BRIDGE

Eta Kappa Nu

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Electrical Engineering Honor Society

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Robert Slade

OUR COVER

The Award Bowl shows that it is ready for its 35th name, to be engraved in a few weeks. This special souvenir issue of BRIDGE is devoted entirely to the New York Award Program for the Outstanding Young Electrical Engineers in America.

New York Award Dinner – March 22nd – Hotel Taft

JAMES B. FARISON

Outstanding Young Electrical Engineer - 1970

HONORABLE MENTIONS TO

Elwyn R. Berlekamp — A. Michael Noll

INTRODUCTION
by
HARLAN J. PERLIS
Chairman
Award Organization Committee

The Outstanding Young Electrical Engineer of the United States for 1970 was selected by the 1970 Eta Kappa Nu Jury of Awards to be James B. Farison. Dr. Farison is the Acting Dean of Engineering and an Associate Professor of Electrical Engineering at the University of Toledo.

Two outstanding young engineers received Honorable Mention: Elwyn R. Berlekamp and A. Michael Noll. Both of these men are Members of the Technical Staff of Bell Telephone Laboratories at Murray Hill, N.J.

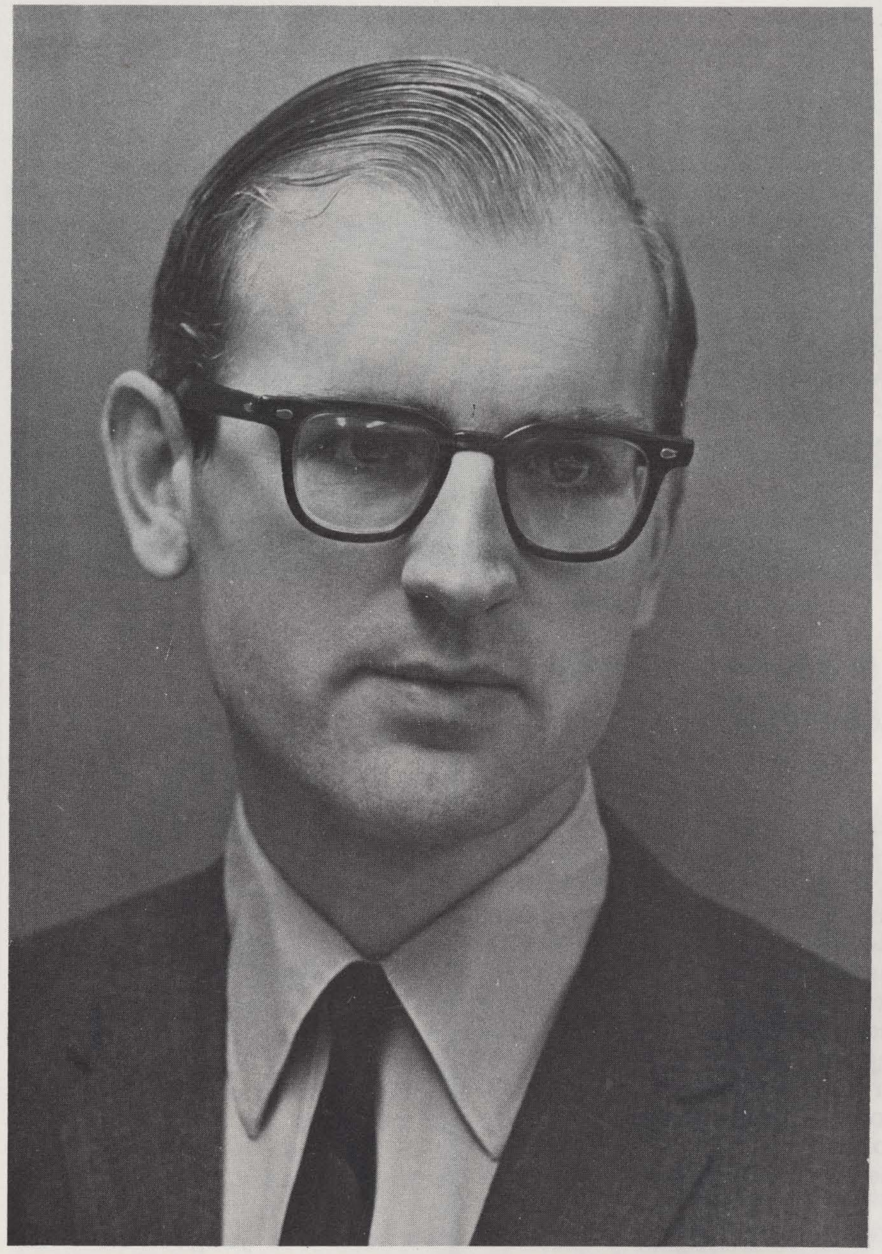
Dr. Farison is one of the few educators to receive this award. He is an outstanding teacher, an accomplished administrator, a thorough researcher, and a leader in professional and church activities. Dr. Berlekamp is one of the leading world experts in coding theory and is active in community and church affairs. Mr. Noll is an outstanding contributor to the field of computer generated graphics in both scientific and aesthetic areas and is actively involved in urban problems.

Prof. Farison was nominated by Dr. O. William Muckenhirn, who is the Chairman of the Electrical Engineering Department at the University of Toledo. This year we have a most unusual situation with regard to the nominations of Dr. Berlekamp and Mr. Noll. Both of these young men were nominated by Dr. John R. Pierce, the Executive Director of Research at Bell Telephone Laboratories. Dr. Pierce is a brilliant example of the men who have been honored by this Eta Kappa Nu Award in the past; he was the 1942 Outstanding Young Electrical Engineer.

These men are being recognized in the true spirit of Eta Kappa Nu not merely for their engineering accomplishments but for their contribution to society. They are versatile men with accomplishments in a variety of cultural, aesthetic, community, church, and professional society affairs. Some of these are related to their everyday work and others are completely in unrelated off-hours areas.

In the Spring of each year a nation-wide search for candidates is initiated by a letter and HKN Nominating Forms from the Award Organization Committee. These forms are available from Professor Paul K. Hudson, Executive Secretary of Eta Kappa Nu. The basic limiting requirements for a nominee is that he has a B.S.E.E. degree held not more than 10 years and that he is not over 35 years old. The winners are judged on their engineering achievement, their civic and social activities, their cultural and aesthetic development, and their performance in other areas.

The Award Organization Committee members are: Reed Crone, Larry Dwon, Irving Engelson, Anthony F. Gabrielle, Willard B. Groth, Everett S. Lee, Robert W. Lucky, Edgar W. Markard, John M. Montstream, James H. Mulligan, Jr., Sheldon J. Raiter, Frederick A. Russell, Charles F. Savage, Berthold Sheffield, Robert W. Slade, Roger I. Wilkinson, and Harlan J. Perlis, Chairman.



Biography of
JAMES BLAIR FARISON
Acting Dean of Engineering
University of Toledo

James B. Farison was born on a farm near McClure, a small town in northwestern Ohio, on May 26, 1938. He was the fifth of six children: four boys and two girls. His elementary and secondary education came from Damascus Township School in McClure, where he excelled in sports and other extracurricular activities while maintaining a superior academic record.

Jim graduated as valedictorian from high school and won a number of awards, including a full four-year tuition scholarship from the Toledo Edison Company. During his four years at TU, Jim was on the Dean's list for eight consecutive semesters and continued his extracurricular involvement, which included sports, church activities, and numerous student officer positions. For his outstanding record he was elected to Blue Key Activities Honor Society, Phi Kappa Phi Scholastic Honor Society, Pi Mu Epsilon Mathematical Honor Society, and Tau Beta Pi Engineering Honor Society. Among his many honors at TU he received the Phi Kappa Phi sophomore and scholar of the year awards; the Tau Beta Pi outstanding freshman, outstanding sophomore, and outstanding senior awards; the Toledo Technical Council outstanding engineering student award; and was listed in Who's Who Among Students in American Universities and Colleges. He graduated summa cum laude with the highest average in his graduating class.

Following a summer as a Member of the Technical Staff at Bell Telephone Laboratories, Jim started his graduate study at Stanford University. He was supported by a Phi Kappa Phi fellowship for the 1960-61 year, during which he completed his MSEE. At Stanford he maintained his high academic record while participating in extracurricular and church activities. It was during this period that Jim married his University of Toledo sweetheart, Gail Patricia Donohue. Gail holds a bachelor of education degree in secondary education with a home economics major from TU.

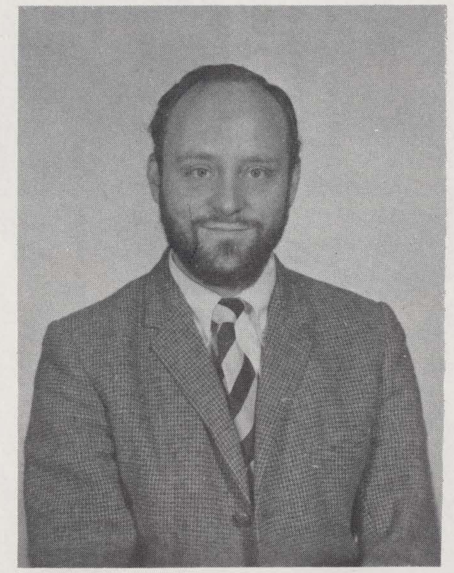
After a summer as a researcher for Ford Motor Company, Jim returned to Stanford on a doctoral program with NSF graduate fellowship support. He specialized in communication and control, studying under Dr. Norman Abramson and Dr. Gene Franklin. He held part-time teaching and research positions at Stanford, and he and Gail participated in campus and church activities. Their first child, Jeffrey James Farison, was born during this period. Jim received his Ph.D. degree in early 1964 and joined the University of Toledo faculty as an assistant professor in February, 1964.

At TU he has taught courses ranging in level from sophomore to advanced graduate in a wide range of areas. He has

developed five new courses and revised several others. His particular interests are in the communication and control system areas where he has published a number of papers, written a few texts, conducted and directed extensive research efforts, and supervised graduate theses.

As an administrator, Jim served (1966-1970) as Chairman of the interdisciplinary committee which oversees the program in system theory leading to a Ph.D. in Engineering Science. In January, 1970, he was appointed Assistant Dean of Graduate Studies for the College of Engineering where he has administrative responsibility for seven MS degree programs in engineering and the Ph.D. program in Engineering Science with three interdisciplinary options. Starting in September, 1970, Jim has been Acting Dean for the College of Engineering. This added responsibility includes administration of six engineering departments with six baccalaureate programs in addition to the graduate studies responsibility.

On the campus, in the community, in the church, and in professional societies Dr. Farison has displayed the same enthusiasm, organizational skill, and leadership. He has served on and chaired numerous committees on the University, College, and Department level that involved academic, research, and all phases of student activity. In the religious area Jim was a leader in churches in McClure, Ohio and Palo Alto, California and, since 1964, has been a leader at the Westgate Chapel in Toledo and other religious organizations on and off-campus in the Toledo area. Jim is a senior member of IEEE and ISA and a founding member of the Technical Society of Toledo. He is currently chairman of the IEEE Toledo Section and has served on the executive committee for four years.



Biography of
ELWYN RALPH BERLEKAMP
Member of Technical Staff
Bell Telephone Laboratories

Elwyn R. Berlekamp was born in Dover, Ohio on September 6, 1940. He received his B.S., M.S., and Ph.D. degrees in electrical engineering from the Massachusetts Institute of Technology in 1962, 1963, and 1964, respectively.

Dr. Berlekamp is a modest young man of great accomplishments. He graduated first in his electrical engineering class and went on to earn his Ph.D. at age 24, as a cooperative student in the MIT—Bell Labs program. His work in the field of coding theory began with the fundamental studies initiated in his doctoral thesis and was quickly followed by a sequence of important papers which investigated both the theoretical aspects of algebraic coding theory as well as the practical considerations necessary to realize efficient usage of good codes. This work culminated in the publication in 1968 of his book *Algebraic Coding Theory*. In 1969 this book because of its great contribution and its extensive inclusion of original work was awarded the IEEE Award for the outstanding research paper on information theory of the preceding two-year period.

From September, 1964 to February, 1967, Dr. Berlekamp was an assistant professor of electrical engineering at the University of California at Berkeley and a regular consultant for the Communications Systems Research Section of the Jet Propulsion Laboratories at Pasadena. Since 1967, he has been a Member of the Technical Staff of the Mathematics Research Center at Bell Telephone Laboratories, Murray Hill, New Jersey. In addition to his coding publications Dr. Berlekamp has published papers in a number of fields, including number theory, combinatorial set theory, group theory, and combinatorial analysis. A patent application has been filed on his recent work in data compression. While at Bell Telephone Laboratories, he has maintained a link between his applied science activities and the academic community. In the Fall, 1966 he was a visiting lecturer in statistics at the University of North Carolina at Chapel Hill. He was an instructor of the graduate coding theory course at Princeton in 1969 and a visiting scholar in mathematics at Westfield College, University of London in 1970.

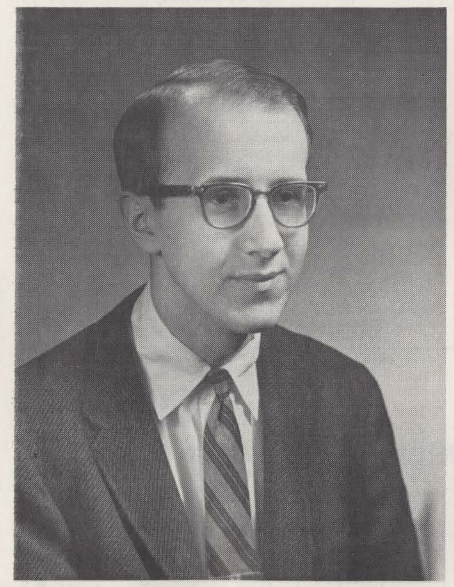
In the professional society activities area, Dr. Berlekamp is active in both the mathematics and the electrical engineering societies: MAA and IEEE. He is a member of the editorial boards of *Information and Control* and *American Mathematical Monthly* and is a member of ADCOM of the IEEE Group on Information Theory. He is also a member of the MIT Corporation Visiting Committee.

Elwyn Berlekamp has been a member of the Riverside Church in New York City since 1967 and has taught Sunday School there. He has been a member of the Sierra Club for six years and, since 1967, he and his wife have participated in Foster Parents Plan, an organization through which he

THE JURY OF AWARD—1970: Left to right, Dean L.B. Cherry, Vice President of Eta Kappa Nu Lamar State College of Technology; Dr. A.E. Fitzgerald, Jury Chairman, Vice President, Northeastern University; Mr. R.I. Wilkinson, Past President of Eta Kappa Nu (originator of the Award); Mr. L.H. Roddis, President, Consolidated Edison Co.; Dr. H.J. Perlis, Chairman—AOC, Newark College of Engineering; Mr. L. Saline (former Award recipient), Manager of Prof. Dev. and Education, General Electric Co.; Mr. G.W. Stagg (former Award recipient), President, Stagg Systems, Inc.; Mr. A.F. Gabrielle, President of Eta Kappa Nu, Assist. Vice President, American Electric Power Co.

provides financial support and monthly correspondences for a needy Philippino boy. During the 1968 Democratic primaries, he was active as a ward captain in Summit, New Jersey.

In his off-hours Dr. Berlekamp holds a Master rating in the American Contract Bridge League. He has won various tournaments and is a member of the Bell Telephone team. He is also a highly talented juggler, one of the few jugglers in this country (among both professional and amateur) who can maintain five objects in the difficult shower pattern. Among his many other accomplishments, he is fluent in Russian, a champion swimmer, a composer of march music for bands, an outstanding chess player, and a member of a Bell Laboratories softball team.



Biography of
A. MICHAEL NOLL
Member of Technical Staff
Bell Telephone Laboratories

A Michael Noll was born in Newark, New Jersey on August 29, 1939. He received the BSEE degree from Newark College of Engineering in 1961 and the MEE degree from New York University in 1963. He is presently working on his thesis for a Ph.D. degree at the Polytechnic Institute of Brooklyn which he expects to receive in 1971.

Mr. Noll joined Bell Telephone Laboratories as a Member of the Technical Staff in 1961 and is currently in the Speech and Communication Research Department. He started his research career with experiments on the effect of sidetones on telephone quality. During the same period he became interested in the two fields in which he has made his major contributions. He applied the cepstrum technique to speech analysis. This work on cepstrum analysis of the fundamental frequency of speech sound wave had two major effects: an accurate and reliable pitch tracking method became available and significant design improvements were made in vocoder systems. Mr. Noll's method of pitch tracking made possible the design of vocoders which both sounded natural and needed only small bandwidth for the transmission of pitch information. He later extended this work and developed the harmonic product spectrum and the cliptrum method of pitch analysis.

A. Michael Noll is best known in both scientific and aesthetic circles for his contributions to the field of computer graphics. He has been involved in this work since 1963 and has developed methods for producing stereoscopic three-dimensional pictures and movies by a digital computer. These techniques have numerous applications in both the scientific and artistic areas. In the scientific field his stereo techniques for data presentation have had an impact on man-computer communication. His methods have been used to display the movement of the basilar membrane in the ear and for representing atomic motion. A recent extension by Mr. Noll allows one to use stereo methods in a real time, on-line manner to explore multidimensional data analysis techniques.

His applications of computer generated stereo techniques to graphical art and design have been both on a theoretical and practical creative level. His deep interest in aesthetics have been seen in his designs computer generated in a quasi—random manner. He has applied his techniques to generate a great variety of 2D and 3D pictures and to produce computer generated choreographic sequences (such as those shown at the 1966 Eta Kappa Nu Award Dinner). His computer art has been widely exhibited throughout the world and has been shown on network television on numerous occasions. He has given many talks and published many technical papers and articles on his work.

In addition to his work in the application of computer graphics to architecture and urban planning, Mr. Noll has been active in other ways of attempting to solve existing urban problems. He resides in a part of Newark which is rapidly becoming a slum area, and he is a consultant to the President and an honorary member of the Upper Clinton Hill Community Council. Mr. Noll has spent much of his time in organizing programs that have been instrumental to the improvement and the stability of the community. He counsels disadvantaged children and works with them in both educational and physical activities. He has been active in getting the community-relations people of the Bell System involved in appropriate areas of action which might help cure urban blight. A good part of Mr. Noll's activity has been to stimulate the actual inhabitants of a neighborhood to take the initiative to eliminate slum conditions. He spearheaded a program to combat rat infestation in the City of Newark; this included work on the local, State and Federal government level and the organizing of neighborhood youths to work on the program.

OUTSTANDING YOUNG ELECTRICAL ENGINEERS

The Story of the New York Award Program

by

Larry Dwon*

This is a story of Outstanding Young Electrical Engineers who were honored by Eta Kappa Nu. It summarizes information from 681 dossiers of nominees from 1936 through 1969. The information includes:

(a) Statistical data pertaining to this award in the 34 year period,

(b) On-the-job achievements of those who were honored, as well as,

(c) Their Civic, Cultural and other accomplishments

Similar reviews were made in 1937, 1941, 1953 and 1954 (1, 2, 3, 4, 5)

INTRODUCTION

Recognition of Outstanding Young Electrical Engineers by HKN occurs in New York City, at a traditional event during the IEEE International Meeting as it previously did during the AIEE Winter Meeting. The award was conceived simultaneously by E.B. Wheeler and R.I. Wilkinson in the early thirties. The procedures of search, nomination and selection have been developed and refined by Mr. Wilkinson and implemented by the Award Organization Committee (AOC).

The award is given for "meritorious service in the interest of their fellow men" to young electrical engineers of good character who are:

1. Not older than 35 years.
2. Graduated not more than 10 years from a recognized American School.

The award aims to inspire and guide young men and women in their early professional careers. More specifically it was created: "To emphasize among electrical engineers that their service to mankind is manifested not only by achievements in purely technical pursuits but by a variety of other ways; and that an education based upon the acquisition of technical knowledge and the development of logical methods of thinking should fit the engineer to achieve substantial success in many lines of endeavor."

Biographical sketches published in the Bridge of Eta Kappa Nu and the Annual Award Dinner provide media for recognizing publicly the winners and honorable mentions. These events hopefully also serve to guide and perhaps inspire young engineers and students towards their own career objectives and programs of implementation.

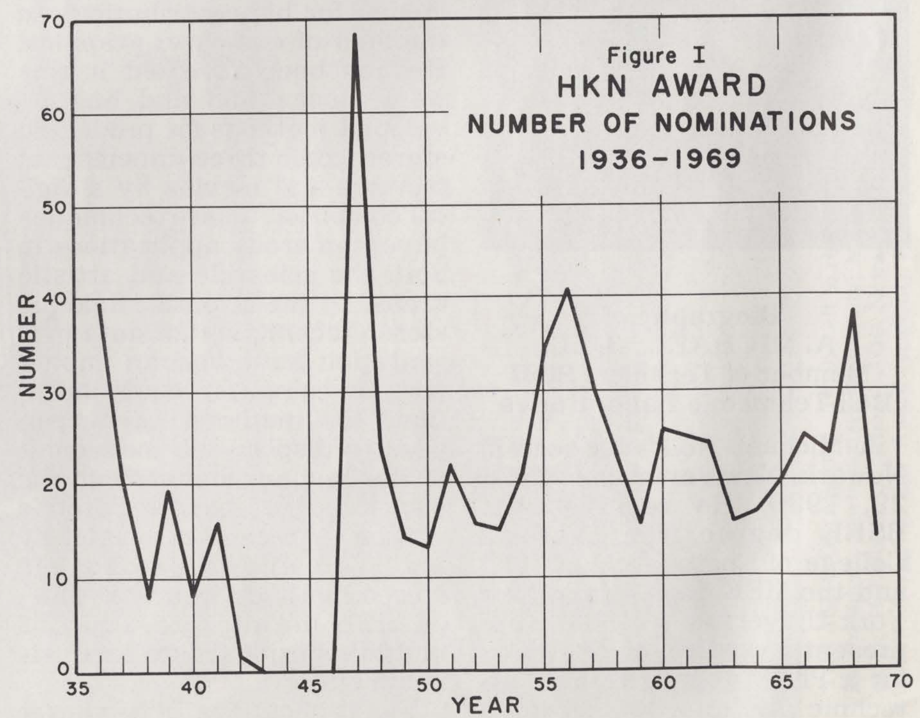


Figure I
HKN AWARD
NUMBER OF NOMINATIONS
1936-1969

AWARD ADMINISTRATION

Final selections of a winner and honorable mentions are made by a jury which is annually appointed by the president of HKN and composed of two present or past national HKN officers, and three or more prominent American educators or industrialists who need not be members of the society. Past juries have had the generous services of many distinguished men.

The AOC canvasses the country for nominees, scrutinizes their records, assists the jury, and helps to plan the Award Dinner. Candidates' records are first studied by the committee, confidential ratings are established, and then candidates in the top third are submitted to the jury for comprehensive review. However, all candidates' records are available to the jury and may be considered in the final selec-

TABLE A

HKN Recognition Award

Winners

1936	F. M. Starr
1937	C. G. Suits
1938	W. E. Kock
1939	L. A. Meacham
1940	J. E. Hobson
1941	C. Brunetti
1942	J. R. Pierce
1943	N. I. Hall
1944	R. W. Porter
1945	J. M. Wallace
1946	E. M. Williams
1947	R. R. Hough
1948	A. M. Zarem
1949	R. C. Cheek
1950	D. P. Campbell
1951	L. G. Gitzendanner
1952	J. V. N. Granger
1953	P. A. Abetti
1954	R. F. Mettler
1955	W. E. Chope
1956	J. J. Baruch
1957	R. P. Crago
1958	M. R. Currie
1959	E. A. Sack, Jr.
1960	K. H. Olsen
1961	C. J. Baldwin, Jr.
1962	J. T. Duane
1963	D. C. Forster
1964	W. L. Shevel, Jr.
1965	E. M. Davis, Jr.
1966	M. H. Lewin
1967	R. F. Elfant
1968	G. H. Heilmeier
1969	R. E. Larson

TABLE B

HKN Recognition Award

Honorable Mentions

1936	P. L. Bellaschi
	E. W. Boehne
	A. C. Seletzky
	G. Veinott
1937	L. L. Carter
	P. T. Farnsworth
	C. A. Faust
1938	H. E. Gove
	G. M. L. Sommerman
1939	C. G. Gieringer
	J. E. Hobson
1940	D. G. Fink
	S. C. Hight
1941	S. Ramo
	G. F. Leydorf
1942	G. D. McCann
	D. B. Smith
1943	A. G. Kandoian
	J. W. McRae
1944	W. E. Ingerson
	E. H. Krause
	D. W. Pugsley
1945	W. A. Depp
	J. A. Morton
	E. A. Post
1946	B. B. Bauer
	A. C. Hall
	D. A. Waidlich
1947	M. Camras
	J. B. Wiesner
1948	J. W. Forester
	H. E. Mohr
1949	L. M. Field
	L. G. Gitzendanner
1950	A. W. Edwards
	K. A. Kesselring
	R. W. Mayer
1951	B. R. Lester
	R. L. Trent
1952	E. O. Johnson
	G. W. Staats
1953	J. E. Jacobs
	A. G. Kegel
1954	E. E. David, Jr.
	J. F. Fuller
	L. K. Kirchmayer
	L. E. Saline
1955	J. N. Grace
	H. R. Johnson
	D. B. Shuster
	G. Wade
1956	R. B. Seidel
1957	W. R. Beam
	G. W. Stagg
1958	D. A. Buck
1959	W. O. Fleckenstein
	K. H. Olsen
	J. W. Wentworth
1960	W. B. Green
	R. R. Johnson
	T. H. Thompson
1961	W. L. Shevel, Jr.
	H. A. Zollinger
1962	F. A. Gicca
1963	F. J. Young
1964	P. Dragoumis
	F. S. Vigliante
1965	R. S. McCarter
1966	R. L. Brass
	W. B. Bridges
	H. C. Nathanson
1967	G. H. Heilmeier
	R. W. Lucky
1968	L. D. Davisson
	S. R. Hofstein
	R. W. Wyndrum, Jr.
1969	G. D. Bergland
	W. G. Scheerer

**Mr. Larry Dwon is Manager of Engineering Manpower for the American Electric Power Co. He has served Eta Kappa Nu in many ways including National President 1958-59 and Assistant Editor of BRIDGE 1968 to present.*

tion process. Before the winner and honorable mentions are chosen, the jury's and the committee's ratings are compared. This is deemed advisable by a mutual desire of the AOC and the jury to select the most deserving candidates. The jury's decision is final, however.

STATISTICS: 1936–1969

INFORMATION ON CANDIDATES

It is often asked, "What sort of information does the jury review"? The nominee's dossier consists of a personally answered 6-page questionaire together with the nominator's story and letters of reference from as many as ten engineers, educators, managers or others. During the 34 year period, 681 candidates were nominated who submitted data which weighed approximately 370 pounds and stacked 14.5 feet high. These records provide the basis for this story.

NOMINEES, AWARDEES AND HONORABLE MENTIONS

Figure I shows the number of nominations received annually. The peak of 68 in 1947 reflects the decision by the AOC to hold the award in abeyance until after World War II. At that time awardees and honorable mentions for each of the years skipped were chosen. The committee periodically has been concerned with the question of whether the number of nominations were sufficient to truly assure that all the best people were being considered. At the same time the committee does recognize that quantity and quality are not necessarily correlative. The quality of candidates has been maintained remarkably high year-by-year.

Table A lists the names of the winners each year and Table B shows the respective honorable mentions. An interesting observation, though possibly of minor importance, is data illustrated in Figure II the birth month of nominees, winners and honorable mentions. November seems to be a favorite month for nominees as a whole. March and September provided the greatest number of winners. Only July seems unproductive in this respect. May and December favors the honorable mentions. May stands out for the combination of candidates who were cited. Of course only astrologists can discuss the significance of this information.

Figure III shows the years from BS degree when the maximum and average number of candidates were nominated. Fifty of the candidates were nominated when they were 10 years from their BS degree in 1947. However, this was a unique year because candidates from prior war years are all grouped in it. The next highest number was 12 candidates who were eight years from their BS degree at the time they were nominated. The same figure also shows the average number of candidates who had been nominated over the 34 year span zero to 10

Figure II

HKN AWARD

NOMONEES, WINNERS AND HONORABLE MENTIONS

MONTH OF BIRTH

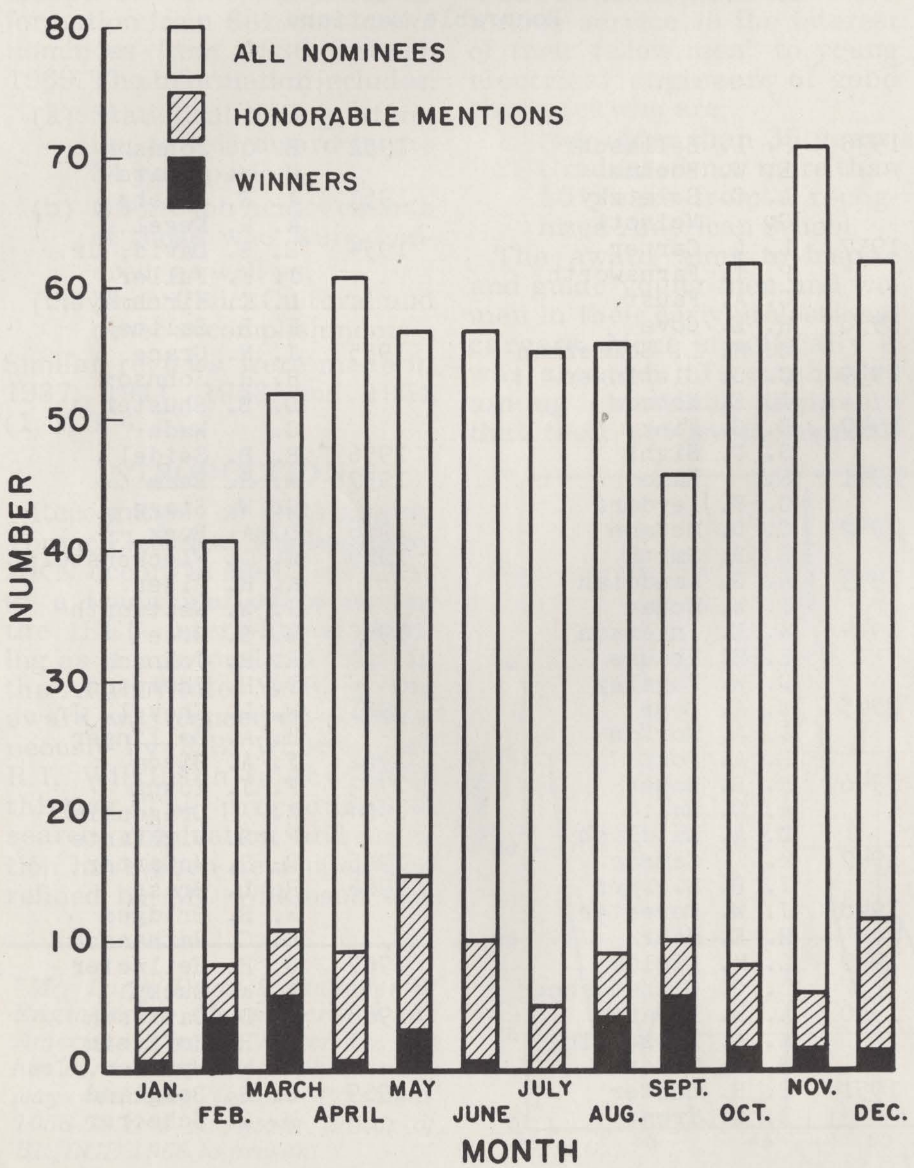
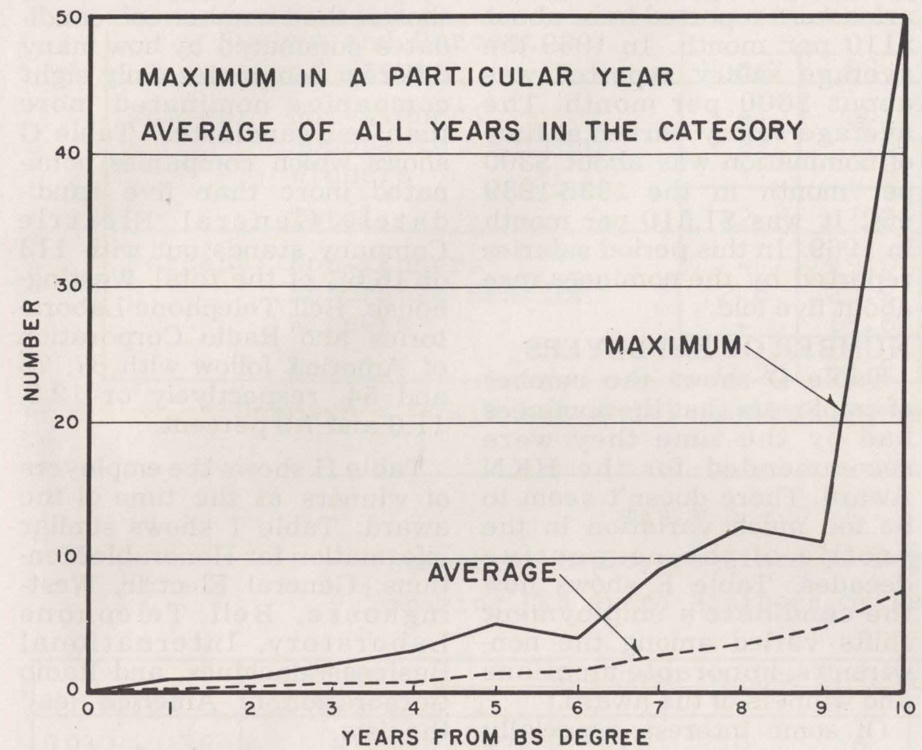


Figure III

YEARS FROM BS WHEN FIRST NOMINATED



years from BS degree. The highest average (7.5) candidates nominated occurred 10 years from the BS degree.

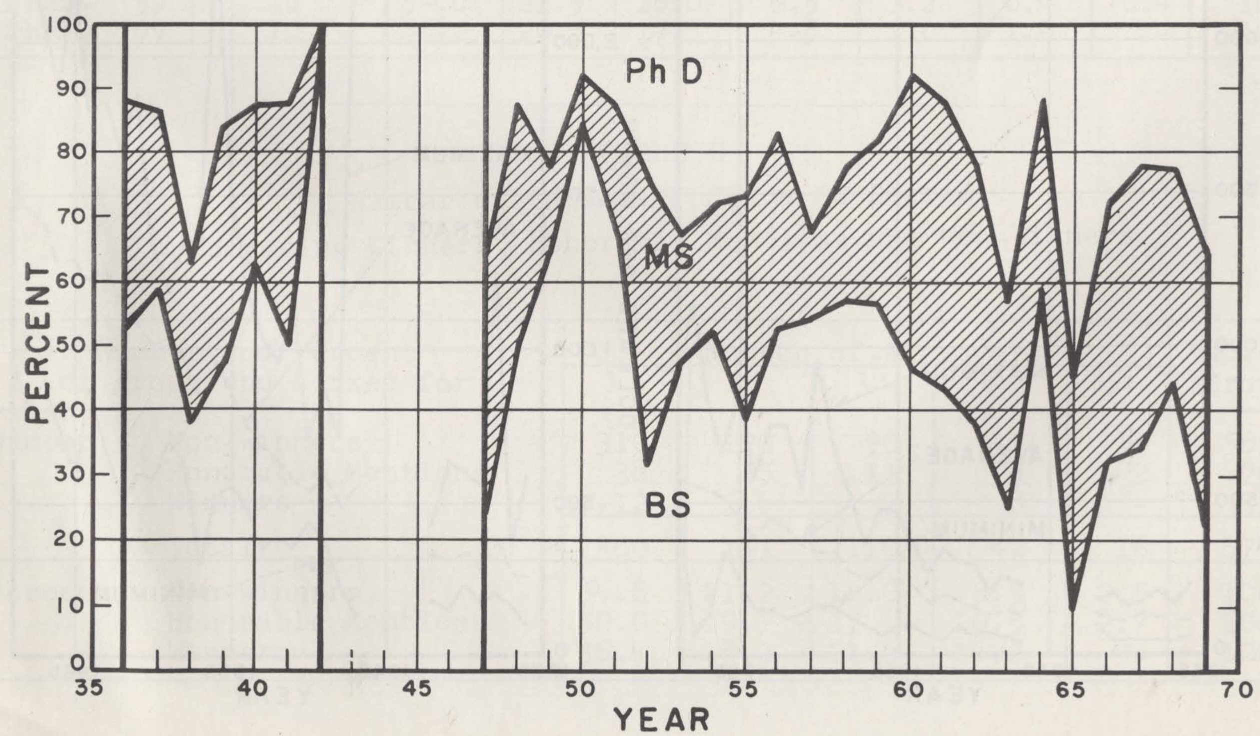
More than 70 percent of the honorable mentions were seven or more years from the BS degree when nominated. More than 90% of the winners were similarly nominated.

DEGREES ATTAINED

Only two nominees didn't receive an engineering degree at the time of their nomination but both of them were judged to be qualified for honorable mention. Figure IV shows the distribution of BS, MS and PhD degrees annually. In 1950 a high (84%) of BS degrees is noted among nominees and a low of 10% in 1965. The high (100%) in 1942 represents only 3 candidates. The high (49%) for MS degrees occurred in 1947 and the low (8%) occurred in 1950. The peak (55%) of PhD's occurred in

Figure IV

HIGHEST DEGREE ATTAINED BY HKN NOMINEES



1965 and the low (8%) occurred in 1950 and 1960.

Table C shows the distribution of degrees among non-winners, honorable mentions and winners. Among the non-winners the percentage with BS degrees is more than twice that of honorable mentions, and three times that of winners. In the MS degree category there is very little difference. However, in the PhD category the percent of nominees among non-winners is one-half that of honorable mentions and one-third that of winners approximately.

SALARIES

The span of years involved portrays a very interesting salary picture for nominees to the HKN Award. Figure V illustrates the maximum, minimum and average amounts of the nominees' starting salaries directly after receiving the BS degree; and also their salaries at the time of nomination. It is noted that in the 1936-1939 period average starting salaries were reported to be about $110 per month. In 1969 the average salary reported was about $600 per month. The average salary earned at time of nomination was about $300 per month in the 1936-1939 era. It was $1,510 per month in 1969. In this period salaries reported by the nominees rose about five fold.

NUMBER OF EMPLOYERS

Table D shows the number of employers that the nominees had by the time they were recommended for the HKN Award. There doesn't seem to be too much variation in the profile of the respective decades. Table E shows how the candidate's employment shifts varied among the non-winners, honorable mentions and winners of the award.

Of some interest, especially to the AOC, is the distribution of companies nominating candidates for the award. Table F shows the number of candidates nominated by how many different companies. Only eight companies nominated more than ten candidates. Table G shows which companies nominated more than five candidates. General Electric Company stands out with 113 or 16.6% of the total. Westinghouse, Bell Telephone Laboratories and Radio Corporation of America follow with 87, 75 and 54, respectively or 12.8, 11.0 and 7.9 percent.

Table H shows the employers of winners at the time of the award. Table I shows similar information for Honorable Mentions. General Electric, Westinghouse, Bell Telephone Laboratory, International Business Machines, and Radio Corporation of America lead the lists.

Figure V

DOLLARS PER MONTH OF NOMINEES

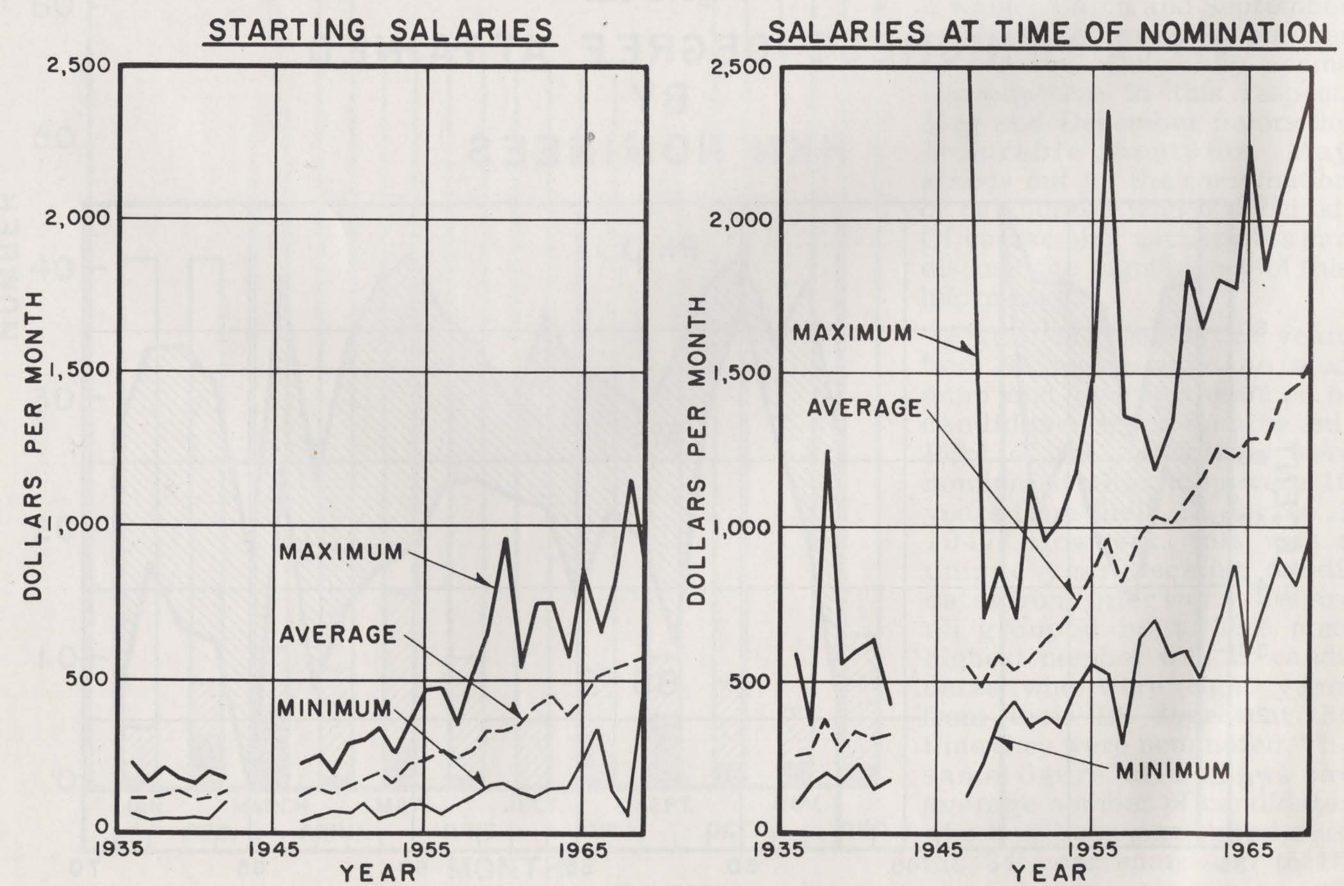


TABLE C

Degrees Obtained by Nominees

to HKN Award

Number and Percent of Group		Degrees None	BS	MS	PhD	Total
Number:	Non-Winners	-	281	188	105	574
	Honorable Mentions	2*	16	30	28	76
	Winners	*	5	8	19	32
	Total	2	302	226	152	682
Percent:	Non-Winners	-	49.0	32.9	18.1	100
	Honorable Mentions	2.6	21.2	39.4	36.8	100
	Winners	-	15.6	25.0	59.4	100
	Total	0.5	44.2	33.1	22.2	100

* Unknown - 3 Winners and 1 Honorable Mention

TABLE D

Number of Employers Since BS Degree

Comparing HKN Award Nominees by Decades

Period	Number of Years	Nominees having Indicated Employers 1	2	3	4	5	6	7	Total
1930 - '39	4	47	21	10	6	2	2	-	88
1940 - '49	10	62	23	23	15	9	1	-	133
1950 - '59	10	125	50	37	15	3	1	1	232
1960 - '69	10	126	47	40	11	2	2	-	228
Total	34	360	141	110	47	16	6	1	681
Percent of Total in Decade									
1930 - '39	4	53.3	23.9	11.4	6.8	2.3	2.3	-	100
1940 - '49	10	46.6	17.3	17.3	11.3	6.8	0.7	-	100
1950 - '59	10	54.0	21.5	16.0	6.5	1.2	0.4	0.4	100
1960 - '69	10	55.2	20.5	17.5	4.8	1.0	1.0	-	100

TABLE E

Number of Employers Since BS Degree

Comparing Winners, Honorable Mentions and Non-Winners

Number and Percent of group Who Worked for		Number of Employers 1	2	3	4	5	No. in Group
Number:	Non-Winners	310	120	90	31	14	565
	Honorable Mentions	38	15	13	8	2	76
	Winners	12	6	7	8	-	33
	Total	360	141	110	47	16	674
Percent:	Non-Winners	54.8	21.2	16.0	5.5	2.5	100
	Honorable Mentions	50.0	19.7	17.1	10.5	2.7	100
	Winners	36.4	18.2	21.2	24.2	-	100

TABLE F

Companies Nominating Candidates to HKN Award

Number of Candidates Nominated	Number of Companies
0 less than 10	156
10 " " 20	3
20 " " 30	1
30 " " 40	0
40 " " 50	0
50 " " 60	1
60 " " 70	0
70 " " 80	1
80 " " 90	1
90 " " 100	0
100 " " 110	0
110 " " 120	1
Total	164

TABLE G

Companies Nominating More than Five Candidates to HKN Award

Company	Number	Percent of Total
General Electric Company	113	16.6
Westinghouse Electric Corporation	87	12.8
Bell Telephone Laboratories	75	11.0
Radio Corporation of America	54	7.9
International Business Machines Co.	24	3.5
Bendix Corporation	15	2.2
Federal Telephone Laboratories	10	1.5
Texas Instruments	10	1.5
Hughes Aircraft	9	1.3
Sperry Gyroscope Corp.	9	1.3
Boeing Corp.	8	1.2
Philco	8	1.2
Raytheon	8	1.2
Sandia	8	1.2
Allis Chalmers	7	1.0
United States Air Force	7	1.0
	453	66.4

COLLEGES

Of interest also are the colleges from which these men received BS, MS and PhD degrees. Table J shows the number of colleges which conferred BS degrees to the specified number of nominees. Table K lists the colleges which conferred more than ten BS degrees to the candidates. Massachusetts Institute of Technology outdistances Purdue, Carnegie Institute of Technology and Cornell University.

Table L shows the number of colleges which conferred MS degrees to the specified number of candidates. Table M lists the colleges which conferred more than ten MS degrees to candidates for the award. Again M.I.T. leads California Institute of Technology, Pittsburgh and Pennsylvania by a large margin.

Table N shows the number of colleges which conferred PhD degrees to the specified number of nominees. Table O lists the colleges conferring more than five degrees to nominees. In this instance M.I.T. leads, by a small margin, Stanford and California Institute of Technology.

Tables P & Q list the colleges which conferred MS and PhD degrees, respectively, to the winners and honorable mentions. In the former category MIT was on top, in the latter category CIT was the leader with Carnegie Tech. and MIT very close.

So much for general statistics. Let us consider now the professional achievements of these outstanding young electrical engineers.

PROFESSIONAL ACHIEVEMENTS

Before discussing the records of the successful candidates we should establish on what basis they are chosen. Succinctly stated the criteria for selection is the "whole man" concept. More specifically the following

TABLE H

Employers of Award Winners At The Time of Award

General Electric	6
Westinghouse Electric Corporation	5
Bell Telephone Laboratories	4
International Business Machines	4
Radio Corporation of America	2
Aircraft Radio Systems	1
Baldwin Piano Co.	1
Bolt Beranek & Newman	1
Carnegie Institute of Technology	1
Digital Equipment Corp.	1
Hughes Aircraft Corp.	1
Massachusetts Institute of Technology	1
National Bureau of Standards	1
Nucleonics	1
U. S. Government	1
Wolf Management	1
Total	32

TABLE J

Colleges Conferring BS Degrees to Candidates for HKN Award

Number of Candidates	Number of Colleges
0 less than 5	102
5 " " 10	29
10 " " 15	12
15 " " 20	4
20 " " 25	2
25 " " 30	0
30 " " 35	0
35 " " 40	0
40 " " 45	1
Total	150

TABLE I

Employers of Honorable Mentions At the Time of Award

Bell Telephone Laboratories	18
General Electric Company	12
Westinghouse Electric Corp.	10
Radio Corporation of America	5
Massachusetts Institute of Technology	3
American Electric Power Service Corp.	2
Hughes Aircraft	2
American Wire and Steel	1
Anaconda Wire and Cable	1
Armour Institute	1
Carnegie Institute	1
Case Institute	1
Digital Equipment Corp.	1
Farnsworth Radio	1
Federal Telephone Laboratories	1
International Business Machines	1
Libel - Flarshem	1
Naval Ordinance Laboratories	1
Navy Research Laboratories	1
Other Brass	1
Philco	1
Princeton University	1
Raytheon Corp.	1
Safety Car Heater Corp.	1
Sandia	1
Shure Brothers	1
Stanford	1
The Crosley Corp.	1
Union Electric	1
United Airlines	1
U. S. War Depot	1
Total	76

TABLE K

Colleges Conferring BS Degrees to more than Ten Candidates for HKN Award

College	Number
Massachusetts Institute of Technology	43
Purdue University	23
Carnegie Institute of Technology	21
Cornell University	19
University of Washington	17
Polytechnic Institute of Technology	15
Texas A&M	15
California Institute of Technology	13
Johns Hopkins	13
Pennsylvania State University	13
University of Wisconsin	13
City College of New York	12
Georgia Institute of Technology	12
Iowa State University	12
Ohio State University	12
Lehigh University	11
Princeton University	11
University of Nebraska	11
University of Pennsylvania	11

TABLE L

Colleges Conferring MS Degree
to
Candidates for HKN Award

Number of Candidates	Number of Colleges
0 less than 1C	60
10 " " 20	13
20 " " 30	1
30 " " 40	0
40 " " 50	0
50 " " 60	1

TABLE M

Colleges Conferring MS Degrees
to more than Ten
Candidates for HKN Award

College	Number
Massachusetts Institute of Technology	50
California Institute of Technology	20
University of Pittsburgh	19
University of Pennsylvania	17
Stanford University	15
Columbia University	14
Harvard University	13
Northwestern University	11
Carnegie Institute of Technology	10
Johns Hopkins	10
University of Michigan	10
New York University	10
Ohio State University	10
Purdue University	10
University of Wisconsin	10

weights have been assigned the various portions of the nominees' records by past juries:

a) Chosen Work —50 points
b) Community, state and national activities —20 points
c) Cultural and aesthetic development —10 points
d) Hobbies and other accomplishments —20 points

Normally, a candidate receiving an average of 60 points from AOC would have his dossier included among the prime candidates which are submitted to the jury.

ON-THE-JOB ACHIEVEMENTS

One significant observation that applies unanimously, to individuals in this illustrious group, is that they were all teachers. Some of them taught only at universities; others taught only in industry; but many of them did both.

Beyond teaching, their interests have included a variety of technical subjects principally in the fields of electronics, power systems, military systems, nuclear, computers and control systems. Included also were a few miscellaneous categories.

Table R gives the percentage of honorable mentions and award winners whose interests were in the subjects indicated. Three significant observations seem to apply:

TABLE N

Colleges Conferring PhD Degree
to
Candidates for HKN Award

Class Limits	Number
0 less than 5	29
5 " " 10	7
10 " " 15	1
15 " " 20	2

TABLE O

Colleges Conferring PhD Degree
to more than Five
Candidates for HKN Award

College	Number
Massachusetts Institute of Technology	19
Stanford University	15
California Institute of Technology	14
Carnegie Institute of Technology	9
University of Wisconsin	9
Northwestern University	8
Yale University	7
Harvard University	6
Johns Hopkins	6
University of Pennsylvania	6

TABLE P

Colleges Conferring MS Degrees
to
Winners and Honorable Mentions

Universities	Number of Winners	Universities	Number of Honorable Mentions
M. I. T.	5	M. I. T.	8
C. I. T	3	C. I. T.	4
Princeton	3	Carnegie	4
California	2	Columbia	4
Stanford	2	N.Y.U.	3
Yale	2	Purdue	3
Cambridge (Eng.)	1	Wisconsin	3
Carnegie	1	California	2
Harvard	1	I.I.T.	2
I.I.T.	1	Illinois	2
Lehigh	1	Pittsburgh	2
Minnesota	1	Princeton	2
N.Y.U.	1	Yale	2
Purdue	1	Case	1
Texas	1	Cincinnati	1
Total	26	Harvard	1
		Iowa State	1
		Johns Hopkins	1
		Maryland	1
		Michigan	1
		North Carolina State	1
		Northeastern	1
		Northwestern	1
		Ohio State	1
		Stanford	1
		Texas	1
		Utah	1
		Washington	1
		Total	56

1) There was a major switch from interest in power to electronics in the two decades immediately before and after World War II.
2) The interest in power systems engineering is being reestablished quite significantly.
3) New fields—computers, nuclear, control systems and military systems—evolved after the war.

Table S lists the specific subject areas in the respective fields which the honorable mentions and award winners pursued.

These activities command a maximum point score of 50. From previous statements such a score would be insufficient to place the candidate into the prime group for the jury to consider. What follows, therefore, makes the difference between a winner, an honorable mention or a non-winner. It separates the pure technical man from the engineer who has the professional attitude that enables him to contribute some part of himself in the interest of his fellow man.

ACTIVITIES IN COMMUNITY, STATE AND NATION

Table T shows the kinds of activities in which the men who were nominated for this award participated.

CULTURAL AND AESTHETIC DEVELOPMENT

Similarly, Table U shows the cultural activities in which these men spent some of their time. Among their pursuits was reading a great many and a large variety of books.

HOBBIES AND OTHER ACCOMPLISHMENTS

Some of the humorists among the nominees asked, "Hobbies?" . . . Other, "Accomplishments?" . . . are you kidding? Yet many of them listed such worthy efforts as are noted in Table V.

TABLE Q

Colleges Conferring PhD Degrees to Winners and Honorable Mentions

Universities	Number of Winners
C.I.T.	3
M.I.T.	2
Princeton	2
Stanford	2
Yale	2
Berlin	1
Carnegie	1
Harvard	1
I.I.T.	1
Minnesota	1
Purdue	1
Tech.Hoch.,Zurich	1
Total	18

Universities	Number of Honorable Mentions
C.I.T.	4
Carnegie	4
M.I.T.	3
Wisconsin	3
California	2
Iowa State	2
Princeton	2
Stanford	2
Johns Hopkins	1
Maryland	1
N.Y.U.	1
Northwestern	1
Purdue	1
Total	27

TABLE R

HKN Award

General Fields of Prime Interest

Field of Interest	Percent in Period Honorable Mentions plus Award Winners 1936-1939	1940-1949	1950-1959	1960-1969	1936-1969
Electronics	35	50	29	39	38
Power Systems	65	10	26	18	30
Military Systems	-	24	6	-	7
Nuclear	-	-	13	-	3
Computers	-	3	10	36	12
Control Systems	-	3	13	-	3
Miscellaneous		10	3	7	7
Total	100	100	100	100	100

TABLE S

HKN Award

Fields of Prime Interest

Winners and Honorable Mentions

Period	Field of Interest	Winners	Number Honorable Mentions
1936-1939	Power Systems:		
	Equivalent Circuits	Starr	
	Transients, Lightning, Impulses		Bellaschi
	Travelling Waves, Lightning Arresters		Boehne
	Magnetic Analysis, Circuit Theory		Seletzky
	Electric Motor design		Veinott
	Wire and cable insulation		Carter
	Electric Railways		Faust
	Transmission Line Design		Gove
	Insulated cables and dielectrics		Sommerman
	Power Systems Analysis	Hobson	Hobson
	Electric Arcs	Suits	
	Electronics:		
	Television		Farnsworth
	Electronic Organ	Kock	
	Constant Frequency Currents	Meacham	
	A.C. Null Detector		Gieringer
	Frequency Substandards		Hight
	High definition television		Pugsley
1940-1949	Power Systems:		
	Lightning Analysis		McCann
	High voltage switches and fuses	Wallace	
	Power line carrier equipment	Cheek	
	Electronics:		
	Microwave Radar		Fink
	Cross modulation in radio transmission		Leydorf
	Microwaves and alectron optics		Ramo
	Oscillators	Brunetti	
	Electron Tube design	Pierce	
	Oscillating circuits		Smith
	Electron control circuits	Hall	
	Aerial navigation and antennas		Kandoian
	Electron discharges, negative feedback		McRae
	Gas discharge tubes		Depp
	Microwave tubes		Morton
	Vacuum tube circuits		Bauer
	Gas switching tubes for radar		Wiesner
	Gas tube switching circuits		Mohr
	Iron propagation effects		Field

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TABLE S (Continued)

1950-1959 (Cont'd.)	Miscellaneous:		
	Xray beam stablizer		Jacobs
1960-1969	Electronics:		
	Silicon rectifiers		Green
	Backward wave amplifiers	Forster	
	Electronic PBX Program		Viglianti
	Surface control tunneling in semi-conductors		Nathanson
	Laser oscillation in noble gas		Bridges
	Signal design		Lucky
	Travelling wave amplifier	Heilmeier	Heilmeier
	Synthesis of RC network		Wyndrum
	Semi-conductor devices		Hofstein
	Radar communication		Davisson
	Wideband transistor amplifier		Scheerer
	Power Systems:		
	Fast response crane		Zollinger
	Power system analysis and applic.	Baldwin	
	Rotating machine design	Duane	
	Field theory applied to power transformers		Young
	Nuclear power plants		Dragoumis
	Computers:		
	Magnetic matrix switch	Olsen	
	Special purpose computers		Johnson
	Rotational switching in ferrites	Shevel	Shevel
	Digital modulation techniques		Gicca
	Ferrite phase shifters		McCarter
	Digital computer elements	Lewin	
	Designing special computer		Brass
	Flux reversal in ferrite memory devices	Elfant	
	Computer applications for complex systems	Larson	
	Structuring fast fourier transforms		Bergland
	Miscellaneous:		
	Military systems development		Thompson
	Design method for multiple feedback	Davis	

TABLE S (Continued)

1940-1949 (Cont'd.)	Military Systems:		
	Aircraft armament	Porter	
	M-9 electrical gun director		Ingerson
	Guided missiles		Krause
	Radio and radar prototypes		Post
	Electronic ordnance equipment		Waidlich
	Anti-aircraft fire control	Hough	
	Magnetic Mine Sweeping	Gitzendanner	Gitzendanner
	Miscellaneous:		
	Electrical engineering teacher	Williams	
	Automatic control systems		Hall
	Tape recorders		Camras
	High speed photography	Zarem	
	Electronic computers		Forrester
1950-1959	Electronics:		
	Measurements in gas discharges		Johnson
	Antennas	Granger	
	Magnatron oscillators		David
	Travelling wave tubes		Wade
	Propagation of Microwaves		Johnson
	Noise in microwave amplifiers		Beam
	Color television		Wentworth
	Electronic switching system		Fleckenstein
	Solid state relay	Sack	
	Power Systems:		
	Protective devices for power		Edwards
	Transmission of power		Staats
	Design of magnetic models	Abetti	
	Power system analysis		Saline
	Power system planning and Control		Kirchmayer
	Power system overvoltages		Fuller
	Separately excited motors		Seidel
	Application of computors to power		Stagg
	Nuclear:		
	Power Reactors		Kesselring
	Radio waves from nuclear detonation		Shuster
	Nuclear reactor instability		Grace
	Accurate weight and thickness measurements	Chope	
	Computers:		
	Digital computer design		Lester
	Digital computer design	Crago	
	Magnetic Matrix Switch		Olsen
	Military Systems:		
	Sonar and radio security		Trent
	Interceptor fire control	Mettler	
	Control Systems:		
	Servomechanisms	Campbell	
	Servomechanisms		Mayer
	Feedback control systems		Kegel
	Feedback systems	Barush	

TABLE T

Activities in Behalf of Community State and Nation

Typical Activities	Percent of Group: Non-Winners	Percent of Group: Honorable Mentions	Percent of Group: Winners
Church Affairs			
Young people's or couples' groups	17	21	28
Directing, teaching, singing in choir	9	14	22
Member of operating committees	13	16	22
Teaching Sunday School	10	23	17
Maintaining equipment voluntarily	4	2	11
Organist in Church	1	-	6
Member of Board	11	16	6
Civic Affairs			
Boy Scout work	12	14	22
Philanthropic collections	21	37	22
YMCA and other youth programs	5	21	39
Adult education	22	49	50
Civic committees	11	42	33
Miscellaneous			
Boys' athletic and recreational programs	4	2	11
Local political activities	4	5	39
Aiding students through schools	-	2	17
Volunteer civil defense	2	5	11
Relief and welfare work	4	2	6
Rebuilding toys for undepriviliged	1	-	6
Parent - teachers association	3	9	6

TABLE U

Cultural and Aesthetic Development

Typical Activities	Percent of Group: Non-Winners	Percent of Group: Honorable Mentions	Percent of Group: Winners
Studied music or appreciation of music	11	16	44
Studied and played instrument	22	30	56
Studied voice or sings in choral group	4	14	17
Wrote articles on music or other cultural subjects	1	9	44
Performed in amateur dramatics or minstrel shows	4	14	28
Painter in oils or water colors	3	28	39
Miscellaneous other activities	3	28	39

A SPECIFIC EXAMPLE

This story would not be complete unless an example of a truly outstanding candidate was given. Table W illustrates one such winner from among the 34 who were chosen. It was selected for the balance that it illustrates in the four categories mentioned previously. Perhaps the following AOC scores which were given this record will illustrate the consistency of independent judgement among members of the pre-screening committee:

AOC REVIEWERS

Activity Group	A	B	C	D
On-the-job record	47	40	—	—
Community & Civic	15	18	—	—
Cultural & Aesthetic	7	9	—	—
Other Activities	15	10	—	—
Total	84	77	79	86
Average		82		

TABLE V

Hobbies and Other Accomplishments

Typical Activities	Percent of Group: Non-Winners	Percent of Group: Honorable Mentions	Percent of Group: Winners
Photography	37	35	50
Amateur radio	15	14	22
Woodworking	18	7	22
Gardening	19	19	33
Golf	15	9	6
Tennis	14	19	33
Swimming	9	21	6
Boating	7	19	6
Flying	3	2	11
Other sports	11	56	67
Stamp Collecting	3	7	-
Model building	1	-	-
Astronomy	1	9	6
Miscellaneous	11	16	6

CONCLUSION

Besides being awed by the intensive review of this amazing collection of dossiers, the writer submits that the following observations about the recipients of the award emerge uncontested:

1. They possessed a large capacity for and a genuine willingness to **work hard.**
2. They had a strong desire to obtain **as much education as possible** in a wide spectrum of accumulated knowledge.
3. They developed an ability to **set goals early in life** and pursue them diligently.
4. They developed working and living habits which **maximized their inate abilities** in the time available for them to perform.
5. They were **not selfish** because their contributions towards other peoples' welfare stand out sharply.
6. They had the **faculty of getting cooperation,** especially from their families, otherwise it would be difficult to account for their having accomplished so much through the effort of a single person.
7. They developed **broad interests.**

Among the nominees who did not succeed there were many who rated excellently in their work as engineers. Some of the non-winners had outstanding records in the other categories. Generally speaking those who didn't receive recognition did not possess a balanced record of achievement in all four categories which are considered.

It is hoped that this review of Eta Kappa Nu's Outstanding Young Engineers will inspire:

1. Other young men and women towards equally great professional careers.
2. Other companies to search their ranks for potential candidates and submit their names for possible recognition.
3. Friends of this recognition to continue their support by nominating other candidates in the future.

A teacher once wrote that, "There are two forms of poverty—the lack of goods for the higher wants and the lack of wants for the higher goods". Neither poverty appears to constrain these Outstanding Young Electrical Engineers.

REFERENCES

1. An Experiment in the Recognition of Engineers, R.I. Wilkinson, Electrical Engineering, Volume 56, number 3, August 1937, p. 945-9.
2. Salary Performance of 102 Candidates, R.I. Wilkinson, Bridge of Eta Kappa Nu, Volume 37, number 2, January 1941.
3. Outstanding Young Electrical Engineers, 1936-1951, Part I, V.L. Dzwonczyk, Bridge of Eta Kappa Nu, Volume 49, number 2, Winter 1953.
4. Outstanding Young Electrical Engineers, 1936-1951, V.L. Dzwonczyk, Electrical Engineering, May 1953, p. 399-404.
5. Outstanding Young Electrical Engineers, 1930-1953, Part II V.L. Dzwonczyk, Bridge of Eta Kappa Nu, Volume 50, number 3, Spring 1954.
6. 681 Dossiers submitted to Eta Kappa Nu Award Organization Committee, 1936-1969.

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TABLE W - SUMMARY SAMPLE OF
1945 H.K.N. RECOGNITION AWARD WINNER

ON THE JOB RECORD 50 POINTS MAXIMUM	CIVIC AND SOCIAL ACTIVITIES 20 POINTS MAXIMUM	CULTURAL ACTIVITIES 10 POINTS MAXIMUM	OTHER ACTIVITIES 20 POINTS MAXIMUM
W. E. Corp. 1935 - Laboratory Technician 1937 - Design Engineer 1943 - Section Manager Switch and Fuse Section Five Technical Papers Ten major contributions towards high-voltage fusing, low-voltage circuit breakers and special rheostats. Patents - Eighteen patents issued, twenty-nine patents pending, twenty-four disclosures awaiting investigation. NEMA Secretary of two committees. AIEE Member of group on standards.	Assistant Scout Master Advertising Manager of North Braddock Civic League Supported actively a Doctor of Medicine running for the school board. Maintained voluntarily pipe organs at local church. Taught Sunday School. Counsellor of Young People's Organization. Member of Board of Trustees of Church. Taught in W. E. Corp. Technical School. Worked with Red Cross blood bank; Contributed seven pints. Contributed 10% of salary to Church and Charity. Married, owns home, one child.	Participated in dramatic, music, and painting fields. Stage Manager in Little Theatre Club, three years. Acted parts - lead in one. Accomplished pianist - played twenty years. Organized amateur orchestra and played at local functions on a voluntary basis. Paints with oil. Reads extensively.	Sailboat racing. Photography - color stills and movies. Held canoe sailing trophy for ten consecutive years. Won three trophies for sailing center board boat. Won one final and one second prize in canoe paddling. Received awards for patents from W. E. Corp. Registered professional engineer, and member of Pennsylvania Society of Professional Engineers. AIEE - Member of two committees Westinghouse Engineers Society - Held four offices including presidency. Organized W. E. Corp. Night School Engineering Society. Co-founder of Alleghany Sailing Association. Trustee, McKeesport United Presbyterian Church. Member of Sylvan Canoe Club - Held office on Board of Governors four times. Member Westinghouse Educational Center, Boosters Club, Pittsburgh Symphony Society and the Western Pennsylvania Safety Council.

SOLVING THE SYSTEMS PROBLEMS OF THE SEVENTIES

Robert E. Larson

Outstanding Young E. E. for 1969

The *systems approach* has become an almost meaningless phrase today because of the extreme diversity of the fields to which it applies and the varied backgrounds of the people who use it. I personally view the approach in what might be called an *optimization theory* framework. From this perspective the systems approach to a complex problem is seen to consist of four steps. The first step is to define the objectives that are to be met. This is clearly a fundamental step in dealing with any complex situation, but it is generally not an easy step. Often there are many different aspects of the situation that must be considered, and there are almost always conflicts that must be resolved. In problems of social significance, that involve the interests of a large number of people, it is particularly difficult to specify the objectives. For example, let us consider the area of transportation systems. In designing a jet engine the objective is to produce a specific thrust with limits on fuel consumption, weight, reliability, and so forth; this is itself a complex enough situation. However, quantifying the objectives of the entire transportation system in the United States is a far more difficult—and controversial—task.

The second step is to enumerate a set of alternative courses of action. Here is where I think much of the creativity and engineering judgment of the systems engineer must be brought into play. In this step it is critical to consider a large enough set of alternatives to ensure that a satisfactory solution will be found, but not so large that it is impractical to consider them all. Clearly, the value of any further analysis of the problems is limited by the effectiveness of the alternatives considered.

The third step is to express the objective as a quantitative function of the alternatives considered. This step is generally referred to as system modeling. This step is heavily influenced by what was done in the first two steps. Often, all three steps are performed in a coordinated fashion, with the objective, the alternatives, and the model all being adjusted until they form a consistent set; that is, a set in which the fundamental elements of the problem are portrayed correctly but not with so much detail that further analysis is impossible.

Again, the influence of human desires greatly complicates the modeling process. Expressing the thrust, fuel consumption, weight, reliability, and so forth, of a jet engine in terms of physical design parameters is a challenging enough task. Expressing the social utility or some similar measure of value for an alternative in transportation systems, such as installing a subway system in a major metropolitan area, involves even more complex interrelationships.

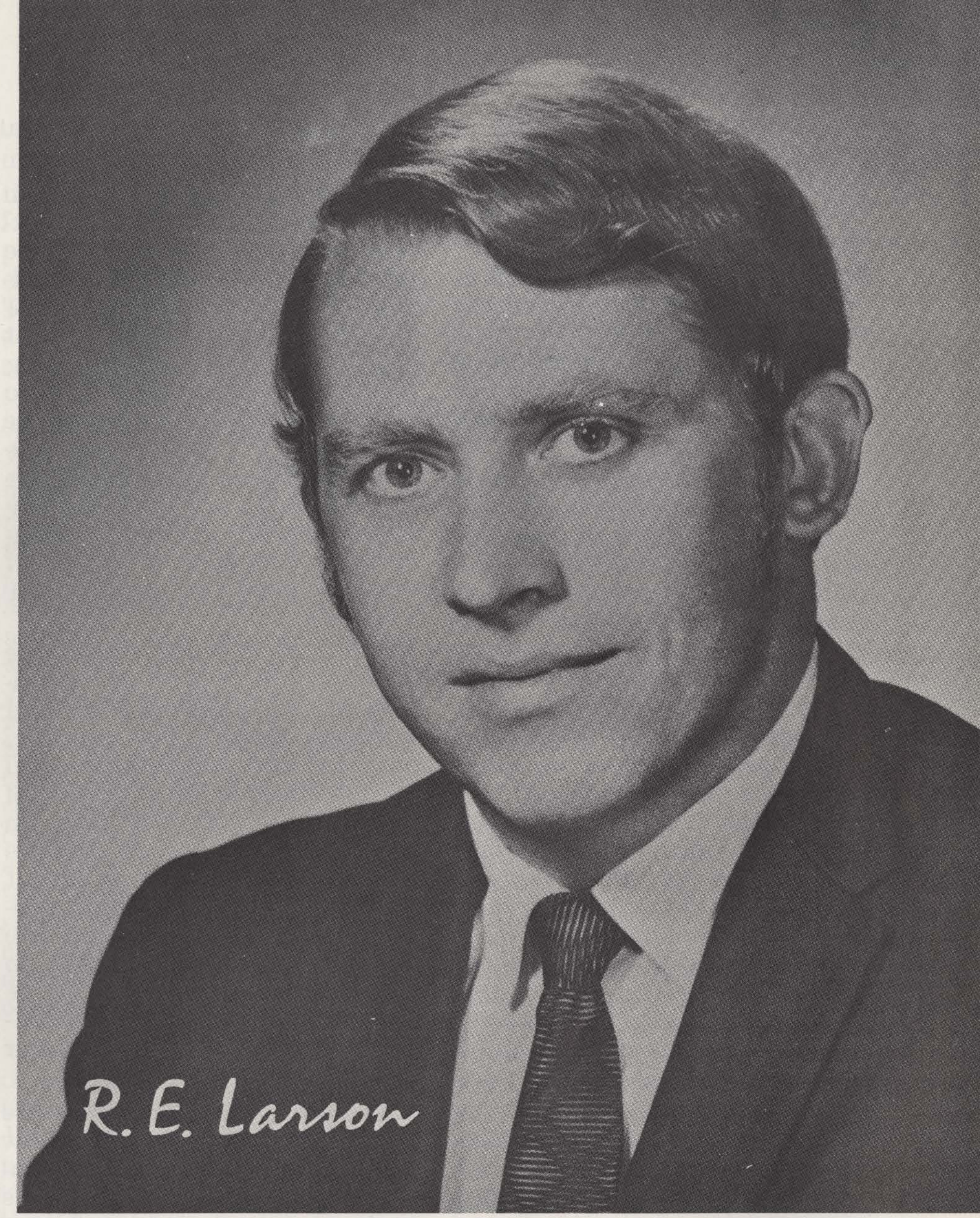
No matter how difficult it is in practice to achieve, the task of constructing a model that accurately represents the situation and that is consistent with the objective and alternatives is critical to the success of the systems approach. It is interesting to note that in this phase of the work the systems engineer must work very closely with specialists from other disciplines and, in most cases, becomes quite knowledgeable about these disciplines himself. Another interesting point is that the science of constructing mathematical models has always been and continues to be an integral part of systems theory.

The final step is to choose the best alternative—best in the sense of meeting the objective to the greatest extent possible. In systems theory this step is referred to as *system optimization.* If the system objective can be expressed as a scalar function of the alternatives, then this process consists of choosing from the set of alternatives that alternative that maximizes the benefit function. The branch of mathematics that deals with maximizing a scalar function is at least as old as calculus and, in a fundamental sense, much older. However, for the types of objectives, alternatives, and models that arise in practice, the classical mathematical techniques are quite limited in finding the best alternatives. Fortunately, the digital computer has opened entirely new ways of solving these problems and has already revolutionized the scope of problems that can be treated. Nevertheless, this fourth step is still a challenging one to the systems engineer, and there is still considerable room for improvement in developing methods to carry out this task.

In regard to this step, I am often asked why bother to find the best alternative, why not settle for an acceptable alternative? My answer is that it would be unfair to the people affected by the system not to demand the best solution. If the objective is meaningful, if the alternatives are indeed available, and if the model is correct, then it is clear that the additional benefit from using the best alternative, rather than one selected on an ad hoc basis, is immediately useful to everyone involved.

The conditions on my statement are rather important, however. If the objective does not truly reflect the goals of the system, if the alternatives considered are not really implementable, or if the model is a poor representation of the situation, then I heartily agree that efforts in this direction at best may be meaningless and potentially are misleading. There is clearly this danger if the fourth step, choosing the best alternative, is treated as

This paper was presented by Dr. Larson at the New York Award Dinner, March 23, 1970, in the Sutton Room of the New York Hilton Hotel.



an end in itself and not as a part of a complete approach to solving problems. Keeping all four steps in perspective is a constant challenge to anyone attacking systems problems.

I will return to a discussion of these four steps later. I would now like to describe a specific problem in order to illustrate the systems approach.

The example I have chosen is the generation of electricity from one hydroelectric station. We assume that the power output of the generating station is available to an electric utility. We also assume that this utility has available other sources of generation for which the cost of generating any particular power level is known. In addition, we assume that this utility has a known demand for power which must be met. Finally, we assume that the dam is the only one on the river.

Now we examine some of the systems problems that arise in connection with this hydro plant. First, consider the problem of daily operation of the dam.

The first step in the systems approach, determining the objective of this system, requires special care. From the viewpoint of the electric utility, it is desirable to use the hydro plant for "peak shaving," i.e., for generating high power levels when the demand is high. This effect is caused by the nonlinear cost characteristics of nonhydro power generation plants. However, the dam may have been designed for purposes other than hydrogeneration, and the changes in flow due to changes in the power output level for peak shaving may have undesirable effects on these other purposes. Examples of these other purposes are flood control, navigation, pollution control, salinity control, recreation on the lake behind the dam, conservation of fish and wildlife, irrigation, and municipal and industrial water supply.

The set of alternatives is, in this case, relatively straightforward to determine. The alternatives are a set of schedules of water releases throughout the day. At any instant of time the rate of releasing water is bounded below by zero and bounded above by some maximum physically possible release. Within these limits the release can vary continuously with time, although it is common to schedule it as piecewise constant over one-hour intervals.

The system model must take into account two types of considerations: physical laws and economic factors. For example, physical laws are fundamental in determining the effects of releases on the river flow, on the water level behind the dam, and on the power output from the hydro station. Economic factors determine the value of the power output to the electric utility as well as the value of the release schedule in terms of the nonpower benefits mentioned before.

The first three steps in the systems approach have now been discussed. Before considering the final step, let us look at a related problem, namely, the planning of additional sources of power generation for the utility. In this situation the objectives are similar to those for the previous case. The utility is still interested in minimizing the cost of generating power to meet its demand. Now, however, the cost of building a new facility must be added to the operating cost. In addition, if the new plant is put on the river, either as another hydro plant or as a thermal plant that uses the water for cooling, then the effects on the other benefit categories mentioned before must be considered.

Defining the set of alternatives in this case is a very challenging task. Nuclear power is now coming of age as a source of generation. Pumped-storage units, in which reversible pump-generators can pump water up a hill when power is inexpensive and generate power when it is most needed, are also becoming available. For each alternative type of generation, there is the problem of what size plant to build, where to build it, and when to build it. Developing a good set of alternatives can become quite difficult indeed.

Modeling is also a real challenge in this problem. Establishing the benefits in terms of power generation costs for new alternatives, such as nuclear power in particular, is very complex. Modeling all of the effects of a plant on all of the nonpower benefit categories, including the effects on the environment, can be very difficult indeed. However, this is clearly necessary if an intelligent choice is going to be made. The current widespread concern about our environment demonstrates the importance of bringing these factors into consideration. If these effects are studied in detail and accurately modeled, then there is real hope for arriving at a plan that is satisfactory to everyone concerned. For example, if a constraint is imposed that no power plants of any kind are to be built on the river, then it is still possible to find the best available building plan. If this plan results in a large increase in power cost and a substantial decrease in reliability of the power supply, then the public may be asked to reexamine this restriction. On the other hand, if the revised plan results in no substantial increase in cost or decrease in reliability, then the new plan can be followed to the satisfaction of everyone.

Now I would like to consider briefly how the fourth step in the systems approach is carried out—namely choosing the best alternative. I will refer to this as the *system optimization problem* in what follows. If the first three steps are carried out faithfully so that the objective, alternatives, and system models form a realistic and consistent set, then this optimization problem will be quite difficult. For example, the model will generally express the objective as a nonlinear function of the alternatives. Also, many constraints will be placed on these alternatives.

In addition, there may be dynamic effects present; that is, an action taken now may influence the benefits obtainable at a later date. For instance, in our hydro problem there may be an apparent instantaneous benefit of running water through the hydro generating station at the highest possible rate; clearly, since this is generating the most power, it results in the maximum decrease in the present cost of generating from other sources. However, there is a limited amount of water stored behind the dam, and sooner or later this policy will deplete that water. Then, when the hydro plant can no longer be used, it is necessary to generate all power from the alternative sources. For typical alternate generation sources, this added cost of producing a very high output at a later time will far outweigh the advantages gained initially. It is thus seen that dynamic effects force consideration of long-term as well as short-term consequences. As in this example, the best alternative over the whole interval may well be quite different from the alternative that is best when only the present is considered.

Another element of the problem that may be present is stochastic effects. These reflect the uncertainty that is present about the future behavior of the system. In the hydro example it is clear that the inflow of water into the reservoir is subject to substantial uncertainty, primarily due to the uncertainty in future rainfall. Also, the demand for power over any future interval cannot be forecasted perfectly. These uncertainties can have severe consequences in systems problems, and it is important in many applications to consider them explicitly.

This brief summary gives an idea of the characteristics of the optimization problem facing the systems engineer at this fourth step. Optimization problems that had any—let alone all—of these characteristics were not remotely solvable 20 years ago. However, the advent of the digital computer has had a dramatic effect in this area. All are aware of the resulting increase in raw computing power that is now available and can appreciate the dramatic increase in the speed at which the computer calculations required in optimization problems can be performed.

It is my belief that the power of computers is going to continue to increase during the 1970s in the way it has in the past decade. A major factor in this further improvement is that the basic architecture of computers, as well as the essential hardware, is being improved. The recent development of parallel processing computers is but one example of this trend.

The improvement in computers has been accompanied by new developments in the mathematical techniques for solving optimization problems. Many of the new techniques have been motivated by the particular capabilities of the digital computer. For static optimization problems, that is problems in which there are no dynamic effects, a whole body of techniques—called *mathematical programming methods*—has developed. These techniques include linear programming, nonlinear programming, and integer programming. In addition, numerous investigators have developed other static optimization methods, ranging from techniques based on direct searth to highly sophisticated gradient search procedures.

Numerous methods have also been developed for dynamic optimization problems. Many investigators have developed dynamic optimization methods based on generalizations of the calculus of variations. These methods have had very extensive application, particularly in the aerospace and defense fields.

The technique that I have worked with most often is dynamic programming, which was first developed by Richard Bellman over 15 years ago. As the name implies, the method is based strongly on the structure of the digital computer. For a number of years the technique was regarded as an elegant but impractical tool. However, a combination of improved computers and improved algorithms for carrying out the calculations has enabled the method to achieve some of its early promise. The method has been particularly attractive in problems with severe nonlinearities, constraints, and stochastic effects. I personally believe the work of myself and others in applying this technique has only scratched the surface of its ultimate value.

Now, to give an idea of the problems that will be attacked in the seventies, I would like to review some of the work that my colleagues and I at Systems Control are pursuing.

One project that I have been proud to have been associated with over the last few years is the development of a ballistic missile defense system. As both friends and critics of ABM have been quick to point out, this is one of the largest and most complex systems ever conceived by man. The coordination of all of the parts of this system is one of the most severe challenges ever posed to systems engineers. I feel that the systems approach has already had a favorable influence on the development of the system, and I think that only by continuing to apply the most powerful systems techniques available to this problem will a system be obtained that achieves its goal of preserving the peace and security of the United States.

Space exploration has been the area in which some of the most spectacular and successful applications of the systems approach have been made. To the general public the Apollo project is the most visible endeavor that has made extensive us e of systems techniques. During the next decade further space exploration will clearly build on the techniques developed here. In addition, there will be increased application of this technology to advanced aircraft systems, such as VSTOL and the SST.

A related area is airline scheduling and operations. Here not only are vehicle dynamics important, but there is the additional problem of coordinating a large number of vehicles with different origins and destinations. Problems include planning fleet expansion, establishing schedules, and air traffic control. Clearly, these problems are becoming more difficult as the demand for air travel increases and the congestion at airports becomes worse. In addition, individual transportation modes are beginning to be recognized as part of a larger system, the total transportation system of the United States. I feel strongly that systems techniques will play a significant role in all aspects of the design and operation of this complex system.

Some of the complexities of our water resource system were touched upon earlier. The planning of future systems and the operation of the present system will continue to utilize systems methods in the next decade.

The electric power industry is currently undergoing tremendous expansion. The availability of new sources of generation, notably nuclear power and pumped-storage units, greatly expands both the generation planning and operations problems. Transmission and distribution of power is another problem area that is at least as complex as generation. Maintaining system security and reliability is still another very difficult problem that is now being faced. My colleagues and I have worked for several years on many aspects of all these problems for both investor-owned and public utilities, and I feel that only now is the true complexity of these problems being appreciated by systems people. Since the power capacity of the United States will at least double in the next ten years, and since there is increasing integration of not only the various operations within individual utilities but of the utilities themselves, I see a tremendous challenge to the systems engineer in this area.

Industrial process control is still another area where I feel that application of the systems approach will grow tremendously in the next decade. My colleagues and I have recently been working on some problems in the steel industry, and we have developed some methods that show promise of producing substantial savings in cost. For large industries such as steel, even a fraction of a percent improvement in efficiency can have a very large impact on profits. At the moment there have been disappointingly few publicized successes in industrial process control using modern systems analysis. However, I feel confident that systems theory has developed to the point where some very dramatic results will soon be forthcoming. Once the initial successes have been made, this area will grow rapidly.

The general area of management is still another area where the influence of the system approach should expand greatly in the next decade. My colleagues and I have been applying these methods to problems such as production scheduling and control, inventory control, distribution, and facility expansion planning. I observe an increased willingness on the part of management to apply advanced tools in these areas. There is no question that the systems approach will play a more important role in these problems as the decade unfolds.

There are many other exciting areas of application that I could discuss, and I would like to conclude by indicating what I feel are some trends in the application of the systems approach to the problem of the seventies.

First, I feel that increased emphasis will be placed on nonaerospace and nondefense problems. Areas such as environment conservation, pollution control, transportation, housing, education, medical care, and analysis of biological systems are beginning to receive attention from the systems community. In all of these areas, as well as many others, there is a definite need for improved procedures. In addition, the problems are so complex that an overall systems viewpoint is critical to coordinating an attack on the many aspects of the problem. Finally, with a few exceptions, these areas have received far less attention in the past from systems engineers than have the aerospace and defense problems, and hence they require more basic work. For these reasons I feel that these areas will have the most growth in the use of systems techniques during the next ten years.

Second, I feel that increased attention will be paid to overall systems problems rather than to subproblems. Recently the computers and the mathematical tools have reached the point where it is possible to take an overall view. However, much remains to be done, particularly in the area of decomposing a large problem into smaller elements such that they can be coordinated to solve the original problem. Nevertheless, the seriousness and complexity of the problems facing us in this decade will strongly motivate systems engineers to adopt a wider perspective in all application areas.

The trend of the last 20 years toward the use of realistic objective functions, better sets of alternatives, and more realistic system models will definitely persist. The increasing power of computers and mathematical techniques will continue to make this possible.

Greater emphasis will be placed on explicit consideration of stochastic effects. Work will continue on decreasing uncertainty by developing better estimation, identification, and prediction techniques. In addition, study will continue on developing s tochastic control techniques for operating in the face of the remaining uncertainty.

Finally, there will be an even further increase in the use of digital computers. Systems in which one level of computers control other levels of computers in a hierarchical structure will become commonplace. There will be further utilization of on-line, real-time computers, such as the popular mini-computers; remote-access time-shared computers; and local and remote large batch-processing computers. The development of better computer hardware will continue at a rapid rate.

In conclusion, I foresee a very exciting future for the systems area in the next decade.

OPPORTUNITIES

Remarks of Honorable Mention Winner

GLENN D. BERGLAND

at the Award Banquet

March 23, 1970

I feel greatly honored to have been selected for honorable mention by the Eta Kappa Nu Jury of Award. I am also honored that a number of the people responsible for my receiving this recognition are here to share this moment with me. I would like to give special thanks to Dr. Fletcher, who nominated me for the award, and to Mr. Jack Githens, who is my department head at Bell Laboratories and who has given me a great deal of help and encouragement over the last several years. Special thanks are also due to my wife, Marilyn, who has given me the understanding, encouragement, and occasionally even the criticism that I needed.

I believe that there were two major factors which led to my recognition by Eta Kappa Nu. The first major factor was that I happened to be in the right place at the right time. At Bell Laboratories, I was given the freedom and encouragement to pursue the things that I enjoyed. This led me to work involving the then new fast Fourier transform algorithm, and eventually this work led to several useful results.

The second major factor was my involvement with a special interest committee of the Audio and Electroacoustics Group of the IEEE. I feel that a large number of electrical engineers are overlooking the tremendous opportunities which are available to them through the IEEE technical committees and special interest groups. These people are missing a very valuable opportunity to meet and to learn from other people who are working in their field.

My personal involvement in a technical committee was a benefit which came through my involvement with the fast Fourier transform algorithm. Through this interest, I met a group of enthusiastic, hard-working, dedicated people who were acknowledged experts in the field of digital signal processing. While working with these people, and participating in several of the activities which their committee organized, I was able to share their enthusiasm, hard-work, and even some of their technical expertise. In addition, I enjoyed every minute of it.

I believe that the lesson to be learned is that we should encourage our people to make and take advantage of the opportunities which are present both inside and outside of our organizations. Being able to participate in the special interest group activities of the IEEE is most certainly an opportunity which can provide every electrical engineer both technical growth and personal enjoyment.

THE ENGINEER AND SOCIETY

Remarks of Honorable Mention Winner
WILLIAM G. SCHEERER
at the Award Banquet
March 23, 1970

Many articles have been written on the technical responsibilities of the engineer to society. My remarks are addressed to the nontechnical role of the engineer. The remarks are not directed at an audience as "involved" as this one tonight, but I believe they are relevant to today's problems.

You are used to looking for messages and meaning in your activities. You are an opposite of the man in this story: A minister worked hard preparing excellent sermons in an attempt to get some of his parishoners to change their ways. He particularly wanted to reach one man. This man was an exceptionally faithful church-goer, who rarely missed a Sunday; he was as reliable as a postman (until the postman's sacred image evaporated recently). One Sunday the weather was extremely bad—so bad that only the minister and this one man arrived at church. The minister preached his most direct sermon yet. The man, as he left, shook the minister's hand and said, "That was a great sermon. It's too bad they weren't here to hear it." Unfortunately, too many men today miss the messages sent their way.

The word "engineer" conjures up an image of a man well trained in mathematics and science. We have all heard that the half life of an engineer's education is 8 to 10 years. Education has been stressed, and it is important. I believe, however, that the most important aspects taught an engineer are to think logically and rationally. He is taught to attack a problem by first carefully defining it, then posing alternatives, selecting an approach, detailing a plan, and executing the plan, all the while evaluating the results and modifying his plan as appropriate. He is taught to think practically, to devise useful approaches. His experience prepares him to work with incomplete data.

Just how can an engineer contribute to the solution of the social problems of today? Many say by applying his technical skills to socio-scientific or multidisciplinary problems, such as environment, ecology, bio-electronics. This approach is useful, but not all of us can be so employed—there is a lot of other important work to do.

Others say that an engineer can contribute by applying the scientific method to problems in sociology or similar fields. This is of long-term value, but more immediate solutions are needed. Besides, this approach amounts to abandoning engineering.

I suggest that a meaningful method calls for the engineer to contribute to his normal technical job *and* to apply a rational, analytical approach to community problems.

Society has its radical left and right, its active left and right, and its silent majority, which is rapidly becoming a silent minority as we polarize. Few deny that we must move toward a more just society. We do not do this by radicalizing, left or right. Milton Mayer of the Center for the Study of Democratic Institutions in *Man vs. the State* said that "Liberty is the liberty of one obnoxious man"; this is a good definition but liberty does not belong to even one destructive man. The radicals of both sides refuse to listen to other views—on the right, they try to suppress them; on the left, to shout them down.

We also do not move toward a just society by saying that our responsibility is to raise our children to be "good," without reference to the world around them. This view is prevalent in the middle class, including many engineers. It is a policy of non-involvement.

We do move toward a more just society by devising rational solutions to the problems around us, and by working hard to implement them.

I submit that an engineer is in an excellent position to lead the uncommitted center to an active, non-radical, useful role in improving society. In other words, engineers can and should play an important nontechnical role in the future of our communities, nation and world—a role for which they are uniquely prepared by education, training, and experience.

DOWN MEMORY LANE: The next three pages, which are reproduced from BRIDGE, present a write-up of the first year of the award and photos of the first two award dinners.

ETA KAPPA NU RECOGNIZES

THE MOST OUTSTANDING YOUNG ELECTRICAL ENGINEER

At a dinner in New York, January 25, attended by more than 100, five young electrical engineers were signally honored. A reading of their achievements will belie those who are continually crying "youth has gone to the 'bow-wows.'"

A new epoch in the electrical industry has begun. For years our industry has celebrated, by awards of various kinds, the recognition of men who succeeded well in its profession. However, heretofore these awards invariably have gone to men of extreme experience and study; to men who, true, have accomplished much, but whose accomplishments were perhaps fully written. A recital of these often sent a thrill through its readers—as an epitome of what man can do throughout his lifetime. But these recognitions required a full life work to accomplish.

Now, our industry has an intermediate stage of recognition, a mile-post at which its young men can look back to note what they and their contemporaries have accomplished and ahead to dream of and plan and strive for what they will do.—*"Excelsior."*

The 1936 Award

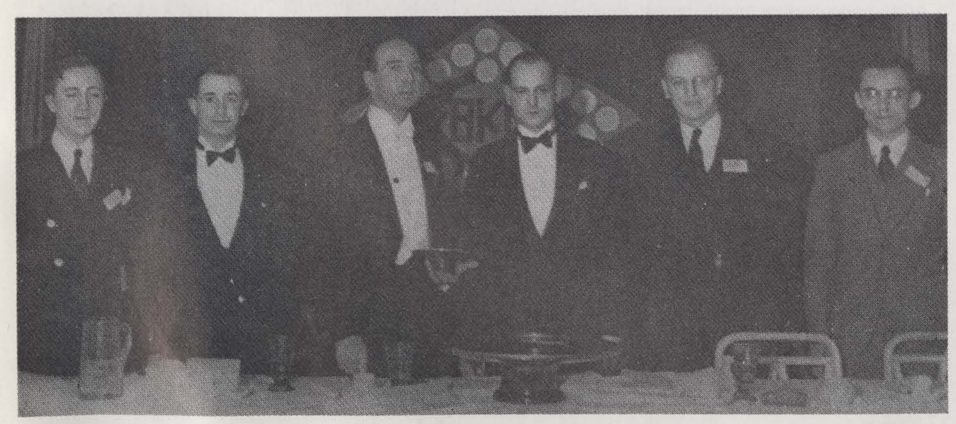
At a dinner attended by more than one hundred members, their wives and ladies, and guests from the electrical industry, Eta Kappa Nu Association, on the evening of January 25th, made its first awards in its Recognition of Outstanding Young Electrical Engineers for 1936. To say that the ceremony was a success would be putting it mildly. All during the occasion and afterwards, as old acquaintances were renewed and new ones made, were heard expressions of approval and thoughts of to what this new idea may lead.

Timed to occur during the midwinter convention of AIEE, the ceremony occurred in the city and at a time when many of the industry's well-known engineers and best educators were present: Charles Francis Scott, for years chief engineer of Westinghouse Electric and later of Yale University; Fred M. Feiker, now of the American Engineers Council; C. Francis Harding, of Purdue; Mervin S. Coover, formerly of University of Colorado and now head of Department of Electrical Engineering of Iowa State College; E. R. McKee, of University of Vermont; and—but to enumerate them all here would be practically reciting the roster of the faculty of the electrical engineering departments of the universities and colleges in which Eta Kappa Nu has chapters and of those institutions from which the recipients of the awards graduated.

Frank M. Starr First Awarded

Frank M. Starr, Rho '28, of the General Electric Company at Schenectady, was selected by the Jury of Award as America's Outstanding Young Electrical Engineer for 1936, and has the honor of being the first to have his name engraved on a large bronze bowl created for Eta Kappa Nu from subscriptions by her alumni. This bowl will be placed on display at the headquarters of AIEE in the Engineering Societies Building in New York. For his personal ownership, Frank was presented with a smaller replica of the large bowl and with a certificate of citation, carrying a brief résumé of his accomplishments.

Starr was chosen from among 47 nominees of accomplished young engineers by a committee composed of E. B. Meyer, president of the American Institute of Electrical Engineers in 1935-36; L. W. W. Morrow, until recently editor of *Electrical World;* the late General R. I. Rees; C. A. Butcher, Eastern Engineering Manager of the Westinghouse Electric and Manufacturing Company; and Everett S. Lee and R. I. Wilkinson, past-presidents of the National Executive Council of Eta Kappa Nu.



(Photo by Winkworth)

THE AWARDED AND PRESIDENT FAUST
Left to right: Seletzky, Boehne, Starr, Faust, Veinott, and Bellaschi.

THE HKN RECOGNITION—for 1937 OF YOUNG ELECTRICAL ENGINEERS

NOMINATION DUE FIRST OF MAY

By ROGER I. WILKINSON, Nu '24, NAB.
Chairman, Award Committee

A year ago the Eta Kappa Nu Recognition Plan for Outstanding Young Electrical Engineers was just getting under way. The national officers were concerned about many uncertainties as to its reception: the attitudes of the men nominated; the willingness of engineering and business executives named as references to write detailed replies; the coöperativeness of eminent educators and engineers to serve on a Jury of Award; all were problematical. Today, after the first year's highly successful award to Frank M. Starr of General Electric at Schenectady, and honorable mentions conferred on Peter L. Bellaschi and Cyril G. Veinott of Westinghouse, Eugene W. Boehne of General Electric, and Dr. Anatoli C. Seletzky of the Case School of Applied Science, we are in a position to make a first appraisal of the whole idea.

To Attention of Employers

As set forth in these pages a year ago, we believed, first, that there was a need for bringing the out-of-hour activities as well as the technical accomplishments of the more exceptional young engineers of the country to the attention of those in high position both in the engineer's own company and in other companies. The concrete expression from engineering executives, through answering by the hundreds the requests made on them as references for the nearly fifty young engineers nominated in the first year, seems strongly to suggest the great possibilities of this first aim of the Recognition Plan. Incidentally, every man nominated, whether eventually cited by Eta Kappa Nu or not, receives no inconsiderable benefit from being favorably called to the direct attention of one or more individuals higher up in his organization and able to influence his immediate or ultimate career.

The Twenty-inch Bronze Bowl
Presented by HKN and Permanently Displayed at AIEE Headquarters in New York City.
(The view to left is top view showing engraving; inset to right is perspective view of same bowl.)

A Bench Mark for the Profession

Secondly, the authors of the Recognition Plan had the belief that the engineering profession as a whole would be greatly interested in obtaining actual case histories of young men at the beginning of what promise to be distinguished careers. A bench mark, so to speak, would gradually be set up against which other young engineers' activities and achievements might be measured. Signs of such comparisons being initiated here and there are already evident. In addition, the salutary effects of critical personal comparisons by other young engineers of the same age as those whose attainments are publicized are, although indeed intangible, potentially of great importance. A young engineer in his late twenties or early thirties is by no means too old to take new stock of himself, and direct his energies into activities more advantageous to himself and to the community.

An Incentive for New Graduates

Finally it was hoped that by presenting each year new and living examples of exceptional young electrical engineers, and briefly sketching what they had accomplished during, and out of, office hours, new graduates of our engineering colleges would observe the methods used, and gain some inspiration and insight for planning more effective careers for themselves. To this end, the successful candidates (whose biographies were published in the last issue of *The Bridge*) were invited to present at the Award Dinner this year some of their views on the attitudes they believed young engineers could well afford to adopt in order to better assure their success. In this issue of *The Bridge*, and in succeeding issues, their remarks will be reproduced.

Your Opportunity to Help—Nominate

The opportunities for alumni and undergraduate chapters to forward this newest major activity of Eta Kappa Nu are many. The various local groups of brothers can readily canvass a considerable number of their members to determine who have made exceptional records; likewise they are likely to discover outstanding men who are not HKNs in the industries where their members or alumni have connections.

Nominations for 1937 Due May 1, 1937

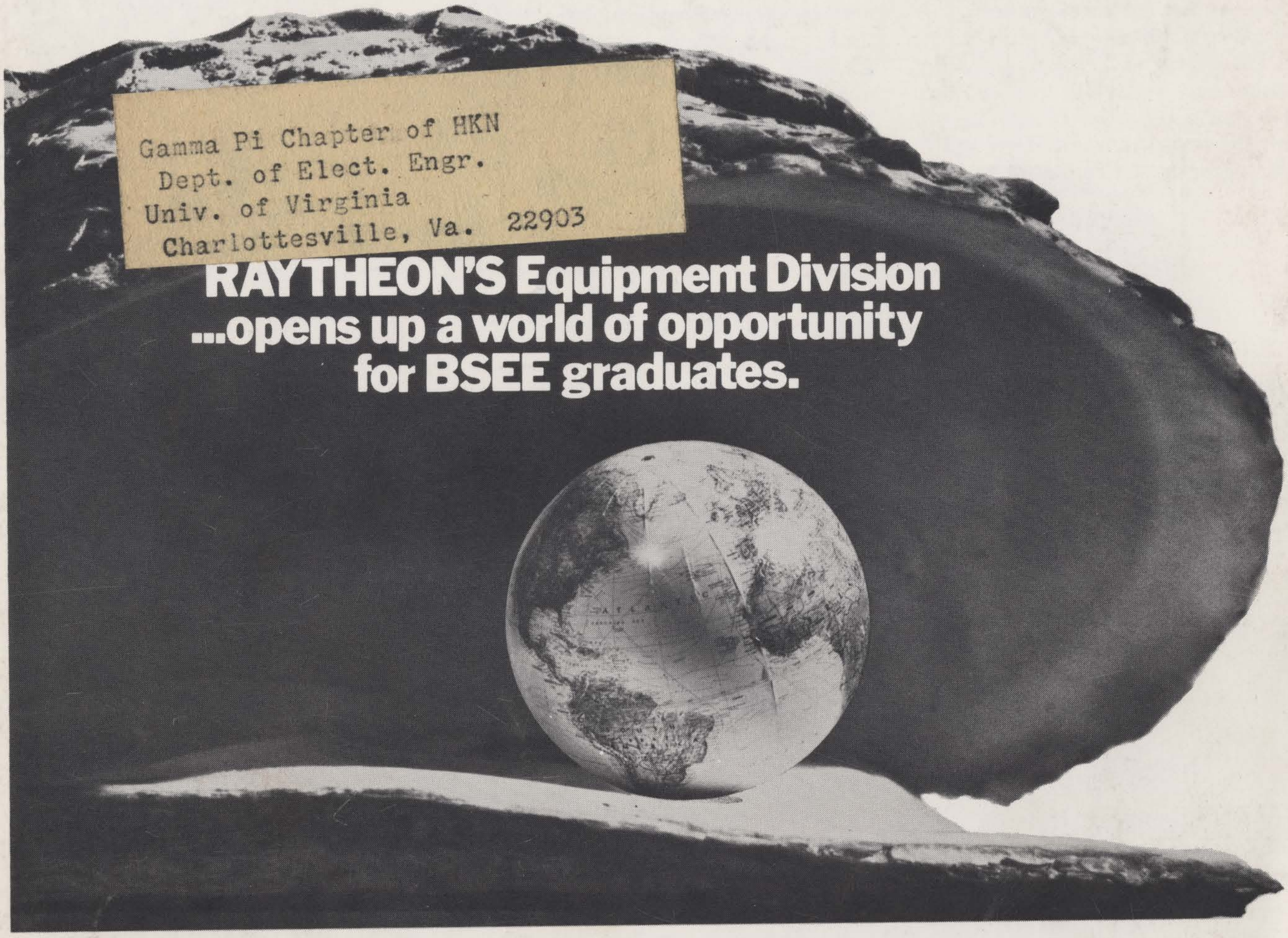
It should be remembered, too, that individual members of Eta Kappa Nu can, and are urged to, propose candidates for the Recognition. The qualifications for the 1937 Recognition remain the same. Any engineer who has graduated since May 1, 1927, from the 4-year electrical engineering course of any American college, and who is under 35 years of age, is eligible. He need not be an HKN (only one of this year's five selections was an HKN as an undergraduate). Remember he should have high technical accomplishment *coupled with* activity for his fellow engineers, the community, state or nation. He should preferably display evidences of cultural development. The zero hour for nominations is May 1, 1937. Open season for outstanding young electrical engineers is on. Nomination blanks, as last year, are being mailed to electrical departments of all recognized American colleges, to our active chapters, and to our alumni chapters. Individuals not receiving these nomination blanks may obtain copies from the Editor of *The Bridge*—see pages 1 or 24 for address.

The First Award Dinner January 25, 1937

At the Speakers' Table (in background), left to right: O. H. Loynes, Prof. C. F. Harding, L. L. Carter, Gano Dunn, R. I. Wilkinson, Chauncey Guy Suits, Morris Buck, Dean Bush, Philo T. Farnsworth, O. W. Eshbach, B. F. Lewis, and A. B. Zerby. (In the extreme left foreground is E. W. Boehne, winner of Honorable Mention of 1936.)

The Award Dinner of January 28, 1938

At the Speakers' Table (in left background), left to right: E. W. Boehne; M. S. Mason; Prof. V. Karapetoff; Morris Buck; Frank M. Starr; Clifford A. Faust, toastmaster; C. F. Scott; F. M. Feiker; A. B. Zerby; C. G. Veinott; R. I. Wilkinson; P. L. Bellaschi; A. Paone. (E. S. Lee and A. C. Seletzky cut off from extreme left by photographer.)



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