to consider other problems in the transmission of digital information over telephone facilities. He recognized that the signal distorting properties of the telephone channel caused the principal limitation of speed and intelligibility of transmission.

Bob made a significant breakthrough in technology in providing the minimum signal distortion condition for a transverse equalizer and in discovering means for automatically achieving this condition in minimal time. This initial breakthrough paved the way for a series of inventions on adaptive systems in which he played a leading role. When these systems were implemented, they enabled data to be transmitted at speeds of three or four times what had previously been achieved. A substantial amount of specific development work is now underway which is heavily based on these fundamental contributions.

In 1964 he was promoted to supervisor of the signal theory group and in 1956 to his present position of Head of the Data Theory Department. He has added administrative responsibilities in the area of education, where he serves on committees for continuing education, and in recruiting, where he acts as a campus recruiter as well as in the capacity of Laboratory recruiting coordinator.

He has continued making original contributions to the field of communication theory, having generated seven patent applications and authored some twenty published papers in addition to co-authoring the book "Principles of Data Communication". He has given many talks at conferences, technical meetings, and at university colloquia. He is on the Communication Theory Committee of the IEEE and serves as a reviewer for a number of technical journals.

George H. Heilmeier

By virtue of his extraordinary contributions to the field of data communication, and his dedication to community affairs.

BIOGRAPHY OF DR. HEILMEIER
by Dr. James Hillier

George H. Heilmeier was born May 22, 1936 in Philadelphia, Pennsylvania. He received his elementary and secondary education in the Philadelphia public school system and upon graduation from high school, entered the Moore School of Electrical Engineering at the University of Pennsylvania with a full tuition scholarship. He was elected to Eta Kappa Nu, Tau Beta Pi, and the Hexagon Senior Society honor societies and received the B.S.E.E. degree with distinguished honors in 1958.

He joined the technical staff of RCA Laboratories in June 1958. His first area of technical interest involved parametric and tunnel diode amplifiers, mixers and harmonic generators. He published five papers in this area between 1958 and 1961, and in 1960 was awarded the RCA Laboratories' Achievement Award for Outstanding Research and Development on amplifiers, converters and harmonic generators using parametric and tunnel diodes. These devices are used in radio astronomy, satellite communications, and in many radar applications.

While working at RCA Laboratories Dr. Heilmeier attended Princeton University and received the M.S.E. degree in 1960, and the A.M. degree in 1961, and the PhD degree in 1962, all in electrical engineering. In 1961, Dr. Heilmeier's field of activity changed to that of organic semiconduction and from 1962 to 1964, he published nine papers in that field. This was also the subject of his dissertation for the PhD at Princeton University. His work in this field was again recognized by an RCA Laboratories' Achievement Award for Outstanding Research in 1962.

Other areas in which he has been technically interested include electro-optic effects in molecular crystals, thin film devices, and surface phenomena and liquid crystalline phenomena. Since 1964, he has published seven papers in these areas and in 1965, his work on liquid crystal phemomena was again recognized by RCA Laboratories as outstanding with the granting of his third Achievement Award in six years.

In June 1966 Dr. Heilmeier was appointed Head, Solid and Liquid State Devices Research at RCA Laboratories and is therefore now responsible for the direction of the work of that group while he continues to contribute through his own research as well. In 1966, Dr. Heilmeier also became a Senior Member of the IEEE.

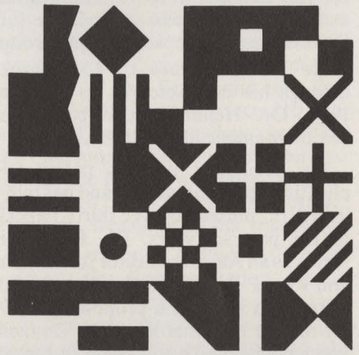
Dr. Heilmeier has six patent applications pending action and has published or presented over thirty papers in the past six years. Dr. Heilmeier serves as an Advisory Editor for Harper and Row Publishers in the area of solid state electronics, as a proposal evaluator for the National Research Council and has reviewed a number of technical publications for various journals such as the Proceedings of the IEEE and the Journal of Chemical Physics. In addition to these exceptional technical contributions, Dr. Heilmeier has continued to give of himself in a variety of community activities. His leadership and maturity was recognized by his selection as a ruling elder in the Mayfair Presbyterian Church. Because of a vacancy in the pastorate of this church during the past year, Dr. Heilmeier assumed some of the duties normally fulfilled by the pastor, including full responsibility for the church newspapers as well as some of the pastoral visitation activities. For three years (1963-1965) he served on the University of Pennsylvania Alumni Secondary School Committee through which he interviewed and counseled secondary school students who wished to enter the engineering school. In this regard, Dr. Heilmeier continues to tutor and counsel those who require help on a no-fee basis. He has continued his active interest in athletics and served as playing captain of the Philadelphia city softball champions in 1958, 1959, and 1960, and the Pennsylvania State Amateur Softball champions in 1959. He continues to play softball in Philadelphia Community Leagues. During the past year he also coached the church-sponsored youth group basketball team.

Dr. Heilmeier married the former Janet Faunce in 1961 and is the father of one daughter, Elizabeth, born in 1965.

MEMBERS OF THE JURY OF AWARD FOR 1967 ARE: Eugene D. Becken, Vice President & Chief Engineer, RCA Communications, Inc.; Jack Farley, Illinois Bell Telephone Co; Frank A. Gunther, (Jury Chairman), Executive Vice President & Director Dynamics Corporation of America, and President Radio Engineering Laboratories; Robert I. Wilkinson, Bell Telephone Laboratories; Berthold Sheffield, Radio Corporation of America; Wm. P. Smith, Dean of Engineering, University of Kansas; S. B. Ingram, Director of Technical Employment Center, Bell Telephone Laboratories; Edward A. Leach, Vice President, Sangamo Electric Co.; John V. Walsh, Vice President of Engineering, Sperry Gyroscope Division.

What is there left for you to discover?

Cyrus the Great, King of Persia, built a communications system across his empire some six centuries before the Christian Era. On each of a series of towers he posted a strong-voiced man with a megaphone. By the 17th century, even a giant megaphone built for England's King Charles II could project a man's voice no further than two miles. This same king granted Pennsylvania to Admiral William Penn as a reward for developing a fast, comprehensive communications system — ship-to-ship by signal flags.



We waited for the combined theories of Maxwell, Hertz, Marconi and Morse before men could transmit their thoughts by wireless, though only in code. Only after Bell patented his telephone and DeForest designed his audion tube could men actually talk with each other long-distance. Today nations speak face-to-face via satellite. Laser-beam transmission is just around the corner. Yet man still needs better ways to communicate across international boundaries.

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Investing

by
Z. J. DALSKI
Pyne, Kendall & Hollister, N.Y.C.

There is no need to worry about the progress of mankind as long as there are men of enterprising and creative spirit, people with money willing to help them and skilled and unskilled men willing to cooperate with them. True, there will probably be always periods of lesser growth, of difficulties, of recessions, retrogressions, crises or however we may choose to label them. But men of enterprise have in history so innumerable times created life, where complete chaos reigned, should we not trust them with overcoming lesser difficulties in future? Let's assist them, not replace them; they are irreplaceable, and no amount of well-meant government action will fulfill the functions of men of enterprise. It will only stifle them.

Great Doctors of Economics can help to strengthen economic life, bad Doctors can weaken it and may kill the patient. But no economist can create economic life. Men of enterprise will.

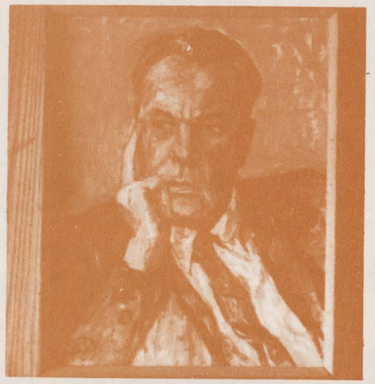
In countries, where money can be used freely, money is freedom. Take money away from man, and you take his freedom away from him. There is not much difference, whether man's money is confiscated or taxed away or the currency's value is reduced, whenever man ceases to hold what he has and loses what he makes to such an extent that he seems to work for the government, on a commission basis, so to say, he ceases to be a free man. It does not satisfy man to have a secure income, enough to live and to travel. In civilized nations a man wants independence, and only financial independence gives him the feeling of personal independence. The urge for money and more money is the urge for a more secure independence. It is an urge inborn and as old as mankind. The desire for financial independence follows his craving for personal freedom.

Money does not grow, unless it is put to useful use in a growing enterprise. Enterprises are the primary source of growth. They may be one-man businesses, partnerships or corporations with many stockholders. The vast majority will select the holding of stock in one or more of the very many existing publicly held corporations. Where an investor will put his money in, depends on his courage and temperament. Some will prefer greater, well established corporations, which may grow slowly, but offer more security and a better income, others will look for young, aggressive corporations, which may be less secure and not pay any dividends yet, but are promising quicker growth. In time, the conservative investor sometimes switches into more speculative issues, another having burnt his fingers, retreats from risky investments into the more secure. Everybody agrees that he invests to see his money grow, not to lose part or all of it.

Let us state once for all that investing is not making a decision after careful deliberation, and letting the management of the corporation do the rest. No corporation exists and will ever exist that will grow steadily at the same pace. Enterprises face possible unforeseeable difficulties, may get sick, recover or die. Price fluctuations of the corporation's stock on the securities markets will reflect sooner or later the state of its affairs. An investor, who sticks to his decision to see his money grow must be prepared to sell his investment, to abandon ship, so to say, if she does not bring him where he wants to go, and to board another. This requires permanent watchfulness and a readiness to make the necessary decisions.

Investing is going into business on your own. Every independent businessman can do it, thus diversifying his interests and lessening his dependence on his primary business, — every employee can do it, thus creating his own business as a sideline, where he is the boss, and diminishing his dependence on his job, — an exhilarating experience. But, like every enterprise, this one requires also intelligence, imagination, courage — and experience.

The best informed investor will make the best decisions. Generally, there is no better way than to give intensive study to all available investment advisory services, to compare their advice with the market action of the stock they recommended and to make one's decision. He may subscribe to some of them or get them



from a brokerage house, all of these subscribe to the more important advisory services and make them available. The investor must, however, be prepared to make also painful mistakes, until he becomes experienced. In any case, it is recommended not to neglect the advice of an experienced security broker. A broker, not a brokerage house. Brokerage houses employ many brokers, whose advice is necessarily individual and different. As always and everywhere in life, it is the personality as well as the knowledge and integrity of the man, the investor is dealing with, which will decide the quality of the advice and its results. A lengthy first discussion of a prospective investor with a broker, recommended to him or selected on another basis, in person or over the 'phone, will attune the investor and the broker and help to make the first investment decisions. If a mutual understanding does not develop, contact with another broker should be tried. If, however, an understanding exists and the results confirm the expectations, a harmonious cooperation will achieve the investor's aims. His money will grow.

Life is fight and the securities markets are one of the battlefields, which reflect the win or lose of decisions by men of enterprise. Changes in the economic or political conditions in one's own or any other country may influence the growth or even the existence of the corporation, the stock of which an investor owns. It is, therefore, better to have an economist-broker, who has not only the necessary familiarity with securities and securities markets but also a thorough knowledge of economics and an experience of at least a good ten years in the securities business. That the reputation and the financial responsibility of the securities firm, with which the economist-broker cooperates, must be beyond reproach, goes without saying.

Some investors will make their investment decisions after consultation with their economist-broker; others will leave the decisions completely to their broker, giving him free hand to manage their investments. Still others will prefer to handle their own investments independently, leaving the hanling of the technicalities and executing their orders to the broker. Some finally, will prefer to invest through the medium of Mutual Funds, which in the past twenty years have grown in number and size. These Mutual Funds accept money from investors and invest it with the money received from hundreds and thousands of others, to the best of their abilities. They perform on a massive scale, what an economist-broker, if empowered, does on an individual scale. They manage the money of the investors with the idea of making it grow, without asking the investors advice or permission. There are so many national and international Mutual Funds, their management results vary so widely that an investor is also in this case well advised to enlist the help of an economist-broker before making a decision as to where to put his money. The broker will also provide the investor with the shares of the selected Fund, any Fund, at the uniform purchase price at the time of the purchase.

The advice and help from economist-brokers is, as a rule, completely free of charge. The brokers reward is the commission on the order, which the would-be investor places with him, to buy or sell some stock, bonds or Mutual Funds. An investor, who has the good fortune to meet a good broker and invests on his advice, will probably make out better than another, who invests in a Mutual Fund, with hundreds of different investments made on a large scale in amounts of tens or hundreds of thousands of shares. Being, so to say, an independent businessman in his investment capacity, he will have all the advantages of an independent business, be it ever so small, which big business, and that is what great Mutual Funds are nowadays, have not: the ability to act quickly without upsetting the price of a stock and to take advantage of all opportunities. What is even more important than the probable greater profitability of his investments: he becomes a man of enterprise in the investment field, with all this implies: being his own boss, taking actions and taking risks, personally. Asking for advice from an economist-broker does not detract from this status.

Should an investor work with one or more brokers? This depends. If he makes his own investment decisions, it is unimportant, whether one or more brokers are charged with the implementation of these decisions. Each broker can place an order to buy or sell securities, and if an investor has reasons to divide his orders among several brokers at the same time or successively, this is his option. But if an investor wants the full assistance of an economist-broker, it seems better to concentrate the orders in his hands. It is only human to expect that a broker who has the full confidence and exclusive following of an investor will do his very best for him and give him the preference of his limited time. Some investors may want, in time, to put part of their money into a new enterprise, be it since they expect the greatest awards when they start at the bottom, notwithstanding the greater risks, or because they have the "wish to help to build the world." Even in the realization of such a legitimate desire, where the help of a broker to place the order for the stock of the new enterprise may be unnecessary, he may be of great help, and no broker will refuse to give his opinion and make his remarks as regards the prospects of the new enterprise. There may be no market for the stock yet, but sooner or later the shares of the new enterprise will be marketable and the broker will be happy to follow in the meantime the development of the corporation, in which his customer has invested. He may be in a better position to do so, than the investor.

Of particularly great help will be an economist-broker in the field of investing in small and little known enterprises. Investment advisory services, Mutual Funds and magazines are restricting their activities and interest to a limited number of great and very great corporations, where risks, but also profits, are defined. It is among medium-sized and small corporations, that firms with great growth potential can be found. To find them for his customers is a broker's greatly satisfying and rewarding research task.

There are no rights without obligations. An investor, who becomes the part-owner, be it ever so small, of an enterprise, has the right to participate in its progress. But he has also the right, or you may call it obligation, to assist the managers of his enterprise with his suggestions, for improving it. This is the same right of obligation, every employee has. In this field of activity, most investors are still far too modest and reluctant. They will derive much moral satisfaction if they become more active, and get sizeable financial rewards, if their suggestions are adopted.

This is, however, only a segment of the activity, which in our times is expected from an investor. Without an investor's money, economic progress in a free society is unimaginable. But interference of politicians with the functions of management of enterprises, tampering of politicians with the steady value of a currency and political mistakes are slowing progress by making efficient work of men of enterprise so much more difficult. If they persist, investors will lose their money and with it their freedom. These obstacles are fundamental. They cannot be overcome by enterprise alone. They are symptoms of a sick society and under the leadership of its most formidable members, the investors, who are bent on progress and the employees, who are bound to suffer as well from a lack of progress as from an unhealthy progress in abnormal circumstances. It is from the ranks of these two groups, which are at the base of every enterprise, the investors and laborers, that the corrective pressures and forces must come, and come continually, which will drive the germs from the economy and free it to devote all the best forces of enterprising men and women to mankinds march forward and upward.

This moral power drive will awaken the spirit of enterprise, which is slumbering in every man and encourage many to become independent job-makers instead of job-seekers, and profit-makers instead of profit seekers, and make them join the ranks of those, who for many thousands of years are leading us to a more god-like existence.

DID YOU KNOW

THAT the Spanish Dollar in colonial times could be divided into 8 pieces or "bits" — our expression "two bits" came from this.

THAT the earliest coin known was made in Asia Minor about 700 B. C. by either the Lydians or Ionians. It was known as the stater.

THAT in one part of Africa giraffe tails are used for money and whale teeth are used for money in the Fiji Islands.

Investment Companies

by

AMERICAN INSTITUTE FOR ECONOMIC RESEARCH

The first organization comparable to the modern investment company was The Societe Generale de Belgique, established in 1822 by King William I of the Netherlands. Thereafter, economic prosperity in England resulting from its extensive and profitable colonial empire and its leadership of the Industrial Revolution facilitated the creation of several British investment companies during the 1860's.

The development of investment companies began much later in the United States. For example, by the end of 1923, only 15 investment companies were operating, and total assets approximated $15,000,000. However, as a result of unusual growth during the speculative boom years of the later 1920's, 675 investment companies with invested capital of more than $7,000,000,000 were in existence by the end of 1929. As might be expected, not only the great depression during the 1930's, but also the succeeding period of business prosperity affected the growth of these companies. In 1940, assets of investment companies had decreased to $1,061,548,000; in 1950, assets were $3,374,025,000; and on December 31, 1966, total net assets of domestic investment companies had increased to approximately $39,000,000,000.

Types of Investment Companies

Investment companies are generally classified as: (1) companies issuing face amount certificates; (2) fixed or unit trusts; and (3) management companies.

The first type of organization offers contracts under the terms of which the investor agrees to pay a specified sum to the issuing company in monthly, quarterly, semi-annual, or annual payments. In return, the company agrees to redeem the certificates for a specified amount at a specified maturity date. There are two main objections to this type of investment. First, if the investor redeems the shares during the early years of the contract, he probably will receive less than the amount that he has paid. Second, even if he held to maturity, the yield is less than that available on many fixed-income investments such as savings deposits or Government bonds.

The second type, fixed or unit trusts, operate in a different manner. The sponsor of a unit trust deposits a specified group of securities with a trustee and then sells to investors a fractional interest in the deposited securities. Again, we believe that there are two primary objections to this type of investment. First, on a specified date or the occurrence of a specified event the trust must be terminated, all assets are then liquidated, and the proceeds are distributed proportionately to shareholders. The redemption of securities at an unfavorable time would result in the investor receiving only a small portion of the possible value of the investments. Furthermore, these trusts are inflexible in that management may not revise the portfolio, although economic conditions or marked changes in security values may warrant such revision.

Primarily because of the foregoing limitations, by far the greatest number of investment companies now in operation are companies of the general management type. As the name implies, these organizations provide continuous supervision and management of the investment portfolio, adding and removing securities whenever it is deemed advisable to do so. Management funds are generally classified as (1) open-end companies, which continually offer their shares to the public and agree to redeem them at net asset value on any business day and (2) closed-end companies, whose capital structure is relatively fixed (closed) at the inception of the company. The latter companies neither offer to sell nor agree to redeem their shares. Trading in the shares of these companies may be arranged only in the open markets.

DID YOU KNOW

THAT there is more than $1,775,000,000 worth of coins circulating throughout the United States. This is an average of more than $10 in coins per person in the United States.

THAT there is about $28,500,000,000 worth of paper money in circulation in the United States. This is an average of more than $170 in paper money per person in the United States.

THAT it cost the early Virginia colonists 150 lbs. of tobacco for an imported wife.

THAT over a million dollars of new currency is issued every day in the United States.

Governing Laws

Passage of the Investment Company Act of 1940 marked a turning point in the investment company field. The unfortunate experience of many investors who owned investment company shares during the 1929-32 period and the unfavorable publicity that resulted from the congressional investigation that followed probably hampered the growth of these organizations during the years prior to World War II. However, the 1940 legislation removed many of the abuses previously possible, which, in turn, restored the confidence of investors in these companies.

In July 1956 an amendment to the Internal Revenue Code eliminated the double taxation that had previously been imposed on capital gains realized by investment companies but not distributed to shareholders. Under the current law, which became effective January 1, 1957, the 25-per cent tax paid by the company on retained capital gains is apportioned and credited to the tax accounts of each individual shareholder.

The Revenue Act of 1962 eliminated any potential tax saving that previously was available to U. S. holders of shares of foreign investment companies that retain and reinvest a portion of their earnings and realized capital gains. Effective December 31, 1962, any gain realized on the sale or exchange of stock in a foreign investment company is to be treated as ordinary income of the shareholder to the extent that the gain represents his proportionate share of retained earnings and profits accumulated by the company during the period the shares were held subsequent to December 31, 1962.

On December 2, 1966, the results of a detailed investigation of investment companies were released by the Securities and Exchange Commission. Although the report stated that "on the whole investment companies have been diligently managed by competent persons," several changes were recommended to protect the public from what the study group considers "excessive" sales charges and management fees of open-end investment companies. Several of the recommendations will require legislation. Whether Congress will take any action on some or all of the proposals remains to be seen.

Dividends

Investment company dividends may be paid from either or both of the following sources: (1) ordinary income derived from dividends and interest on the securities in the portfolio or, (2) profits realized from the sale of portfolio securities. Shareholders would recognize distributions from the latter source, identified as capital-gain distributions, as a return of principal and not as a payment of income.

Who Should Buy Investment Company Shares?

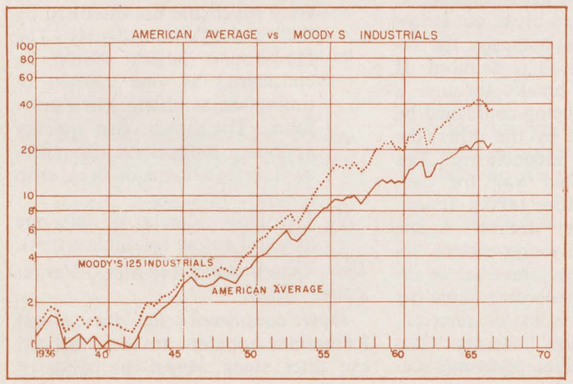
We do not believe that investors who have less than approximately $50,000 of investible funds should undertake direct investment in common stocks. Adequate diversification is difficult to obtain with smaller funds, and the fees for competent investment management usually are larger than the one-half of one per cent of net asset value per year usually charged by investment companies for management services. Therefore, we recommend that the fixed-income portion of such a portfolio be invested directly in savings deposits and/or U. S. Treasury, Federal agency, or other high-grade bonds, and that investment company shares be used in lieu of direct common stockholdings for the variable-income section of the fund. Investment company shares may be suitable for larger funds in many instances.

Comparisons of Results

Although some investors believe that investment company shares may not be a suitable hedge against more inflation, historical evidence shows that leading investment companies have provided adequate protection against the reduced purchasing power of the dollar.

For the past 30 years we have made a continuing study of investment companies. As a part of this study we have compiled and maintained an average performance record for a group of 44 investment companies. This composite record we call the American Average. Included among the organizations in this group are widely held close-end companies, open-end stock funds, and open-end bond-stock funds. Therefore, the composite performance record (American Average) is representative of a broad cross section of the investment company field.

The accompanying chart, plotted on a semilogarithmic scale so that equal vertical intervals represent equal percentage changes, shows the results that would have been obtained by investing in the American Average compared with those that would have been obtained by a similar investment in Moody's 125-industrial-stock average. In both instances we have assumed the reinvestment of all dividends paid during the period indicated. Obviously, the two lines parallel each other closely, indicating that the results obtained from an investment in the average investment company were comparable to those that would have been obtained by the direct investment in a diversified list of stocks.



Closed-End vs. Open-End Companies

It has long been our practice to select for recommendation to our clients and subscribers only those investment companies that have outstanding performance records. In compiling the long-term performance record for each individual company we assume that an investment of $1,000 was made in each company at the offering or market price on the date shares were first offered to the public. We then assume the reinvestment of all dividend distributions (whether classified as ordinary income or capital gains) on the date that the dividend was paid. This method of evaluation most nearly represents the results that an individual investor might have obtained from investments in the respective companies.

The chart entitled "Performance Records" shows the composite performance records for a representative group of companies in each of three major classifications during specified periods.

The chart clearly indicates that the performance of the close-end group has been substantially more favorable over a prolonged period than that of the open-end common stock funds.

In other words, the chart, plotted on semilogarithmic scale, presents the percentage increases or decreases of the cumulative value (dividends reinvested when paid) of investments made on the day each investment company first sold shares to the public. The loading charges paid on shares of most open-end funds and the commissions paid on the purchase and sale of closed-end shares would have been amortized over a prolonged period.

Recommended Companies

The investment companies whose shares we recommend are listed below together with the discount or premium from net asset value for each company as of March 13, 1967.

Plan	March 10, 1967 Net Asset Value	Market Price	Discl. or Prem.
(I. S-I. s) Adams Express	$31.39	$27.25	-13%
(S-I.S) Carriers & General	33.95	29.00	-14.5
(I.S-I) Consolidated Inv. Trust	12.85	12.00	- 6.5
(S-I. S) General American	35.72	31.75	-11
(I. S-I) Lehman Corp.	37.42	32.50	-13
(I. S-I. S) Madison Fund	20.29	22.625	+11.5
(I. S-I. S) Tri-Continental	33.44*	25.25	-24.5
(I. S-I. S) U. S. & Foreign	41.99	31.75	-24.5

*If all warrants had been converted, the net asset value per share would have been $31.51 and the discount 20 per cent.

The Dow Theory

by
C. HOLMES MacDONALD
National Director, H.K.N.

History:

The Dow Theory is a mechanical method of market analysis based solely on the action of the stock market. It was first published in the Wall Street Journal by Charles H. Dow, the founder of the Dow-Jones financial news service. Dow was primarily interested in manipulators of the stock market, and on the predicting of business trends from price changes in the stock market.

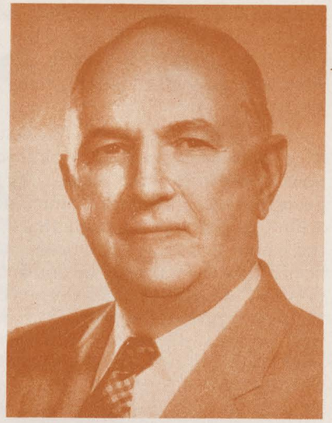
The first notable figure to expound the Dow Theory after Dow's death in 1902 was William P. Hamilton, who formulated the general concepts into a loose set of rules. From this set of rules, Robert Shea set forth various tenets in a set of clearly defined concepts. Since the time of Shea, the tenets of the Dow Theory have been modified still further by a number of authors. Their chief concern however, has been to forecast prices on the New York Stock Exchange rather than to predict the trend of the national economy.

The Theory:

A present day description of the principal tenets of the theory are listed below. Indices are based on fluctuations in the weighted average of 30 industrial and 20 railroad stocks.

1. Three components of the price fluctuations on the N.Y.S.E. are:
   a. *Primary movements* (P.M.) recognized are broad, basic undulations of Bull or Bear variety, extending over periods of about a year or for several years. Correct determinations of such movements is the major objective of Dow theorists.
   b. *Secondary reactions*, (S.R.) lasting from three weeks to about three months but running counter to the primary trend. During this interval prices retrace from 0.33 to 0.67 of the primary price change, measured from the termination of the preceding "Secondary Reaction."
   c. Erratic day to day fluctuations superposed on the previous two movements. They are considered to be only of minor significance but are useful to determine what "lines" are being formed. Daily values must be charted and studied since they are elements of the longer term movements and include the effects of current news together with segments of the underlying basic movements.
2. Actually the variations in the Market of price with time are a series of unique transactions between mutually unknown buyers and sellers. For analysis the Dow Theory assumes that the variations are a continuous function, represented with satisfactory accuracy, by a smooth curve drawn near each day's closing price. The curve is obviously complex, but for practical purposes can be resolved into just the three components enumerated in "1"

   The amplitude, the relative phase angle and the periodicity of each component may also change in sudden and unpredictable ways.
3. It is argued that a lack of movement of prices results from a nice balance of potentials to BUY and to SELL. When movements of two weeks or longer are confined to both industrial and rail indices to a range of about five per cent, a line is said to have formed. But this static condition suggests either accumulations or distribution by those "in the know." If both the Rails and the Industrials break out above the line prices are predicted. If the two indices break out below the line simultaneously, the reverse conclusion is deduced. If one average breaks through a line without being confirmed by similar action by the other, the indication is inconclusive. The investor should wait for confirmation before taking action.
4. A "rally" or "decline" is one or more daily movements resulting in a net reversal of direction and exceeding three per cent of the index in question.
5. An up "trend" occurs when successive rallies penetrate preceding "highs," and when ensuing declines terminate above their preceding "lows."



6. The relation of price to volume of trading is critical. In an overbought market trading becomes dull on rallies and active on declines. Conversely oversold markets are dull on declines and active on rallies. Large volume characterizes the termination of a Bull Market. In contrast, Bear markets end with light trading, apathy and virtual neglect.
7. Manipulation of prices by private, vested interests was considered possible by Dow, in so far as daily fluctuations were concerned. He considered such "rigging of prices" improbable causes of Secondary Reactions and impossible of P.M.'s. The P.M.'s are based on intrinsic values and cannot be altered by cliques or the largest private fortunes.
8. The D.J. Index discounts all known factors; it is a summation of composite financial knowledge. It reflects with precise weighing all actions taken by all individuals and funds, who deal in the market; there are no secrets which are not disclosed by the "ticker" immediately. The Dow-Jones indices should be considered as one method of timing major changes in a portfolio. The ticker also quickly appraises unforeseen calamities such as floods, major fires, crop failures, wars, etc.
9. The Dow Theory is only one aid, and not an infallible system.

Dow Theory Applied to Stock Market Action

Dow considered that the several formations apparent to the practiced eye after stock, reveal the hands of the investor and manipulator. The charting theorists of today use the averages as a frame of reference for studying individual stocks. Many believe that the tenet on "Lines," is the most and best documented part of the entire theory. The Indices did forecast the 1929 crash, opposed to most writers of the time.

Criticisms of the Dow Theory

The most important and persistent criticisms may be summarized as follows:

1. It is based on too few stocks for modern times i.e., only some 50 out of 1600 which are listed on the N.Y.S.E. And many more stocks are now traded "over the counter" and on other exchanges.
2. Dow Theorists are second guessers. At critical periods this is true, for Dow theorists argue among themselves, and at times some have to reverse their predictions when rendered worthless by subsequent fluctuations.
3. The Dow Theory is not infallible. Actually the market is governed by humans who are not infallible. However, in retrospect the theory has been right more often than it was wrong.
4. It leaves investors in doubt. Sometimes it says nothing over considerable periods. This is true and obviously serious in our world of hectic change.
5. It doesn't help the intermediate trend investor nor was it intended to.
6. You can't buy the Averages. This is perhaps the most important criticism of all and the Dow theorists all agree.

   It is possible, however, with a well rounded portfolio of active stocks of high grade, to minimize the effect of this criticism. It is also easy to buy shares of closed end or no load mutual funds. Thus one also obtains professional management.
7. Its practice cannot be continuously successful. If the theory were generally accepted and studiously followed by large numbers of investors their commitments would destroy its effectiveness. Reasons 1 thru 6 above do tend to restrict those who staunchly and continuously follow the Dow and thus the point may not be vital.

Using the Dow Theory in an Investment Program

For one who patterns his investment program on the D-J Theory and "rides" the P.M.'s, a most intriguing and complicated problem is that of interpreting the current variations in the Indices. In looking back a year or so, one can classify PM's and SR's with some assurance.

But in today's Wall Street Journal a SR appears much like the start of reversal in the P.M. In fact during the first few days, they may be identical. Even the proponents of DJ do NOT claim to be able to detect the difference immediately.

Identifying the trend soon enough, to be useful in making profitable commitments is, however, essential to the D.J. Method. This leads to a study of past market action.

Secondary Reactions versus Primary Movements

To differentiate between a SR near the peak of a Bull Market from a change in the current direction of the PM, the characteristics of continued upward pressure should be carefully considered.

The classical characteristics of the third phase of a Bull Market are:

1. High turnover, general Market unrest, tips, Business optimism, strikes and Labor unrest and increasing costs for materials and services.
2. Disregard of basic values such as lower earnings, decreased sales, tighter money as evidenced by higher interest rates and yields on stocks falling below those of high grade bonds.
3. "Cats and Dogs" issues are in great demand; they advance more proportionately than the Blue Chips.
4. Blatant rationality by financial writers explains to the credulous the "New Era" of continuous growth.
5. Odd lot purchases of the less well informed exceed odd lot sales by six per cent. Total odd lot sales exceed purchases for protracted time.
6. Stock prices as measured by Indices and issues in vogue penetrate a new high area; they tend to continue up. It is a kind of emotional inertia; it requires force to reverse the direction.
7. Highs in the Industrials are NOT confirmed by the Rails.
8. Statistically, the average duration of:
   A. - A Secondary Reaction is 43 days.
   B. - A Primary Advance, measured from the previous SR, is 10 days.
9. Forty-four per cent of S.R.'s terminate within an interval of 25-55 days.

   Sixty per cent terminate within an interval of 20-100 days.

A Manager's Use of the Dow Theory

For success an enterprise requires both short term and long term planning. Budgets, staffing of operating personnel, contracts for future delivery of supplies, accurate appraisal of the volume of the coming year's production are a few of the many facets of short term planning. These business fundamentals are closely related to the national economy and should be planned to vary with it in proper phase consonance.

The implication is clear. If Managers are to make money for their firms, it is probable that the Dow Theory can aid them in making decisions. It should also improve their judgments in selecting expansion and merger policies, inventory controls, pricing considerations, marketing techniques, and related long range plans.

Summary and Practical Considerations

For the individual investor a Market Index should:

a. Indicate Financial Trends easily, quickly and wherever newspapers are available.
b. Indicate changes in market value of his portfolio. Partially this may be a diversified list of say twenty or more securities. Detailed pricing out can be done at less frequent intervals if one uses the Dow Jones Index to provide an engineering type differential to update the value frequently.

Despite adverse comments the Dow-Jones Indices will probably continue to have an important place in investment literature. The average investor is familiar with the DJ Rails and Industrials and probably understands them as well as he does the newer indices. For comparisons over a long period of years the Dow-Jones has the very great advantage of essential continuity.

Rate Of Return

by
PAUL K. HUDSON
Executive Secretary, H.K.N.

Almost everyone occasionally has the opportunity of making an investment and it is important to be able to determine the true rate of return that it produces. Consider the case of the man who bought a city lot for $4,000, paid taxes of $30 per year for twenty years, and then sold it for $6,000. The total money paid out was $4,600 and the money taken in was $6,000 — a profit of $1,400. He thought it was a good investment. But was it? The correct way to view this problem is to consider a reasonable alternative. If he had placed the $4,000 original cost and the $30 taxes each year in a Savings institution paying 5% interest, he would have had at the end of the 20 years $11,600. Thus, instead of making $1,400 he actually lost $5,600 on the deal. The rate of return that the man obtained on his investment was very small. Now let us see how to calculate the actual rate of return on any investment.

The rate of return is not the interest rate. The interest rate is the annual income divided by the investment, expressed as a percent. The rate of return is the interest rate plus the equivalent annual interest obtained from the capital gains. The annual income may be negative (such as the taxes in the above problem) and the capital gains may be losses instead.

The various factors that are involved in a simple investment may be outlined as follows:

A. THE AMOUNT INVESTED OR EXPOSED. We will assume that there is only one investment and it occurs at the beginning of the study period.

B. THE AMOUNT RETURNED OR RECOVERED EACH YEAR. If it is expressed as a percentage of the original investment it is called the *Interest rate.* If it is expressed as a percentage of the face value of a bond it is called the *coupon.* We will assume this to be constant.

C. THE AMOUNT RECEIVED WHEN THE INVESTMENT IS TERMINATED. This refers to the amount of money received when the stock, bond, real estate, etc. is sold.

D. THE NUMBER OF YEARS THE INVESTMENT IS IN EFFECT. This is the number of years from the time of the original investment to the time when the investment is sold. For example, the number of years that a stock or bond is held.

E. THE RATE OF RETURN OF THE INVESTMENT. This is equal to the interest rate only when A is equal to C. This is the unknown quantity in the type of problem presented here.

The accompanying table shows the relationship between D and E and two other quantities X and Y. A, B, C, X, and Y are related by the following equation:

$$A = BX + CY$$

When rate of return E is unknown we assume that A, B, C, and D are all known quantities. A, B, and C are substituted directly into the equation. The value of D is then taken to the tables and a corresponding set of values of X and Y are found which, when substituted into the equation will cause it to be correct. The rate of return E is indicated in the tables by the particular set of values of X and Y selected. Because of the limited number of sets of X and Y, it may be necessary to interpolate these values to obtain a high degree of accuracy.

EXAMPLE

A certain Bond was bought 10 years ago for $925 and sold today for $975. It paid $40 interest at the end of each of the 10 years. What is the rate of return?

SOLUTION

$$A = BX + CY$$
$$925 + (40)X + (975)Y$$

In the tables find 10 in the D column (bond was held for 10 years). As a first guess take a rate of return of 4%. For E = 4% and D = 10, X is found to be 8.111 and Y is 0.6756. Substitute these values of X and Y into the above equation and get

$$925 = (40)\ 8.111 + (975)\ 0.6756$$
$$925 = 983.11$$

This indicates an error of +58.11

Next try 5%. For E = 5% and D = 10 as before, then the tables indicate X = 7.722 and Y = 0.6139. Substitute these into the equation and get:

$$925 = (40)\ 7.722 + (975)\ 0.6139$$
$$925 = 907.43$$

This time the error is -17.57

By interpolation the rate of return E is

4.76% answer

Now consider the case of the man who bought the city lot.

$$A = \$4{,}000$$
$$B = -\$30.$$
$$C = \$6{,}000$$
$$D = 20 \text{ years}$$
$$E = ?$$
$$A = BX + CY$$
$$4{,}000 = -30X + 6000Y$$

Try E = 1%

For D = 20 and E = 1, from the tables we find X = 18.046 and y = 0.8195

Then:

$$4000 = -30(18.046) + 6000(.8195)$$
$$4000 = 4376 \quad 376 \text{ too high}$$

Next try E = 2%

$$4000 = -30(16.351) + 6000(0.673)$$
$$4000 = 3548 \quad 462 \text{ too low}$$

Interpolation gives: 1.45%

D	1% E		2% E		3% E		4% E		5% E		6% E		7% E		8% E		10% E		12% E		D
	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	
1	0.9901	0.990	0.9804	0.980	0.9709	0.971	0.9615	0.962	0.9524	0.952	0.9434	0.943	0.9346	0.935	0.9259	0.926	0.9091	0.909	0.8929	0.893	1
2	0.9803	1.970	0.9612	1.942	0.9426	1.913	0.9246	1.886	0.9070	1.859	0.8900	1.833	0.8734	1.808	0.8573	1.783	0.8264	1.736	0.7972	1.690	2
3	0.9706	2.941	0.9423	2.884	0.9151	2.829	0.8890	2.775	0.8638	2.723	0.8396	2.673	0.8163	2.624	0.7938	2.577	0.7513	2.487	0.7118	2.402	3
4	0.9610	3.902	0.9238	3.808	0.8885	3.717	0.8548	3.630	0.8227	3.546	0.7921	3.465	0.7629	3.387	0.7350	3.312	0.6830	3.170	0.6355	3.037	4
5	0.9515	4.853	0.9057	4.713	0.8626	4.580	0.8219	4.452	0.7835	4.329	0.7473	4.212	0.7130	4.100	0.6806	3.993	0.6209	3.791	0.5674	3.605	5
6	0.9420	5.795	0.8880	5.601	0.8375	5.417	0.7903	5.242	0.7462	5.076	0.7050	4.917	0.6663	4.767	0.6302	4.623	0.5645	4.355	0.5066	4.111	6
7	0.9327	6.728	0.8706	6.472	0.8131	6.230	0.7599	6.002	0.7107	5.786	0.6651	5.582	0.6227	5.389	0.5835	5.206	0.5132	4.868	0.4523	4.564	7
8	0.9235	7.652	0.8535	7.325	0.7894	7.020	0.7307	6.733	0.6768	6.463	0.6274	6.210	0.5820	5.971	0.5403	5.747	0.4665	5.335	0.4039	4.968	8
9	0.9143	8.566	0.8368	8.162	0.7664	7.786	0.7026	7.435	0.6446	7.108	0.5919	6.802	0.5439	6.515	0.5002	6.247	0.4241	5.759	0.3606	5.328	9
10	0.9053	9.471	0.8203	8.983	0.7441	8.530	0.6756	8.111	0.6139	7.722	0.5584	7.360	0.5083	7.024	0.4632	6.710	0.3855	6.144	0.3220	5.650	10
11	0.8963	10.368	0.8043	9.787	0.7224	9.253	0.6496	8.760	0.5847	8.306	0.5268	7.887	0.4751	7.499	0.4289	7.139	0.3505	6.495	0.2875	5.938	11
12	0.8874	11.255	0.7885	10.575	0.7014	9.954	0.6246	9.385	0.5568	8.863	0.4970	8.384	0.4440	7.943	0.3971	7.536	0.3186	6.814	0.2567	6.194	12
13	0.8787	12.134	0.7730	11.348	0.6810	10.635	0.6006	9.986	0.5303	9.394	0.4688	8.853	0.4150	8.358	0.3677	7.904	0.2897	7.103	0.2292	6.424	13
14	0.8700	13.004	0.7579	12.106	0.6611	11.296	0.5775	10.563	0.5051	9.899	0.4423	9.295	0.3878	8.745	0.3405	8.244	0.2633	7.367	0.2046	6.628	14
15	0.8613	13.865	0.7430	12.849	0.6419	11.938	0.5553	11.118	0.4810	10.380	0.4173	9.712	0.3624	9.108	0.3152	8.559	0.2394	7.606	0.1827	6.811	15
16	0.8528	14.718	0.7284	13.578	0.6232	12.561	0.5339	11.652	0.4581	10.838	0.3936	10.106	0.3387	9.447	0.2919	8.851	0.2176	7.824	0.1631	6.974	16
17	0.8444	15.562	0.7142	14.292	0.6050	13.166	0.5134	12.166	0.4363	11.274	0.3714	10.477	0.3166	9.763	0.2703	9.122	0.1978	8.022	0.1456	7.120	17
18	0.8360	16.398	0.7002	14.992	0.5874	13.754	0.4936	12.659	0.4155	11.690	0.3503	10.828	0.2959	10.059	0.2502	9.372	0.1799	8.201	0.1300	7.250	18
19	0.8277	17.226	0.6864	15.678	0.5703	14.324	0.4746	13.134	0.3957	12.085	0.3305	11.158	0.2765	10.336	0.2317	9.604	0.1635	8.365	0.1161	7.366	19
20	0.8195	18.046	0.6730	16.351	0.5537	14.877	0.4564	13.590	0.3769	12.462	0.3118	11.470	0.2584	10.594	0.2145	9.818	0.1486	8.514	0.1037	7.469	20

CHAPTER DIRECTORY

School	Chapter	City State
A		
Air Force Inst. of Tech.	Delta Xi	Wright-Patterson AFB, Ohio
Alabama, Univ. of	Delta Nu	Tuscaloosa, Ala.
Arizona State U.	Epsilon Beta	Tempe, Ariz.
Arkansas, U. of	Gamma Phi	Fayetteville
Auburn U.	Xi	Auburn, Ala.
B		
Bradley U.	Delta Upsilon	Peoria, Ill.
Brooklyn Polytech. Inst.	Beta Beta	Brooklyn
C		
Calif. State Coll. Los Angeles	Epsilon Nu	Los Angeles
Calif. State Coll. Long Beach	Epsilon Theta	Long Beach
California, U. of	Mu	Berkeley
Calif., Univ. of Southern	Upsilon	Los Angeles
Carnegie Inst. of Tech.	Sigma	Pittsburgh
Case Inst. of Tech.	Zeta	Cleveland
Cincinnati, U. of	Tau	Cincinnati, Ohio
Clarkson College of Tech.	Gamma Gamma	Potsdam, N. Y.
Cleveland State U.	Epsilon Alpha	Cleveland
Colorado State U.	Delta Pi	Fort Collins, Colo.
Colorado, U. of	Rho	Boulder, Colo.
Columbia U.	Gamma Lambda	New York 27
Connecticut, U. of	Beta Omega	Storrs, Conn.
Cooper Union	Delta Chi	New York 3
Cornell U.	Kappa	Ithaca, N. Y.
D		
Delaware U. of	Epsilon Omicron	Newark
Denver, U. of	Delta Delta	Denver, Colo.
Detroit, U. of	Beta Sigma	Detroit, Mich.
Drexel Inst. of Tech.	Beta Alpha	Philadelphia
Duke U.	Delta Lambda	Durham, N. C.
F		
Florida, Univ. of	Epsilon Sigma	Gainesville, Fla.
G		
Georgia Inst. of Tech.	Beta Mu	Atlanta, Ga.
H		
hawaii, U. of	Delta Omega	Honolulu
Houston U.	Epsilon Epsilon	Houston, Texas
I		
Illinois Inst. of Tech.	Delta	Chicago 16
Illinois, U. of	Alpha	Urbana, Ill.
Iowa State College	Nu	Ames, Iowa
Iowa State, U. of	Beta Iota	Iowa City
J		
John Hopkins U.	Gamma Upsilon	Baltimore, Md.
K		
Kansas State U.	Beta Kappa	Manhattan, Kans.
Kansas, U. of	Gamma Iota	Lawrence, Kans.
Kentucky, U. of	Beta Upsilon	Lexington, Ky.
L		
Lafayette College	Gamma Psi	Easton, Pa.
Lamar State Coll. of Tech.	Delta Beta	Beaumont, Texas
Lehigh U.	Chi	Bethlehem, Pa.
Louisiana Polytech. Inst.	Delta Gamma	Ruston, La.
Louisiana, Southwestern U. of	Delta Tau	Lafayette
Louisiana State U.	Delta Iota	Baton Rouge
Lowell Tech. Inst.	Epsilon Zeta	Lowell, Mass.
M		
Maine, U. of	Delta Kappa	Orono, Maine
Manhattan College	Gamma Alpha	New York 71
Marquette U.	Beta Omicron	Milwaukee, Wis.
Maryland, U. of	Gamma Xi	College Park, Md.
Massachusetts Inst. of Tech.	Beta Theta	Cambridge, Mass.
Massachusetts, U. of	Delta Eta	Amhearst
Miami, U. of	Epsilon Kappa	Miami, Fla.
Michigan State U.	Gamma Zeta	East Lansing, Mich.
Michigan Tech.	Beta Gamma	Houghton
Michigan, U. of	Beta Epsilon	Ann Arbor
Minnesota, U. of	Omicron	Minneapolis
Mississippi State U.	Gamma Omega	State College
Missouri Sch. of Mines and Met.	Gamma Theta	Rolla, Mo.
Missouri, U. of	Iota	Columbia
N		
Nebraska, U. of	Beta Psi	Lincoln, Neb.
Newark College of Engr.	Gamma Kappa	Newark, N. J.
New Mexico State U.	Gamma Chi	Las Cruces
New Mexico, U. of	Delta Omicron	Albuquerque
New York, The City College of	Beta Pi	New York
New York U.	Beta Zeta	New York 53
North Carolina State College	Beta Eta	Raleigh
North Dakota State U.	Gamma Tau	Fargo
North Dakota, U. of	Delta Rho	Grand Forks
Northeastern U.	Gamma Beta	Boston
Northwestern Tech. Inst.	Beta Tau	Evanston, Ill.
Notre Dame, U. of	Delta Sigma	South Bend, Ind.
O		
Ohio State U.	Gamma	Columbus
Ohio U.	Delta Epsilon	Athens
Oklahoma State U.	Omega	Stillwater
Oklahoma U.	Beta Xi	Norman
Oregon State Coll.	Pi	Corvallis
P		
Pennsylvania State U.	Epsilon	University Park
Pennsylvania, U. of	Lambda	Philadelphia
Pittsburgh, U. of	Beta Delta	Pittsburgh, Pa.
Pratt Inst.	Delta Theta	Brooklyn 5, N. Y.
Princeton U.	Epsilon Pi	Princeton, N. J.
Purdue U.	Beta	W. Lafayette, Ind.
R		
Rensselaer Polytech. Inst.	Beta Nu	Troy, N. Y.
Rutgers U.	Gamma Epsilon	New Brunswick, N. J.
Rose Polytech. Inst.	Epsilon Eta	Terre Haute, Ind.
S		
St. Louis U.	Delta Psi	St. Louis, Mo.
San Jose St. Coll.	Epsilon Iota	San Jose, Calif.
South Carolina, U. of	Delta Phi	Columbia, S. C.
South Dakota Sch. of Mines	Beta Chi	Rapid City, S. D.
South Dakota State Univ.	Gamma Rho	Brookings, S. D.
Southern Methodist U.	Gamma Omicron	Dallas, Texas
Syracuse U.	Gamma Eta	Syracuse, N. Y.
T		
Tenn. Tech. U.	Epsilon Rho	Cookeville
Tennessee, U. of	Beta Phi	Knoxville
Texas A & M	Gamma Mu	College Station, Tex.
Texas Tech. Coll.	Gamma Nu	Lubbock
Texas U. at Arlington	Epsilon Mu	Arlington, Texas
Texas, U. of	Psi	Austin
Toledo, U. of	Epsilon Gamma	Toledo, Ohio
Tufts U.	Epsilon Delta	Medford, Mass.
U		
Union College (inactive)		
Utah, U. of	Gamma Sigma	Salt Lake City, Utah
V		
Vanderbilt U.	Epsilon Lambda	Nashville
Villanova U.	Delta Mu	Villanova, Pa.
Virginia Polytech. Inst.	Beta Lambda	Blacksburg, Va.
Virginia, U. of	Gamma Pi	Charlottesville, Va.
W		
Washington U.	Delta Zeta	St. Louis, Mo.
Wayne State U.	Delta Alpha	Detroit, Mich.
West Virginia U.	Beta Rho	Morgantown, W.Va.
Wichita State U.	Epsilon Xi	Wichita, Kan.
Wisconsin, U. of	Theta	Madison, Wis.
Worcester Polytech, Inst.	Gamma Delta	Worcester, Mass.

ALUMNI CHAPTERS

Boston — Melvin M. Weiner, 54 Harvard Ave., Brookline, Mass.; Philadelphia — W. J. Johnson, 900 Sansom St., Phila., Pa.; Los Angeles — William E. Murray, 15543 Royal Oaks Ridge Rd., Sherman Oaks, Calif.; New York — Irving Engelson, Trenton Junior College; Chicago — John Leary, Western Electric Co., Naperville, Illinois.

COMMUNICATIONS in the Space Age

by
WINSTON KOCK
Eminent Member

For the average citizen, perhaps the greatest impact of our space program is to be found in the field of communications. This is a consequence of our ability to place satellites in the one revolution per day orbits called stationary orbits. Because the earth also rotates on its axis once every day, such satellites appear stationary with respect to the earth. Communications satellites are now "parked" in stationary orbits over both the Atlantic and Pacific oceans, where they act as relays, receiving and sending on television signals or hundreds of telephone conversations. And it appears that such satellite links are much more economical than the earlier undersea cable links, which further could not transmit television.

Because of my recent association with NASA as first Director of the NASA Electronics Research Center in Cambridge, Massachusetts, I have often been asked whether there are any tangible ways in which the space effort benefits people like you and me. Many people think of our program as a prestige effort, a race with the Soviet Union, a way to prove to the world that even though they put up the first Sputnik, we can and will catch up and overtake them. Not nearly as many, however, are aware that there have already accrued to us numerous benefits, benefits which are making a better life for you and me.

A talk presented at the HKN luncheon, Aug. 24, 1967, San Francisco, in honor of Douglas Johnstone, the Outstanding E. E. Student in the U. S. Dr. Kock is Vice President of Bendix Corporation.

Several of these affect us indirectly, by making our U. S. companies more competitive in world markets. I will briefly refer to three industry trends which the space program has engendered which have significantly aided the U. S. economy. They are associated with weight, reliability, and complexity. Weight is important because the space engineer wants all components of his spacecraft to be as light as possible. As a result of this need, tinier and tinier components were developed, such as electrical circuits no larger than the head of a pin. Soon these tiny circuits were applied to other fields, such as, for example, computers, and today U. S. computers dominate the markets of the world. Reliability was another feature the space designer insisted upon, at almost any cost, because of the huge economic waste in expending costly boosters to put an unreliable unit in orbit. The reliability techniques developed for the space program also found their way into commercial products of many kinds, again placing U. S. companies ahead of their competitors in world markets. Finally, complexity is certainly the name of the game in space. A knowledge of many different disciplines is needed in the overall design of a complete space launch. Accordingly, a full-fledged systems approach is absolutely required. In the systems approach, engineers must know many fields well, and this broad knowledge leads to great advantages in applying new discoveries in one field to another field. U. S. companies have become more able to recognize the value of new developments and can more quickly incorporate these in their commercial products, again aiding our nation and our economy in the international market place.

I said these effects were indirect, and they are. But by having U. S. industry able to export more commercial products, you and I can import more items such as French wines and German beer, and still keep our nation's balance of payments situation favorable.

Whereas these benefits to us are indirect, in the field of communications the space benefits are directly evident. Improvements in communications are extremely important to you and me because in the United States communications is big business, really big business. Our long distance phone calls alone total almost $5 billion a year.* At this $5 billion a year rate, if we could, for example, make twice as many calls at the same cost, we would be saving right there the $5 billion a year the space program is costing. Our overseas calls (not including Mexico and Canada) total almost a quarter of a billion dollars, and satellites now parked over the Atlantic and Pacific are already relaying a large fraction of these calls.

Now the economics for satellites for telephoning are rather startling. Although it now costs $7.50 for a 3-minute call to London, the wholesale cost of a trans-ocean voice channel via satellite is only 10 cents per minute. So, our telephone costs are destined to come down. Furthermore, satellites are providing us with something heretofore unavailable . . . live television coverage of many worldwide events, including, for example, just in the last few days, live telecasts from Viet Nam and from Moscow.

** I am indebted to Mr. Frank Biscak of Michigan Bell for the telephone statistics quoted.*

The enormous potential for communications by satellite led Congress to establish in 1962 the Communications Satellite Corporation, usually called "ComSat". The extensive possibilities for worldwide communications suggested that this new corporation be separate from the nation's telephone companies, most of which are units of the American Telephone and Telegraph Company. This country's lead in space technology will continue to reflect itself in the strength of ComSat, and this in turn will affect the results of our participation in international communications arrangements. If other nations can communicate more economically by utilizing the space know-how of the United States, these nations will continue to turn to the United States and to ComSat for communications leadership.

Satellites are destined to extend our communications horizon in many ways. The present transoceanic phone conversations and television transmissions via satellite are just the beginning. Already ways have been developed for using ComSat's satellites for tying together computers located here and in other parts of the world. Furthermore, present satellites are not limited to their present tasks; they could relay transmissions across the United States and could also relay from Europe all the way to the Far East. Another very promising use of satellites in communications, and probably the next to materialize, is that of linking together by satellite the network television stations throughout the United States. Let us consider this application.

The size of our nation's rockets is continually growing. With more powerful rockets, heavier satellites can be placed in orbit, and this added weight can be allocated to the solar batteries which provide the electrical transmitter power for relaying (or retransmitting) the signals received by the satellite. As the satellite's transmitter power grows, the complexity of the earth stations which receive the relayed signal diminishes. The cost of the first such earth station (the one built by the AT&T at Andover, Maine exceeded a million dollars, in part because it was designed to accommodate the earlier, rapidly orbiting communication satellites such as Telstar. But the Andover station was costly also because it employed an exceedingly large receiving antenna so as to gather in as much as possible of the miniscule amounts of power radiated by the first tiny satellites. Now, because of the larger rockets, the satellites can be much larger and therefore transmit much more powerful signals, and the receiving stations for these signals can therefore be much smaller and less expensive. Soon it will not be out of the question for every television station to have near it such a receiving antenna. At that point, a single satellite could relay to hundreds of television stations the television network programs they now receive via land lines. This same satellite could relay several different programs simultaneously, thereby furnishing programs to all of the existing television network stations, and also to stations not yet tied together as a network, such as, for example, the educational TV stations.

Because such network satellites are expected to provide significant cost savings over the system now employed for network television (microwave relays), they have aroused much interest. ComSat recently proposed a pilot version of such a system using two satellites handling combinations of up to 12 TV channels or many thousands of voice channels. This system would have one major ground terminal in Los Angeles and one in New York, and thirty-two "receive-only" stations spotted throughout western United States from Kansas to the coast. ComSat suggested that this use of the television traffic as "an economic base" would bring satellite economies to the general users of communications for "radio, telephone, telegraph data and facsimile", the obvious implication being that these satellites could act to lower our long distance telephone costs.

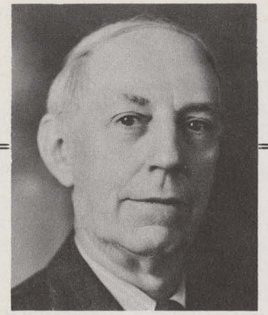
The expanding use of satellites in communication thus seems certain to bring about significant changes in our domestic communications patterns, just as it already has in our overseas phone patterns. Presently, the Bell system provides the networks for the television stations. When the domestic satellite system materializes, it would take over most of these TV network operations; in addition, many coast-to-coast long distance phone calls could undoubtedly be handled more economically via satellite. As you know, the AT&T already leases channel space across the Atlantic and Pacific from ComSat to supplement its undersea cable capacity. So, if the economics dictates it, the AT&T would undoubtedly also lease transcontinental telephone channel space via satellite. So, changes are coming.

But the changes are just beginning. They are just beginning because still bigger rockets are in the making. When these become available, still bigger satellites with still bigger transmitting powers can be orbited, and then the antennas to receive their much stronger signals will drop in cost from the million dollar Telstar antenna to a cost so low that the average home owner will be able to afford one.

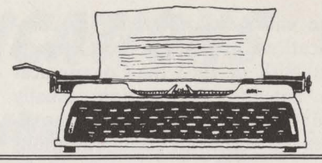
At that point additional segments of the TV economic community will feel the revolutionary effects of communication progress in the space age. For then the satellite will itself be a TV broadcasting station, broadcasting directly to the home owner. It would broadcast, that is relay, perhaps a dozen different television programs, including, of course, non-commercial (i.e. education) programs. This satellite would be parked over the U.S. mainland and be continually in view. Because every home owner would always be on a direct line-of-sight path from the satellite transmitter, he should never again experience poor TV reception.

Such a direct-broadcast television satellite system will by-pass not just the television network systems, it will also by-pass the hundreds on hundreds of television stations throughout the country. Further, since all homes will then experience good TV reception, it will also by-pass the already rather extensive community antenna TV networks (CATV) whose primary function is to provide improved reception to homes in poor receiving areas. Perhaps the most surprising thing of all is that such a direct broadcast satellite is not too many years away. NASA has already awarded a contract of a one- to three-ton stationary satellite for just this purpose of direct broadcast television.

Certainly there is a bright future in store for the field of communications. It is a field whose growth has been spurred tremendously by our nation's developments in space and is a field in which you and I will benefit through a more extensive use of our phone system at a lower cost.



LETTERS from Ellery



HIGHGOLESSTIVES

As a small boy I was greatly embarrassed to have some older person ask "What are you thinking about?" And even more embarrassing was it to me when I heard one of the men, after coming from the fields say "Its the gol-darndest contraption you ever saw." I at once knew that man had found one of the things I had put together and had hidden as well as I could to keep folks from finding and talking about it.

Some of the things were my attempt to build a device that would run like a locomotive. The locomotive was a thing I thought about much of the time. And I schemed many ways to get a source of driving force for my contraptions, such as the metal parts of discarded corsets found in the trash pile, or the coiled spring of a dismantled clock. I hid these devices behind stone walls in wooded places hoping nobody ever would find them to talk and laugh about.

The word at the top of this letter is what I devised to keep hidden what I was thinking about should I ever be asked the question and locomotives were what I really was thinking about. I tried my best to think of a name for the locomotive which was in fact the most different in meaning from the word "Locomotive." Syllable by syllable I used its opposite. So for "Lo" I used "High" — for "Come" I used "Go" — for "More" "Less" but think as hard as I could I never found the opposite of "Tive" so was forced to make the ending as it really was in the real name.

So it was that the word "Highgolesstive" was in my mind as I by myself imagined and thought how I might possibly make a small one that would run. I built several using spools for wheels or making wheels of wood using the saw which would cut round pieces.

One "Highgolesstive" I devised could run only in my imagination. In the Snake Lot under a large tree was a rock taller than I. I imagined it to be a "Highgolesstive" and pulled myself up as into the cab of one. Then with knife I cut and trimmed branches of the overhanging tree to represent the throttle, the reverse lever, the whistle rods and the bell ringing rope. In that imaginary locomotive I made many exciting runs. Sometimes I would go to the place just to have an enjoyable ride and sometimes I took one when my farm duties took me to the region where it stood.

I was happy that nobody ever made embarrassing remarks about that contraption and never did anyone ever ask me what I was thinking about when the subject happened to be "Highgoglesstives." So I never needed to pronounce that word and had it ever been drawn into my speech I now realize that in spite of my belief that word would hide it, the thing I really had in mind would quickly have been brought into the open.

And since here is space I'll tell you of another of my boyhood "Highgolesstives" on which I took many exciting rides in imagination. This one stood in the slaughter house and it wasn't a "Gol darned contraption" of my devising. It was the big grindstone.

This stone was unlike any other I ever saw. It had a long iron shaft rectangular in cross-section. To make it turn more easily it rested on two sets of small iron wheels and the shaft was given a round shape at the places where it rested on the small wheels.

I found that by lifting the shaft and moving it so the four-sided shaft rested on the wheels when the shaft turned it gave four bumps during each rotation. In so doing it emitted four rhythmic sounds for each rotation. That produced the same rhythmic sound as did the puffing locomotive which gives four puffs for each wheel rotation. Then too, as the grindstone whirled there was a vibration given the frame which I thought felt like the shaking I felt when I rode in the cab of the real locomotive.

So I arranged a seat and clamped a large monkey-wrench on the shaft to use as a lever to pull and make the wheel go round and round.

I arranged a bell I could pull with a cord. And then all by myself I raced my Highgolesstive at high speed along the imaginary track. And as I rode the emitted sounds and shakes and sound of bell seemed real. But as road crossings came in imaginary view the emitted whistle given as warning had to come from my own voice. I couldn't think of any way to get a whistle sound except by blowing with my own mouth. Yet the rides on that Highgolesstive were most enjoyable to me.

I don't remember whether I ever wrote that when Aunt Susan saw how enraptured I was by locomotives she arranged with a neighbor who was a locomotive engineer to let me ride with him on his locomotive. He worked the night shift on the Willimantic switch engine. As a boy no other experiences seemed so wonderful to me as those rides.

My Love to All
ELLERY PAINE
Eminent Member

CHAPTER NEWS

EPSILON, Pennsylvania State University —The Epsilon Chapter extended invitations to new members twice this year — during the Spring and Fall terms. As part of the initiation proceedings, the pledge with the best pledge book and key was given a small monetary award.

Epsilon's annual banquet was held at the Autoport Restaurant, where a delicious steak dinner was served. Our honored speaker was Dr. Carl Volz, Professor of Electrical Engineering, who talked about some of the pitfalls which should be avoided on a "first job."

Thomas Wylonis, a senior in electrical engineering, was selected as our Outstanding Electrical Engineering Student. His application was submitted in the national competition for this year.

Several times during the year, the ITT **Reference Data for Radio Engineers** handbooks were sold for purchase by students of the E. E. department.

The display case in the Electrical Engineering Building was again maintained by Epsilon Chapter. A greater emphasis was placed on new and different displays this year. The most notable was a faculty information display in which the faculty were listed with a short personal history and an informal snapshot.

As in previous years, Epsilon's members conducted a weekly tutoring session for freshmen and sophomore engineering students.

OMICRON, University of Minnesota — During winter and spring quarters Omicron Chapter of the University of Minnesota successfully completed a very active and rewarding year. Speakers from four local industries were invited to speak on some technical aspect of their industry in an undergraduate colloquium sponsored by Omicron Chapter. An average of forty students were present at these colloquia.

Eight new members were initiated into Omicron Chapter on April 22 and at the banquet held in their honor Valdemar Johnson, Senior Member, Diplomatic Corp of the United States, spoke on his experience in the Corp.

The Chapter also participated in "Campus Carnival", a scholarship fund raising project, by building a CCTV "Good-Driver" test. It proved to be a fun but challenging test. The same set-up was also used as an attraction for "IT Week", a time when new college and high school students can get a look at our Electrical Engineering Department.

The year was capped with the annual student-staff picnic sponsored by HKN. About one-hundred people were present and enjoyed themselves with athletic activities, eating and drinking.

OMEGA, Oklahoma State University — This past year has been good to Omega chapter. The usual pledging activities saw two very fine classes admitted to membership. The fall banquet was highlighted by a speech from the new president of O.S.U., Dr. Robert B. Kamm who spoke on the position an engineer must assume amongst the leaders of the people. Omega chapter was very ably represented at the regional meeting in Rolla, Missouri by Don Terwilliger who brought back some fine ideas he had gotten from the other chapters represented. We were active participants in the annual Engineering Week festivities and sent a group of members to enlighten some Junior College students on the subject of entering the electrical engineering profession.

BETA PHI, University of Tennessee — This year Beta Phi chapter initiated 30 undergraduates, 1 graduate and 2 professional members. One of the newly elected members, Miss Alice Rebecca Tyson, was the first woman ever initiated by Beta Phi chapter.

The Chapter was quite active this year in Engineers Day in helping with displays and tours through the E. E. Building. Also this year the Chapter elected to present to each of the new members the book entitled **Ten Founding Fathers of the Electrical Science.**

This quarter the Chapter provided the E. E. Department with a display case for the lobby of the E. E. Building. This case will be used for displays portraying the past, present, and future in Electrical Engineering.

GAMMI PI, University of Virginia — Gammi Pi Chapter held its annual banquet at the Blair House in Charlottesville on the night of April 27, 1967. The final activity of the year was a very successful (although rainy) Sunday picnic. The spring initiation included two undergraduates and three graduate students. The pledge project for the spring initiate was a card file of active and inactive members. A very attractive table-covering was made by the Electrical Engineering secretary for the initiation ceremony, featuring the Eta Kappa Nu emblem.

EPSILON GAMMA, University of Toledo — Epsilon Gamma Chapter of Eta Kappa Nu took in 11 new members, all undergraduates, on May 7, 1967. The annual banquet was held at the same time and graduating seniors were recognized. A smoker had been held three weeks earlier on April 16 after which election for the new members was held.

PHILADELPHIA ALUMNI, During the fall and winter months of the year the Philadelphia Alumni Chapter meets on the first Wednesday of each month at a noon luncheon meeting for fellowship and, usually, discussion of some interesting and current topic of science or engineering technic.

For the 1967-1968 season the Chairman, Dr. Nahil Farhat, has lined up tentatively a promising program, including such subjects as:

- holography by lasers,
- satellite communication and interference developments in high power switching apparatus
- high-speed railway trains, control and signals
- underwater explorations and phonetics, etc.

Each subject will be presented in a talk by an engineer in its field, followed by discussion by those members present. The meetings are held in the Philadelphia Engineers' Club, and the first one of this season was on October 4.

by W. A. Holland

FROM THE MAIL BAG

Dear Sirs:

It's a shame to see "The Great Sahara Mousehunt" story shrink, issue by issue of the BRIDGE. Really, this story is the most interesting one you have published in many years. It portrays people. And people are important. They make the world in which we live, and these people are interesting.

Sincerely,
R. E. Robertson
Northridge, Cal.

One Day In The Life Of A "FURST GRAD TEECHER"

by
Joanna Pittman
and
Elizabeth Hyde

Alarm — 6:00 A. M. — Coffee ... What to wear? Must be warm in the morning and cool in the afternoon, and I must look nice for an after-school meeting. Home duties done, I leave for school at 7:45.

Arrive at school at 8:05. Go to the room and deposit work carried home, purse, and lunch. Note... paper drawer is empty — I must pick up some from the storeroom.

8:10 — Straight to office to read the bulletin and sign in. Greet and chat with teachers on the way . . . don't forget the paper... and sign up for the strip film projector for 2:30.. In the office you see your name is circled for recess duty... no coffee at recess time this morning... have to wait 'til it's cold.. on to the storeroom.. paper in hand... don't forget to write down the date... Mrs. Green, Speech Correctionist, stopped to say she will be by for three of my pupils at 10:40 for therapy.

8:30... Four children are here, and I still have paper in hand .. put it away... board work isn't up... write carefully so the children have an example... fold newspaper... turn on record player... soft music to start the morning by.

8:40... Reading... explain board work... and repeat again what we do when our work is done.... Red, White and Blue groups performed well...

10:10-10:30 . . . Recess . . . collect seat-work... all done on time... don't forget the whistle.. all fun, no skinned knees... thank goodness... all here ... drinks... rest time... heads down ... soft music...

10:40... New Math... today we're on numerals and numbers... glad I studied this... flannel board ready ...as I say the numeral "three" who can... interruption . . speech time... yes, this is your teacher, too .... now back to the lesson...

11:00... Science... Fall is here... you can tell by the signs... acorns, buckeyes, pretty leaves and wooly worms have all been placed on my desk... Tip toe back to the circle and lets hear a story, "I Like Caterpillars." Enter 3 speech pupils with a little commotion... Mental note: — Plan a nature walk; call Special Education Office for film strip and films. Call Science Laboratory for books and charts. Call Mrs. Scobie to see if we can get thirty library books for our room... Call room mother — see if she will pick up the books... must do this during lunch period... must leave for meeting with Guidance Committee at Kenwood — 3:45.

11:30... Dismissal... line up girls, tip toe to the door like Monarch butterflies.. boys tip toe too.. like creepy, crawly caterpillars... They are gone. Sigh! Hurry, hurry, hurry... erase the board... put up the afternoon work . . . straighten desk . . . check seatwork, pick up dittos and sandwich and head for the office to make my phone calls... Elementary Education . . . Science Lab . . . Public Library . . . Room Mother, can't reach her... must call her after I get home.

12:10... Twenty minutes to eat my sandwich and chat... time is all gone .... come early in the morning and run off dittos.

12:30... Children are arriving... I forgot to powder my nose and comb my hair... Oh well, they will be glad I'm here, anyway...

12:30-12:40... Oh no, it can't be raining again! yes, here come the yellow coats and four-buckle boots ... all size three and no labels yet! .... Children, hang them up on your hooks and stand your boots straight like soldiers! Don't cry Janie, I'll call your Mother... "Mrs. Jones, could you please bring Janie some dry clothes? — She's drenched!"

1:00... It's getting late, but we must take time to talk to each other!

1:20... It's time to read. Here we go — Red first, White second, and then Blue. Hurrah! We sounded our first words. We can read!!

2:00... Johnny has a "sorry" look on his face — he's quite warm. "Johnny, lets go to the office."... It's P. E. time, but it's raining — so get out the Physical Fitness record — a quiet game of Seven Up — next toilets, then drinks...

2:30... Film strip — "Your Job at School and All Our Seasons" — Pull shades, reverse the map — get the projector...

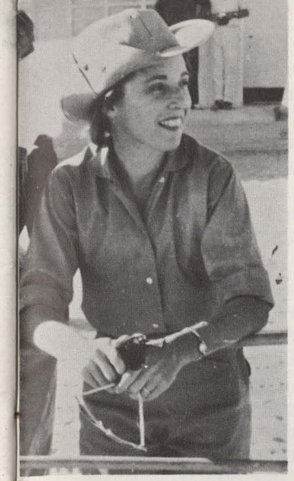
2:50... Wish I'd signed up for the autoharp this morning . . . but the pitchpipe will have to do... Let's sing some songs about fall and dramatize the seasons... Here comes our hostess with PTA flyers to be sent home... and a note to call Johnny's mother...

3:10... Should have started earlier with all these boots... don't forget to bring leaves tomorrow for our Art project... we want our room to look pretty for the PTA...

3:20... The last boot is pulled on ... the last yellow slicker is gone ... now, hurry, hurry, hurry; erase the board, clean the sink, straighten that desk, run off the dittos in the morning.... I've got five minutes to get to Kenwood...

5:00... So with papers to check, memos of names to call, and dinner to prepare, I leave Kenwood for home.

Mrs. Pittman (left) and Miss Hyde



The Great Sahara Mousehunt

Catherine Collins
and
Miggs Pomeroy

22ND MARCH

THIS MORNING WE pay our respects and deliver the letter from the Governor to the Mutaserif, Mr. Bufarwa. The Chief of Police, Mr. Susi and the Kaimakaan, Sheik Mohammed Salih, who is head of the Zawiya—the school run by the Senussi—are also there to receive us. Mr. Susi and Mr. Bufarwa wear tarbooshes and the former has on a raincoat, although it has not been known to rain in Kufra in twenty years. The Sheik is handsome and jovial, his turban is white and his beard flowing. He wears a blue kaftan embroidered in gold, and he talks with evident pleasure of Rosita Forbes and Hassanein Bey whom he told us returned many times to Kufra. We are in a long reception-room with chairs along the sides and a desk at one end. A portrait of the King as a young man hangs on the wall, and in a handsome frame on the desk is a picture of an ashtray and a burning cigarette—advertising a well-known brand. Although there is no electricity in Kufra a solitary light bulb hangs from the ceiling. We realize as we sit down just how infrequent visitors are. The arm falls off Catherine's chair and a cloud of dust spurts up from Winston's.

Liv, as leader of the expedition and diplomat into the bargain, opens the conversation with a flowing exchange of formal salutation. He translates for us and we all ask questions. While we drink the ritual three glasses of tea, boiled with mint leaves and heavily sugared, we learn that olives, pomegranates and figs are raised here as well as dates. Wheat and millet are also grown and some flowering trees called susayas acacia. We find Kufra warm, but our hosts all laugh when we say that it is like summer. They think we should come back in summer and we would change our minds. We are offered sweets and biscuits. We think that Mr. Bufarwa has a very sweet tooth. The Sheik asks Winston after the health of his grandfather and says that of course he himself is a good deal younger, being only seventy. We take pictures and as we leave Liv translates that His Excellency 'hopes to God we will soon be on our way'. Adding firmly, 'And I hope so too,' Liv asks permission to take a moving picture of Their Excellencies, but we cannot convince them that it is permissible to move during the photographing. I try to speed the action but am left with my hand out and no one to shake it as our actors stand in frozen dignity.

By noon the R.A.F. plane has not appeared, and we know that they will not start out late in the day. We have decided to take this opportunity to visit Jebel Sherif. Hank will remain at Kufra to trap, and we will take only two cars; with Francis, Winston and John in one, Liv, Catherine and myself in the other. We will look for traces of the Long Range Desert Group/Italian skirmish at Jebel Sherif, about eighty miles south of Kufra. We had been impressed with Kennedy Shaw's account of it in his book *Long Range Desert Group*, and the incredible walk by Moore. We wanted to try to find the burnt-out British and Italian trucks.

According to Kennedy Shaw, 'T' patrol of L.R.D.G., on 31st January 1941, were coming north from the Chad when they were attacked in a valley among the rocks of Jebel Sherif by an Italian motorized patrol. Their officer, Clayton, had eleven cars and thirty-odd men, and the enemy five cars and forty-five men, with four 22 mm. Breda guns and three aircraft overhead working in close co-operation with their ground force. The Italians entered the valley from the north, and it was not very long before three British trucks were burning and a British officer and two Italian prisoners on his truck killed. Clayton was wounded and taken prisoner and the rest of the patrol withdrew south. Unknown to them, four of their men remained alive at Jebel Sherif, hiding among the rocks until the Italians turned north again for Kufra.

Now they were alone. As Kennedy Shaw says, the alternatives were not attractive: to make for Kufra and surrender to the Italians, or to follow the tracks of their own patrol southwards in the hope they would be picked up. They chose the latter. From Mr. Shaw's book, this* is the record of the next ten days:

So at dawn on February 1st this was the position. Moore—wounded in the foot. Easton—wounded in the throat. Tighe, Winchester. An Italian. A two-gallon tin of water with a bullet-hole through it near the top and containing about one and three-quarter gallons. No food. The clothes they wore; everything else had been burnt in the trucks. . . .

February 1st—Walking southwards following the tracks of the patrol. At some period during this day the Italian disappeared and was picked up by his own people.

February 2nd and 3rd—Walking. The night temperatures here at this time must have been near freezing and it was almost impossible to get any sleep and rest.

February 4th—Tighe beginning to tire; he was feeling the effects of an old operation. They found and ate some lentils thrown away after a meal on their way north.

February 5th—Tighe could not keep up so he was left with his share of the water in a bottle which they had picked up. Later, when he came to drink it, he found that something the bottle had contained had made the water salty and almost undrinkable.

February 6th—Sandstorm. The car tracks almost obliterated and very hard to follow. (In the soft sand of the desert, where your foot slips back at every step, one pace is equal—in effort—to three on a hard road.) The first three reached Sarra, 135 miles from Jebel Sherif. At Sarra is a well, two hundred feet deep, which the Italians had filled in, with a few mud huts nearby. In them they found some waste motor-oil and bathed their feet and also made a fire out of odd bits of wood. There was no food.

February 7th—Three walking on. The tracks still hard to see. Tighe reached Sarra and sheltered in the huts, unable to follow the others. On the ground he found *one* match. It did not fail and he got some comfort from a fire.

February 8th—Three walking on. Tighe at Sarra.

February 9th—Late on in the evening of the 9th a party of French with Mercer-Nairne reached Sarra from the north. They were returning from a reconnaissance of Kufra . . . and had visited Jebel Sherif, buried Beech and the Italians, and called in at Sarra. The Sarra–Kufra track is wide and ill-defined, and the northward-bound French had missed Moore and the others. In a hut they found Tighe, weak but conscious. (Imagine his feelings when he heard the sound of their cars!) With his first words he told them of the others ahead. The French tried to follow their footmarks in the sand but in the dark this was impossible and they had to wait till dawn. Meanwhile the others had been walking on. Easton had dropped behind. During the day a

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French aircraft sighted Moore and Winchester and realized, I suppose, the plight they were in. The ground was too rough for a landing, but the pilot circled round and dropped food and a canvas bag of water. The food Moore and Winchester could not find; the cork of the water bag was knocked out in its fall and when they got it only a mouthful or two remained.

February 10th—At first light the rescue party left Sarra. They followed the three men's footsteps and after a time one set turned vaguely off to the west. At the end of them they found Easton, fifty-five miles from Sarra, lying on the ground but alive. Fortunately the French had with them a doctor who took Easton back to Sarra and all that day strove to save his life. But help had come too late and at seven in the evening he died. He kept his sense of humour to the end. The French made some tea for him, weak and sweet. Easton drank it and smiled. 'I like my tea without sugar,' he said.

Meanwhile another party was following Moore and Winchester. Sixty-five miles from Sarra, Winchester could not continue and Moore gave him half the remaining water—one mouthful—and pushed on. Here the French found him, near delirium but able to stand up when he heard their cars. Ten miles further south they overtook Moore, then about 210 miles from Jebel Sherif and marching steadily southwards. He felt confident that in three days he could reach Tekro, the nearest water, eighty miles ahead, and was slightly annoyed, so Mercer Nairne told me, at being prevented from proving that he could.

It has taken us three hours to reach Jebel Sherif. We have light loads, the going is excellent, Francis's navigation faultless. We have managed to stay in two-wheel drive all of the way, travelling sometimes at fifty miles an hour. We arrive at sunset and camp on the northern slope of the Jebel, which is a range of black rock outcroppings rising from a flat plain. It is too late to look for the battle site tonight. We make camp and have a quick supper and Liv puts out some traps for Hank, then everyone but Catherine climbs into one of the cars for a night hunt. Crossing the plain earlier we had seen a fresh camel-carcass and Liv thinks that we might find hyena or jackal feeding. It would be a good catch to take back to Hank. We set out across the plains swinging the big spotlight as we go. Catherine, who is in any case not interested in hunting, has decided that this is her chance to see how it feels to be alone. Travelling in the desert there is little opportunity to be really alone and she sometimes thinks that it is one of those things impossible to imagine being as it is so outside of normal experience. Watching the car lights until they are blotted out on the plain, she takes a flashlight and, half scrambling half sliding, makes her way down the slope into the long dark valley. The flash is to help her keep a wary eye out for snake and scorpion, than which she would rather come face to face with a Gorgon. The silence has a singing quality which is infinitely soothing, and the mind acts as a vacuum-cleaner whishing in thoughts and images from the cosmos about. In this still, barren and empty place all of the unused thoughts in the world seem to have come to rest, and then unavoidably she thinks of the battle fought here those twenty years ago: gunfire, explosion, roar of flaming tank or scream of the mortally wounded were a brief interruption of this continuing silence which runs at once into the past and into the future. There is a voice for the dead and a voice for the living here and a great sense of compassion. Turning at last back to camp, the mountain looms like a volcano and the stars are burning sparks shooting out of its black top.

In the desert we hunters find the dead camel undisturbed. 'There can't be any life around here,' Liv says, 'or something would be feeding. This carcass is going to mummify in the sun without a single bite being taken out of it.'

No jackal, no hyena, no fox; but recrossing the plain we pick up a desert mouse in the car lights. John lowers his rifle, which he has held at the ready.

'What a trophy to take back to barracks!' he says in disgust. But Liv jumps out of the car and tries to net the little creature with his coat. I train the spotlight on him as he zigzags long-legged across the desert, lunges and comes down on his face. The mouse pauses and then hops away to shouts and laughter from us all.

Soren H. Mortensen

Dr. Soren H. Mortensen, 89, retired chief electrical engineer for Allis-Chalmers, and long recognized as a leading authority in the field of motor and generator design, died Sunday, July 30, at Methodist Hospital in Indianapolis, Ind.

In 1905 he became a designer and electrical engineer for Allis-Chalmers. in 1932 he was made engineer-in-charge of Allis-Chalmers design. Ten years later he was named chief electrical engineer.

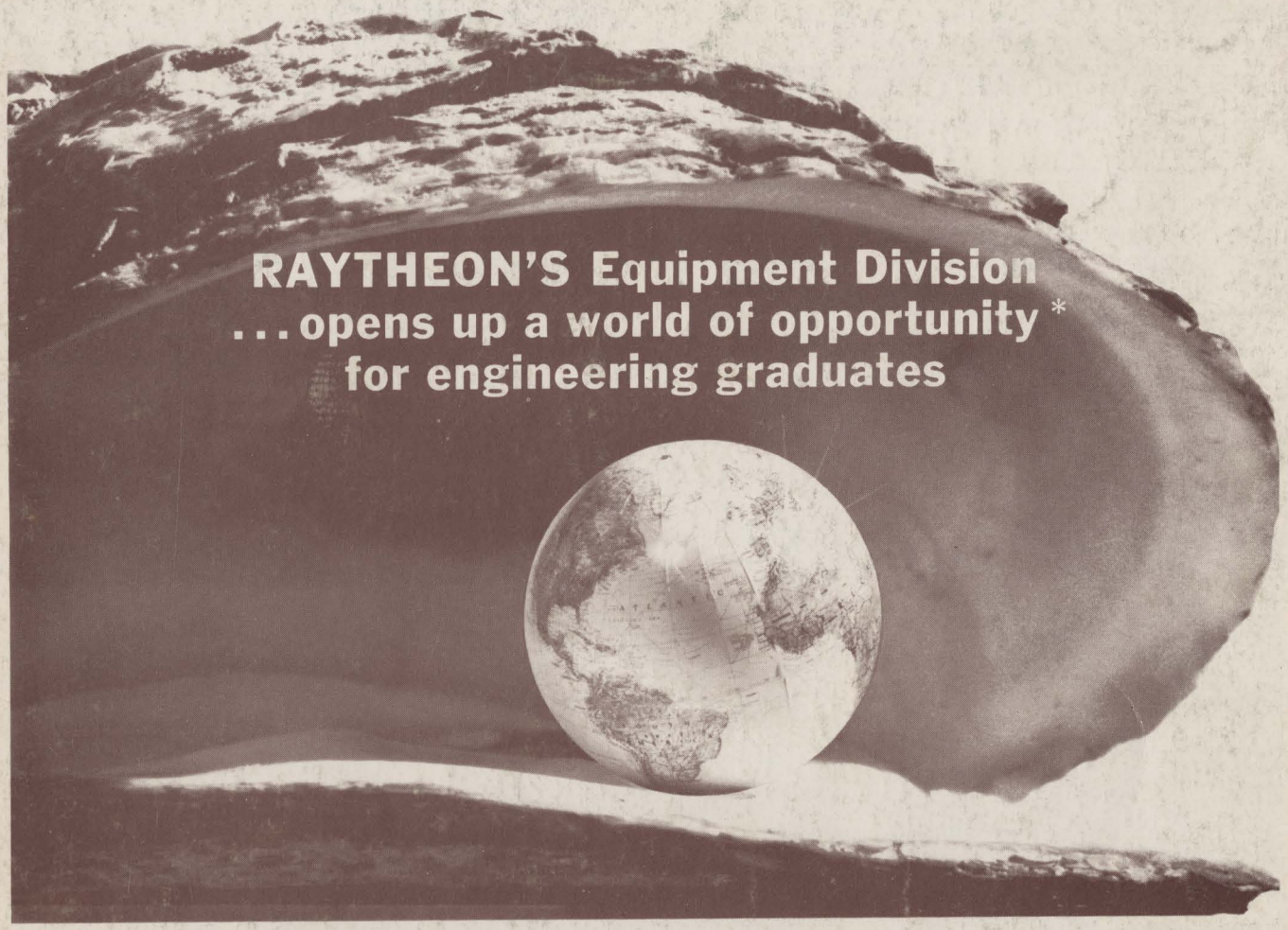
Dr. Mortensen was outstanding in the field of self-starting synchronous motors, large salient pole machines, ventilation of motors and generators, amortisseur windings, coil design, large air or hydrogen cooled turbogenerators, turborotor ventilating systems, hydrogen seal, and lead construction. Patents have been granted to him for many of these.

His contributions to the literature on electric machinery are numerous. Notable is his textbook, "Electrical Machine Design," and the section, "Alternating Current Generators and Motors," in the 1941 edition of the McGraw-Hill Standard Handbook for Electrical Engineers. He has also contributed numerous articles to Electrical World, Power, Lubricating World, and Engineering Review, and has furnished the American Institute of Electrical Engineers with significant papers and discussions.

In February, 1944, the Illinois Institute of Technology conferred upon him the honorary degree of Doctor of Engineering" for distinguished leadership in the development of alternating current machinery and rectifiers and the extension of their applications; and for his contributions to the design of synchronous motors and generators and his pioneering research in the development of self-starting synchronous motors and condensers."

In June, 1945, the 1944 Lamme Medal of the AIEE was awarded to Dr. Mortensen "for his pioneer work in the development of self-starting synchronous motors and for his contributions to the development of large hydraulic and steam turbine driven generators."

In January, 1952, Dr. Mortensen was installed as an Eminent Member of Eta Kappa Nu Association.



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