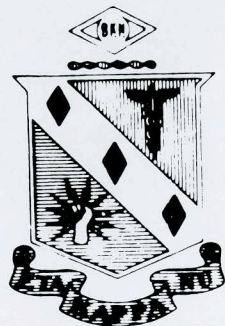




BRIDGE

Eta Kappa Nu

An Educational Journal



Editor and Business Manager
Paul K. Hudson

Contributing Editors

George Brown
Jim D'Arcy
Marc Dodson
Oscar Dodson
Larry Dwon
Alan Lefkow
Howard Sheppard
George Swenson

February 1988
Volume 84 No. 2

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

The BRIDGE is published four times annually: November, February, May, August and is published by Eta Kappa Nu, Haywood Printing Company, 5th & Ferry Sts., Lafayette, Indiana. Second class postage paid at Champaign, Illinois and additional mailing office: Eta Kappa Nu Association, Subscription price, three years, \$7.50; Life Subscription, \$30.

Address editorial and subscription correspondence and changes of address to BRIDGE of Eta Kappa Nu, P.O. Box 2203, Station A, Champaign, Illinois 61820.

by Irving Engelson Chairman, Award Organization Committee

1986 marked the 51st anniversary of the Outstanding Young Electrical Engineer of the Year Award. Last year, Eta Kappa Nu celebrated the award's Golden Anniversary with an historical overview of the accomplishments of the award through the demonstrated achievements of the awardees. A book that chronicles the history of the past 50 years of the award was published and the Golden Anniversary Awards Banquet was, in itself, a memorable occasion which will long be remembered by those who were privileged to attend.

This year was the start of the second half-century of the award. As I am reporting on this 51st awards recognition banquet, I realize how much more difficult it becomes from year to year to say something new and exciting about the award. After all, 50 years of continuous achievement clearly deserves to be described as excellence in steady state, and there is not much new one can say about a steady state condition. On the other hand, human ingenuity and creativity appear to be almost limitless, always changing, always revealing a new facet for the first time. Thus, if we achieve a steady state, it is one of change, or as the old French proverb states, "The more it changes the more it remains the same."

The young electrical engineers who were honored during this 51st year of the award again demonstrated that steady state does not imply a constant condition but rather one's ability to extrapolate future expectations based upon a long and well established past. The young engineers honored in 1986 reinforced our faith in the contin-

ued standing of the award. The faces and personalities may change but their creative intellects continue to operate at the highest level. Yes, the more it changes the more it remains the same.

The 1986 awards banquet was held in the New York Marriott Marquis in New York City. James A. D'Arcy was Master of Ceremonies. The keynote address was presented by Henry L. Bachman, 1987 President of the Institute of Electrical and Electronics Engineers, Inc. (IEEE). His address was on "Professional Excellence—A Prerequisite for Productivity and Competitiveness." Mr. Bachman stressed the importance of excellence, as exemplified by the activities of Eta Kappa Nu, in achieving increased industrial productivity and market competitiveness.

The Outstanding Young Electrical Engineer Award for 1986 went to Michael Keith, a member of the Technical Staff at the RCA David Sarnoff Research Center in Princeton, New Jersey. Mr. Keith was recognized for his "outstanding contributions to the fields of computers in the arts, teletext systems, and in church and cultural activities." Honorable Mention was awarded to Ms. Lauren A. Christopher for her "contributions and leadership in digital integrated circuit design and participation in civic and cultural activities." Mr. Keith's and Ms. Christopher's acceptance remarks reviewed the profound influence that family and associates had on their professional and intellectual development. Three engineers were recognized as Finalists: Russell T. Fling, Indianapolis, Indiana; Gary Gendel, Somerville, New Jersey; and Steven D. Krueger, Dallas, Texas.

New York...

AWARD DINNER

The awards were presented by Mr. Alan Lefkow, 1987 President of Eta Kappa Nu. Mr. Howard H. Sheppard, a Past President of Eta Kappa Nu, acted as photographer for the event. Mr. Sheppard has demonstrated his excellent photographic talents during many past banquets. He, too, has established a steady state condition of activities as we can always rely on his willingness to contribute his photographic talents to these events and the excellence of his products. The

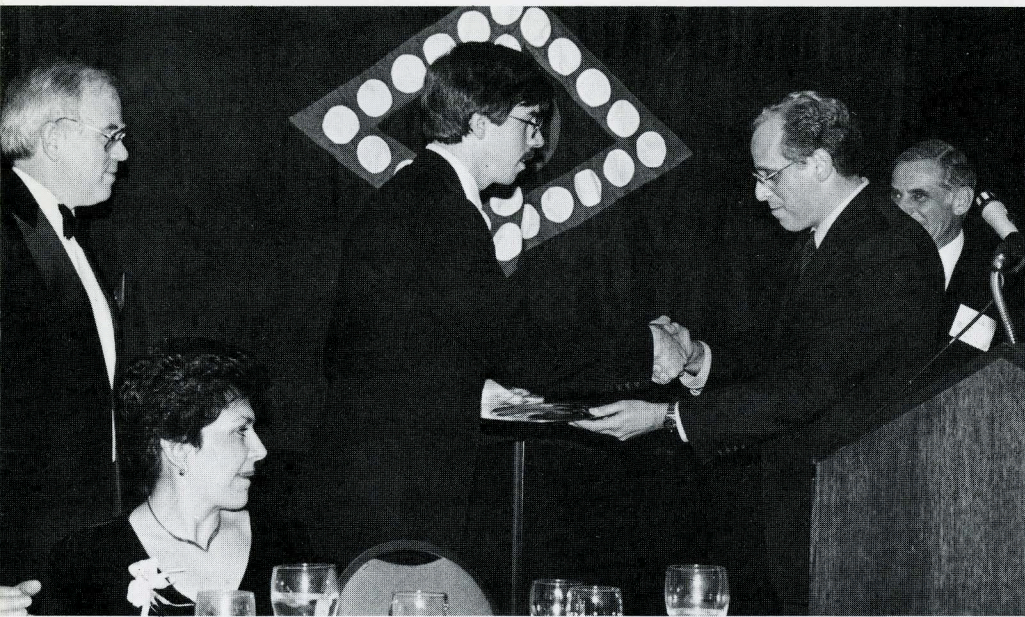
banquet was expertly planned by the Recognition Dinner Committee under the Chairmanship of Michael R. Hajny.

Other members of the audience were composed of the Eta Kappa Nu Board of Directors, leaders from industry and academe, and members and friends of Eta Kappa Nu. Included in the audience was Dr. Luo Peilin, from Beijing, China, who is a Fellow of the IEEE and was the first Chairman of the IEEE

Beijing Section. Dr. Luo was very impressed by the high ideals of Eta Kappa Nu and its stress on excellence in technological and socioeconomic achievements.

The banquet was adjourned with full confidence that the start of the second half-century of the award is now based on a well established tradition and that the award, just as Eta Kappa Nu, continues to have a bright future in the history of the electrical engineering profession.





HKN President Alan Lefkow presenting certificate to the winner, Michael Keith.

Dr. Henry L. Bachman, President of the I.E.E.E. at the podium.



Mrs. Keith; Mrs. Carla Wilkinson, wife of the founder of the award; Michael Keith, holding large recognition bowl.



Dr. Irving Engelson, Chairman of the Committee at the podium.



Mr. Jim D'Arcy, Master of Ceremonies and former Award Committee Chairman at the podium.

H.K.N. Board of Directors pose for a group picture. l to r. Alfred Arnold; Robert Arehart, Laureen Parker; Jean L. Delcroix (Paris, France); Harold Knudsen, V.P.; Alan Lefkow, Pres.; Eugene Mlecsko; Paul Hudson, Exec. Secy.



Robert Arehart, Director; Past Director George Balderston and wife Marge; Mrs. Helen Arehart.



L to R. Bert Sheffield with guest; Mrs. Carla Wilkinson; Mrs. Beatrice D'Arcy; Dr. Jay Brandinger, Staff Vice Pres., Sarnoff Research Center.



Table reserved by the New York Power Authority.

Past President and Official Photographer Howard Sheppard (left) and President Al Lefkow.



Dr. and Mrs. Peilin Luo from Beijing, China; Henry L. Bachman, President of I.E.E.E.



Two Editors compare notes. Paul Hudson, Editor of Bridge (left) and Don Christiansen, Editor of the Spectrum of I.E.E.E.



Drifting Around the Kingdom

Part One

The White Rose

Years ago when my youngest daughter was in college, she had a large poster on the wall of her dorm room that asked in big letters: WHAT IF THEY HAD A WAR AND NO ONE CAME? This is not very likely as people seem to love wars.

Probably the most romantic name that was ever given to a war was the WAR OF THE ROSES. The name alone might have made a guy want to sign up and fight. It would not have been a good idea however, because that particular war was one of the most cruel ever waged. The name came about in a rather left-handed way. The war was fought between the Duke of Lancaster and the Duke of York—those two Shires anyway. The emblem of the house of Lancaster was the Red Rose and the emblem of the House of York was the White Rose. Nowadays the city of Lancaster is not very important but the City of York is one of the most important and interesting cities in Great Britain.

York, under the name Eboracum, was a Roman military center of the greatest importance. It was there that there occurred an event which was to be followed by consequences momentous for the history of the world. In A.D. 306 Constantius, ruler of the west, died among his troops in York, and they immediately acclaimed his son Constantine as Caesar. At the time

the empire was not under unified control, but within a few years he had become sole emperor, and in his march to power had assumed the role of protector of the Church. With him began the alliance of Church and State which was to form basis of the Christian civilization of the Middle Ages.

We arrived in York, on a beautiful morning in June and checked into the Viking Hotel. It is, I think, the only four-star hotel in town. The young lady desk clerk stated, with a smile, that she had put me on the top floor which, at that hotel, is the eighth. I told her that I did not want to be there but would like the lowest floor available. She replied sweetly, "But Mr. Hudson, we selected this room especially for you. Maybe you would want to take a look at it before you turn it down." That startled me a bit. I did not remember any hotel selecting a room especially for me at any time in the past, so I decided to look it over. As soon as I walked in I saw that it had been refurbished and it was very lovely. More than that, it contained all sorts of conveniences including something I had not seen before—an automatic pants presser. I hasten to say that you take them off first. Then I walked over to the window. The air was clear and crisp and bright and cool, and there before me was a breath-taking view of the York Minster—the Cathedral of York and seat of the Primate of England. I realized that I had been given the most desirable room in the place, but I did not know why. I think I discovered that later. During my stay in York I saw several commercial photographs of the Minster on sale in the stores and many of them had been taken from our room. Some readers who are

Left—The Nave of the York Minster where we heard Verdi's Requiem sung. Note the object protruding into the Nave at upper left (above the arch but below the window). I asked several church officials what it was and got a different answer each time. The answer that is most likely correct is that it is a serpent that guards all the Minsters (people) from harm.

by PAUL K. HUDSON
Editor—Bridge



The York Minster Cathedral. Photo taken from the window of our room in the Viking Hotel.

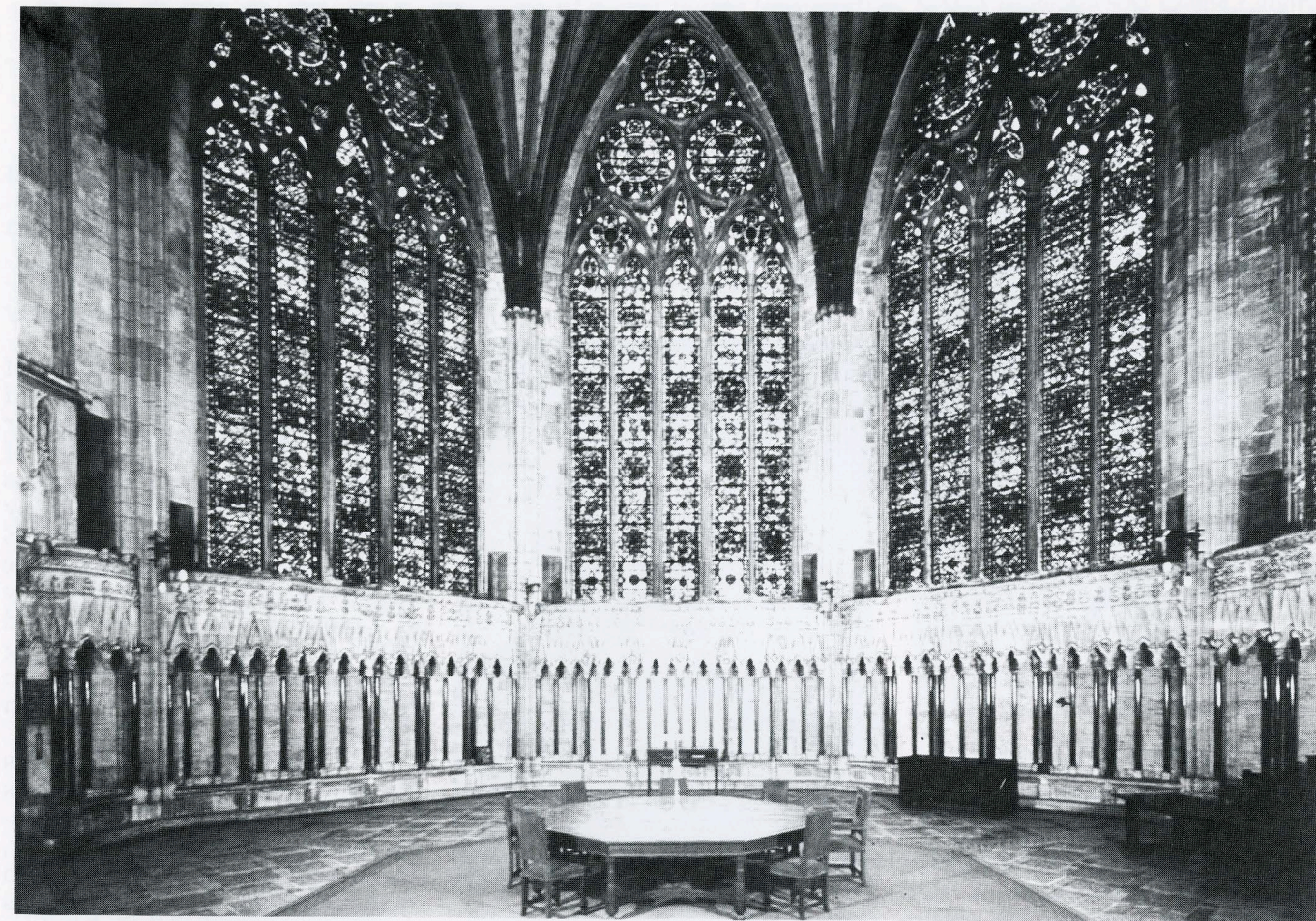
familiar with England might be tempted to tell me that I had made a mistake—That Canterbury, not York is the seat of the Primate of England. Norman archbishops often resisted the claims of the see of Canterbury to precedence, and the dispute was not settled until the fourteenth century. It was then that the present titles of the two archbishops were defined by Pope Innocent VI—York was to be the Primate of England, but Canterbury was to be the Primate of all England. I do not know what “all England” includes—maybe the illegal aliens and heathens.

I never do much planning when I go anyplace but I often have a bit of luck. Without knowing anything about it ahead of time we had, by luck, arrived in York at the time of the annual York Festival. There were about a half dozen concerts and plays taking place in the town each evening. On the first night I tried to get into some of them but they were sold out. So the next day I went to the tourist office to see what shows were still available. The young lady at the desk said, “I am sorry but almost everything is sold out for this week. However, tomorrow night in the Minster a choir is going to sing Verdi’s Requiem and the next night the Chapter Choir of the Minster will sing a concert in the Chapter House. I was astonished by my good luck.

To hear Verdi’s Requiem sung anyplace is a treat to remember for always, but to hear it sung in the York

Minster would be a thrilling experience beyond all telling. However, the lady had not given me the entire story. When we arrived we discovered that “the choir” she had mentioned so casually was actually made up of five hundred voices that had come there from all over Great Britain just for this occasion. They were formed in the shape of a U, with a large symphony orchestra in the center. This was by far the most impressive concert I had ever attended. When they hit the loud notes there was just solid music in the air. I thought they might shatter some of the windows in the Minster. At one point I said to myself, “Oh God, please make sure I live to the end of this—I wouldn’t want to miss any of it.” The concert lasted almost two hours with no intermission and when it was finished I just sat there wishing that they would do it all over again.

We walked over to some of the singers on one side of the U and congratulated them. I commented on how the voices blended together in the Minster. One replied, “We couldn’t hear anything except ourselves, and we couldn’t hear ourselves very well. They explained to us that although the orchestra was from York, the singers had come from Scotland, southern England and all over. As I stood there looking at one of the



The Chapter House of the York Minster Cathedral where we heard a lovely concert by the Chapter House Choir.

singers our eyes met for a moment and she anticipated my next question. “We love the Minster” she said. I was deeply touched by that. Every country should have national treasures that people love and want to serve for the joy of it. She explained that although they had rehearsed for only one day, that was all they needed because all of the singers had sung the Requiem elsewhere.

The Chapter House Choir the next night was quite small by comparison but their voices were lovely and perfect. The Chapter House at York Minster is the largest in the world that does not have a central pillar. The vault was exquisite.

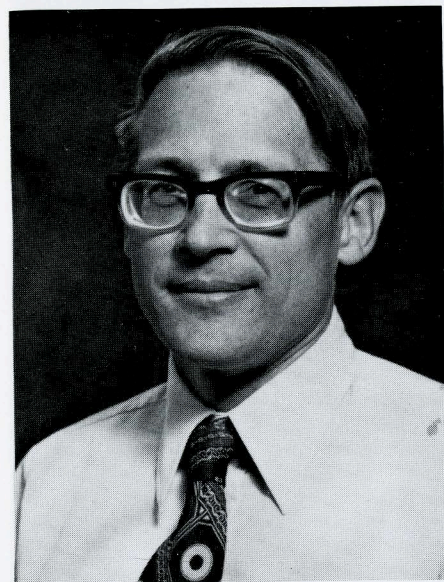
During a Sunday morning service in the Minster the *Te Deum Laudamus* was sung. In English translation the opening words are:

*Infinite God to thee we raise
Our hearts in solemn songs of praise
By all thy works on earth adored
We worship Thee, the common Lord
The everlasting Father own,
And bow our souls before Thy throne.*

The *Te Deum* is one of the oldest and most famous hymns of Christendom. It was written about 400 A.D. If any music student would like to write a thesis on this great hymn, I can give him a small start. When Christopher Columbus came back from the New World, Isabella required that the *Te Deum Laudamus* be sung by the entire congregation before she would listen to his report. However, I have to say that I have never heard the *Te Deum* sung in America, in either Latin or English. Maybe I do not hang around in the right places. But I got the impression that it is sung so often in the York Minster that the people take it for granted.

A week or so after we left York, the Minster was hit by lightning and burned. The roof burned off and I presume the choir stalls went with it. I was so glad that I was gone and did not have to stand at the hotel window and watch it burn. The damage was estimated at about two million dollars. The reason it burned, of course, was because the lightning rods were not installed properly. I have seen some cathedrals that sooner or later will have the same disaster. People who install lightning rods do not realize that the wire going to the ground must be straight—with no curves or square corners. You cannot make lightning turn a corner. Continued.

NEW OFFICERS AND DIRECTORS



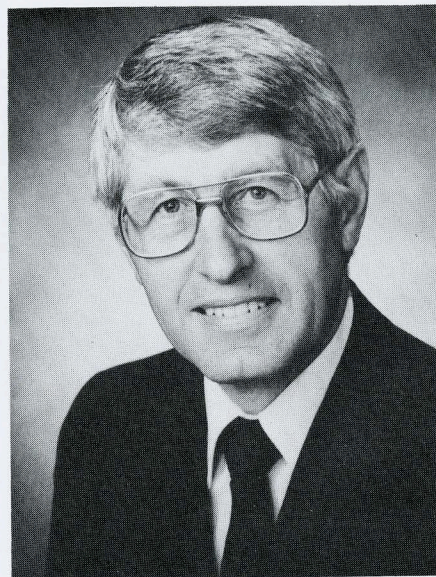
**Harold Knudsen
President**

Harold K. Knudsen is Professor of Electrical and Computer Engineering at the University of New Mexico. He received his undergraduate education at San Francisco City College and at the University of California at Berkeley, receiving his B.S.E.E. degree in 1958. He continued his studies at the University of California, receiving his M.S. and Ph.D. degrees in 1960 and 1962, respectively.

He joined the staff of the M.I.T. Lincoln Laboratory where he studied problems in optimal control and digital differential analyzers in 1962. In 1966 he left Lincoln Laboratories to become Associate Professor of Electrical Engineering at the University of New Mexico. His main areas of interest have in applications of system theory and in digital system design. In the last several years his work has been primarily in the development of new methods for the description, analysis, and design of communicating digital processes. He has been a Visiting Staff Member and a Collaborator with Los Alamos National Laboratory in support of this work.

Dr. Knudsen has served on the International Board of Directors of Eta Kappa Nu. He is the Faculty

Advisor of the Delta Omicron Chapter, and is technical advisor to the project. He is a member of Eta Kappa Nu, Tau Beta Pi, Sigma Xi, Phi Beta Kappa, and the IEEE.



**Virgil Ellerbruch
Vice-President**

Virgil George Ellerbruch was born in Bloomfield, Nebraska and at the age of five years the family moved to Wyoming. All schooling was in Wyoming. Higher education began with the two-year college in Casper and ended with the Ph.D. at the University of Wyoming.

Kinnear, Dubois, Lander, Casper, Cheyenne and Laramie have all been residence cities in Wyoming. A small school at Kinnear was attended for ten years and then a move made to Lander. The high school graduating class at Lander had 34, so like many South Dakota students the schools attended were rather small.

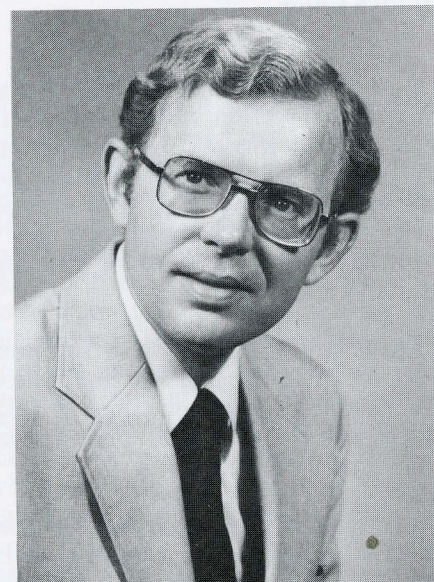
Five years were spent as an automotive engine rebuilder before and while attending college. Industrial experience with missile systems was gained at Cheyenne and Salt Lake City, Utah.

Present professional interests are in electronics and microcomputer systems. A strong interest in under-

graduate and graduate teaching also creates much satisfaction. Research activity has always been agricultural related. The Ph.D. dissertation was with the microbiology department at the University of Wyoming.

Dr. Ellerbruch is a member of Eta Kappa Nu, Sigma Tau, Phi Kappa Phi, and Tau Beta Pi honor societies. He is a past member of Sigma Xi. Professional memberships are held in NSPE (National Society of Professional Engineers), IEEE (Institute of Electrical and Electronic Engineers), ASEE (American Society of Engineering Educators) and SDES (South Dakota Engineering Society). Memberships are held in Kiwanis and Mt. Calvary Lutheran Church.

The Ellerbruch family includes his wife, Georgan, three daughters and one son. Hobbies include family activities such as sailboating, water skiing and pool, and also square dancing. Spectator sports are also enjoyed.



**John Mitchell
Director**

John "Jack" D. Mitchell is a Professor of Electrical Engineering at The Pennsylvania State University.

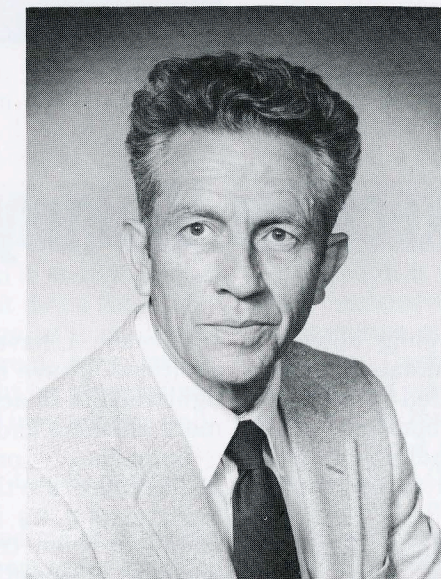
He and his wife, Louise, have two sons, Stephen and Andrew. Jack received his B.S. Degree in Electrical Engineering from The Pennsylvania State University in 1966. As an undergraduate, he became a member of the Epsilon Chapter of Eta Kappa Nu Association. He continued his graduate education in electrical engineering at Penn State, earning an M.S. Degree in 1968 and a Ph.D. Degree in 1973. While working on his Ph.D. thesis, he also fulfilled his R.O.T.C. active-duty obligation with the U.S. Army as a first lieutenant at Fort Benning, Georgia.

As a Ph.D. student, he was a Research Assistant/NSF Trainee with the Ionosphere Research Laboratory. His research involved instrumenting rockets with probes to measure the electrical properties of the middle atmosphere (30 to 80 km). A very supportive thesis advisor (Leslie C. Hale) allowed him to define and conduct his own rocket experiments—a total of four different campaigns—at White Sands Missile Range, New Mexico. The results of this research were presented at an international symposium in Madrid, Spain—a big reward for a graduate student.

The experience at White Sands led to his first job after graduation, a faculty position with the Department of Electrical Engineering at The University of Texas at El Paso (UTEP). This university's close proximity to White Sands presented an excellent opportunity for continuing this area of research with support from the Atmospheric Sciences Laboratory. Although relatively small in number, a very talented and committed electrical engineering faculty provided an invaluable experience for a young Ph.D. wanting to pursue a career as a university professor. One of his responsibilities was serving as faculty advisor to the student chapter (Zeta Delta) of Eta Kappa Nu Association. Jack spent seven years as a faculty member at UTEP, being promoted to the rank of Associate Professor.

In 1980, he returned to his alma mater as an Associate Professor of Electrical Engineering. On his first day on the job (February 1), he boarded a plane for Kenya with his old colleague, Les Hale, to conduct

a series of rocket flights for investigating a solar eclipse. His more recent rocket investigations, supported by NASA, have included studies of other interesting phenomena such as aurora (Norway, Alaska), the equatorial region (Peru), thunderstorms (Wallops Island, VA) and noctilucent clouds (Sweden). His activity with Eta Kappa Nu also has continued as the faculty advisor of Epsilon Chapter since 1980. In addition to his teaching and research, he has been involved with the advising of graduate students and undergraduate University Scholars, students who have distinguished themselves academically at Penn State. He also has been active in the administration of the Central Pennsylvania IEE Section, and just completed a year as its chairman.



**Stuart McCullough
Director**

Stuart McCullough comes from northern Minnesota, and graduated from the University of Minnesota in 1944 with a degree of BEE. Currently he holds a PE license in Ohio and California, and is the holder of 8 US patents. Professional work has been principally in the fields of design and fabrication of instruments, mechanisms to support electronic systems, and the electrical/mechanical interface area.

Subsequent to graduation Mr. McCullough spent 7 years with the

NACA (now NASA) Lewis Laboratory as an Instrument Research Engineer. Projects included the NACA statistical ice rate meter used to collect data defining the severity and frequency of icing conditions on major air routes, and a camera to photograph cloud particles from an aircraft.

This was followed by a period of self-employment as a consultant and a machine shop operator. The latter activity included the development of an electronically controlled tracer mill with optical sensors.

Since 1958 Mr. McCullough has worked in the southern California aerospace industry. Assignments included Project Engineer on the AN/MPQ-T2 radar at what is now the Tasker System Division of Whittaker Corp. He is currently with Hughes Aircraft in Buena Park, CA, with responsibility for a group of sensors on a military program.

He has been active in the Los Angeles Alumni Chapter of Eta Kappa Nu since 1958, and served as Chapter President in 1965. Other organizations include Tau Beta Pi and IEEE.

Iota Kappa Chapter, Montana State University—The Iota Kappa Chapter at Montana State University has had a productive Spring Quarter. Twenty new members were initiated at a banquet that featured Dr. John Hanton as a guest speaker. In addition, the chapter has had success with the projects that were started at the beginning of the year.

As a fund-raising activity, the chapter has provided the university students with a tutoring service. The tutoring service has been successful in helping many students with engineering subjects as well as other educational disciplines.

For the 1986-87 academic year, the chapter assisted faculty advisors in giving preregistration advice to freshman and sophomore students. In addition, a Senior Directory of electrical engineering students was compiled and made available for all students.

by Patrick Nanto

and part of which I was

Recollections of a Research Engineer

George H. Brown



Executive Whimsy

A few weeks ago as we were traveling down a highway at a speed well within the mandates of the law, an extra-large black limousine hurtled by us. The only visible occupant was a liveried chauffeur. The side and back windows were black, indicating that the distinguished passenger, invisible to us, could view us—if he wished to do so.

My wife said, "I guess that person does not want to be seen."

I replied, "There is a difference between being seen and being noticed. If that fellow really wanted to be inconspicuous, he could have an ordinary Cadillac with plain glass windows."

This episode took my thoughts back over many years when I have known a wide variety of so-called executives, from middle management to those at the top of the heap. I have known many real people who have achieved their positions on merit and hard work and have not been concerned with demonstrating their importance at every turn. If one is to be cynical about executives, one must exclude these folks from this essay and confine oneself to the misplaced little people who have achieved positions which require that their egos be massaged quite frequently. According to Archimedes principle, light weights rise to the top and that applies too often to executives as well as to other inert objects.

Because I have spent many years in executive positions, I have been able to observe some of these lightweights in action and to now relate a few of the more amusing and revealing idiosyncrasies.

Immediately on reaching executive status, one must redecorate the newly-acquired office, no matter how tasteful its initial state. A number of potted plants or even trees are mandatory. A coffee pot must be discreetly hidden behind the curtains so each visitor may be impressed by the availability of a cup of coffee.

Next the desktop must be cleared of all papers which are stuffed into desk drawers, a visible mark of efficiency.

As soon as the budding executive has cleared his desk, he must admonish his secretary that he will take no calls and is not to be disturbed. Then he sits down to develop a more impressive executive signature. The signature soon becomes a batch of illegible curliques. On one occasion, I received a letter signed by an assembly of vertical lines which made me remember my seventh-grade penmanship teacher who chanted, "Up, down, up, down—." Since I found such pretentiousness a bit disgusting, my secretary and I cut out the signature and pasted it and a copy on the envelope and the letter. In a short time, back it came with a note asking that we further identify the addressee.

Executive dress usually comprises button-down shirt collars, cuff links, and very thick knots in the ties. Then a box-like attaché case must be acquired so one can consult papers to impress any lucky minion who may be offered a ride in the executive limo.

To really establish executive importance, it is felt to be effective to be the last to bustle into meetings, preferably a little late, having already arranged to have the great man's secretary pop in at intervals to deliver discreetly-folded notes. After reading each message, the receiver nods to his patiently waiting secretary thus conveying some message not intelligible to the rest of us.

I remember well another note-passing episode. I was a member of a corporate committee chaired by a particularly pompous vice president. In the midst of one meeting, he referred to a certain report by number as an explanation of a major decision he had made. Quite innocently I asked what the 10-K report might be. The chairman frantically riffled through a pile of papers in front of him. He then turned to an assistant on his right who also began to riffle his papers to no avail. Soon the assistant on the left of the chairman joined the search. After a suitable interval, the chairman promised to produce the missing information at a later date and then adjourned the meeting much earlier than usual.

Two weeks later we met again. The meeting dragged along with the usual trivia. I sat at one end of a long table and Elmer Engstrom sat at the other end. Because he was the newly elected president of RCA, his every move was noted with curiosity, respect, and alarm. Finally Engstrom busily wrote a note on a small piece of paper, folded it neatly, wrote my name on the paper, and started it down the table to me. All eyes were on the message as it made its way to me and there was discreet speculative whispering as to what my order might be. On reading the message, I immediately followed instructions and the meeting quickly adjourned.

The note read, "Please ask about the 10-K report so we can go home early."

At one time, my secretary informed me of an edict issued to his secretary by a very important executive vice president to the effect that a telephone caller must be on the line before the important man could take a call. I found it satisfying (to me) to call the man's secretary myself and then hand the telephone to my secretary who was thus innocently on the line when the great man responded. News of my antics quickly spread and the act of handing the phone to one's secretary became so prevalent that the request routine from that executive office ceased.

Another amusing event occurred regularly on the days when the board of directors met at the corporate headquarters. I observed (and so did the company chauffeurs) that on these days large numbers of vice presidents of varying degrees of importance converged on the corporate headquarters. Each was hopeful that he might be elected to the board on that day and he wished to be readily available in case the board in its wisdom desired to invite him to join the board and accept congratulations. I knew from

experience that was not the way it was done.

At one time in my career, I was associated with two executives who were as different as different could be. One man feared to make decisions even as where to lunch. His department was often marking time waiting for a tiny semblance of a decision while he was figuratively wringing his hands. The other person made decisions on the spur of the moment with little or no facts to guide him. He shouted orders continually, left no room for initiative on the part of his subordinates, and left his operations in a state of confusion as he dashed from one project to another, issuing a stream of unintelligible commands. Unlike the proverbial bull in a china shop, he more resembled a bull who carried his china shop with him.

These two men had completely different views of management-committee meetings. The noisy one liked to "run his own shop" because he was certain that he was much more knowledgeable than a committee. He jumped from one crisis to another so that he was not able to make a coherent statement to a committee. He also seemed to measure his contributions to the company by putting in long hours daily and on weekends.

The other man seemed to take comfort in putting his dilemmas in the hands of a committee. He apparently thought that his problems had been solved when the committee reached an apparent conclusion such as "Perhaps we should reserve a decision until we research it a little more."—"We might establish an ad hoc subcommittee."—"We must not make a firm decision until all the returns are in."—"Let's have another meeting before we make a firm commitment."

Although it was hard to believe, I heard that our chief executive of the moment had ordered the construction of his very own podium which traveled with him. I asked his chief flunky why it was special. He replied that the boss could have his speech arranged on the podium in advance of his performance and so placed that the audience would not know he was reading the speech. Actually even with one's eyes closed, one could readily recognize that the speech was being read.

My first sight of the magic podium came at a corporate meeting held at a resort hotel in the hills of Pennsylvania. An extra-large station wagon carrying the podium arrived shortly after a large limousine bearing a bevy of strong men to carry the podium to the speakers' platform.

Ten minutes later, the great man arrived in a huge conveyance which could easily have accommodated the speaker, the podium, and the outriders. As I listened to the stilted speech, I wondered what it would have been like without the custom-built podium.

A few months later, this CEO was asked to address a meeting of RCA engineers in Indianapolis. The man's chief flunky informed me that there was a problem of logistics since the CEO was scheduled to speak in Los Angeles two days later. I innocently assumed that there could be no problem in securing a flight from Indianapolis to Los Angeles which would even allow a day of rest on arrival. I was informed that the problem of logistics related to the podium.

GEORGE BROWN

Public speaking by most executives is remarkable. I have always felt that if an executive cannot write his own speech, he should not make a speech. It is amazing to hear an executive who is the most inarticulate luncheon companion mount the platform and casually quote Shakespeare or the Bible. The ghost-written speech flourishes in executive circles. One of the many presidents of RCA went so far as to have his ghostly outpourings bound in leather and then donated them to a university library. No doubt his income-tax return benefited from the gift. Since I personally wrote two of his major speeches, perhaps I should have shared in the tax advantage.

Another one of our presidents became "born again" which forced his speech writers to become biblical scholars in order to pepper the speeches with apt quotations from the good book.

When one has been retired for several years, it is amusing to reflect upon the antics of pompous individuals who achieved varying positions of privilege. It is sad to realize that these persons can inflict so much harm on an otherwise potentially successful corporation and affect the careers of many able people.

I do not wish to imply that lightweight, pompous, and less-than-bright individuals are peculiar to the executive ranks of business. Their proportions seem to be common to university faculties, law firms, research laboratories, and the military as well as government bodies. However, business executives are usually paid much more for their antics. But it still remains a mystery to me how so many people change their attitudes after they achieve positions of pomp and privilege.

George Mason University

Prepared by
Michael Olson, Bridge

The 175th chapter of Eta Kappa Nu was installed at George Mason University on April 4, 1987. George Mason University is located on the outskirts of Washington, D.C., in the city of Fairfax, Virginia. More than 17,000 students attend the University. The newly accredited Electronics Engineering program offers both undergraduate and graduate level degrees in such areas as Electronics, Computers, Communications, and Control, and Robotics.

Mr. George Balderston, past Director, presided over the first initiation of Iota Mu chapter of Eta Kappa Nu. 43 students were initiated into the chapter. The evening's events included a sitdown dinner and Dr. Andrew Sage, Dean of the School of Information Technology and Engineering, as a guest speaker.

A second initiation was held on May 1, 1987 in which 16 students were brought into Iota Mu chapter. The provisional officers of the chapter performed the initiation. The first official meeting of Iota Mu chapter was held directly following the ceremony, during which the provisional officers were elected to fill their position for the next term.

With 60 members, under the guidance of Dr. Daniel Tabak, the Iota Mu chapter is off to a great start. On May 3, 1987, the first bi-annual "HKN, End of the Semester" picnic was held and the newly elected officers are already busy planning for next year's events.

←
**INSTALLATION AT GEORGE
MASON U.**

Outstanding Chapter Activities Award

by **ALAN LEFKOW**
Chairman

The Chapter-Activities Award Committee announced that six chapters received national recognition for their outstanding programs for the year 1985-86. The winners were:

National Winner—Beta Chapter, Purdue University; Honorable Mention—Psi Chapter, University of Texas at Austin; Honorable Mention—Gamma Theta, University of Missouri-Rolla; Certificate of Merit—Delta Omicron, University of New Mexico; Certificate of Merit—Delta Omega, University of Hawaii at Manoa; Certificate of Merit—Gamma Chi, New Mexico State University

The Award Committee bases its selection of winners on the annual chapter report each chapter is asked to submit at the end of the academic year. National winner Beta Chapter's annual report was of the highest caliber and justly reflected a very active chapter. The chapter has been a consistent high performer, and the national winner for the past five years.

Beta's activities for the past year included a 280-page resume book, staffing and operating their own lab and snack lounge that dispersed 168,000 snacks in two semesters, maintaining graduate picture files, maintaining a manufacturer's data book library, Christmas decorating at a local hospital, assisting with Engineering Day, staffing 48 phones at an EE phone-a-thon, maintaining

a homework solution file, supplying ICs and other circuit parts free of charge to students from a stock of 32,000 chips, maintaining a professor picture file, providing over \$2000 in scholarships, donating money to local charities, running educational trips to industry and fifteen speakers at meetings, running over a dozen social activities, and presenting HKN recognition awards to students and professors.

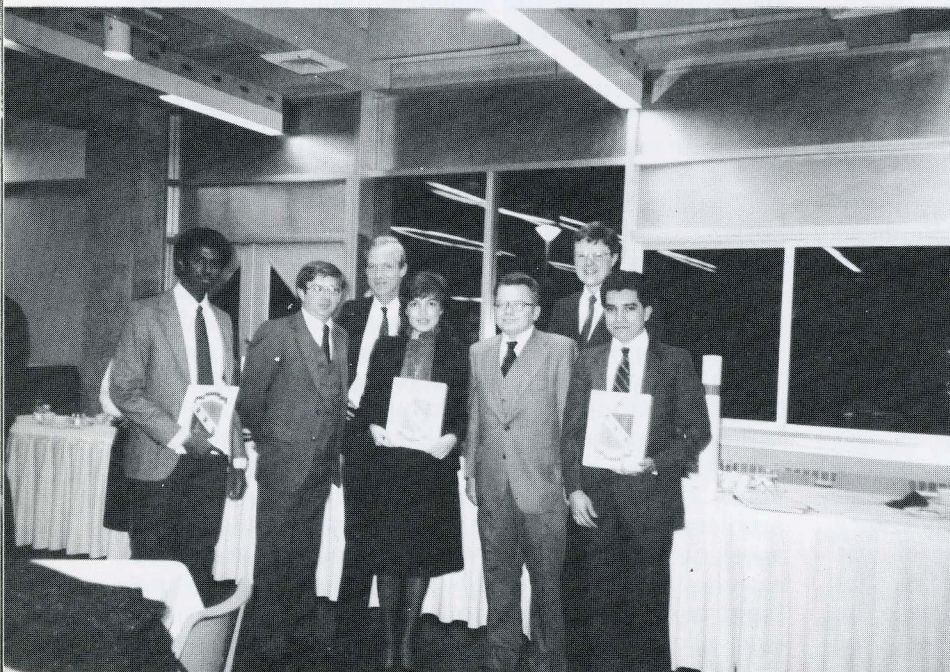
Honorable Mention Psi Chapter is also a past winning chapter, having received Honorable Mention three years in a row. Psi's many activities include student tutoring, registration assistance, taking EE student photos, providing a parts source for student projects, provided tours for high school students, collected canned food for the needy, renting to students lockers obtained and refurbished by the chapter, supported Engineering Expo, sold coffee in the EE office on a daily basis, maintained Psi's large library of textbooks and data books, and ran many social functions.

The second Honorable Mention winner, Gamma Theta Chapter, is no stranger to the Award Program. Gamma Theta has been a past National and Honorable Mention winner over these many years. Highlights of their activities include the original fund-raising laboratory equipment breakage insurance for students,

providing a lab for student hobby use, awarded scholarships, supported freshmen orientation, provided technical assistance seminars to EE students, sponsored an annual Career Day, provided, for the tenth year in a row, behind-the-scenes help for the local Junior Miss Pageant, awarded Boy Scout Merit badges, ran fundraisers for charity, acted as science fair judges, and ran numerous social activities including smokers, picnics, and initiation banquets.

The Outstanding Chapter-Activities Award program has been providing recognition of chapter achievements for over 50 years. All chapters are encouraged to report on their programs to the best of their ability. In this manner, the good works of members working in concert as a college chapter can be recognized by their peers.

Zeta Upsilon, Old Dominion University—Zeta Upsilon presented the second annual junior class lunchtime seminar series in March. The series consisted of four seminars to acquaint junior ECE students with the 400-level technical elective offerings, and to discuss career options. This activity was very successful and will be presented again next year.
by Michael O'Sullivan



Amber: The Golden Gem of the Ages

By Bert Sheffield

Past Director and Chairman of Publicity

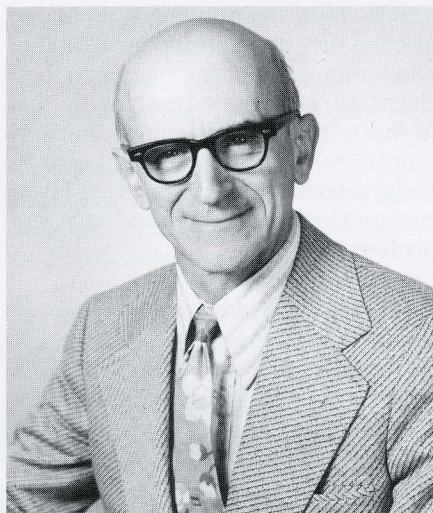
Amber: The Golden Gem of the Ages. by Patty C. Rice, Ph.D., Van Nostrand Reinhold Company, New York, 1980; \$28.50

Eta Kappa Nu members will be fascinated with "Amber: The Golden Gem of the Ages" because our name, ETA KAPPA NU, was derived from E(le)K(tro)N, which is Greek for amber.

Author Patty Rice did an exhaustive study, based on her own collecting endeavors as well as on her jewelry work using amber. She answers many questions about this controversial gem such as why it is controversial, whether amber is a gem, and how Thales discovered its electrical qualities. She reveals why amber jewelry feels warm to the touch, is soft, malleable, flammable, and why smoldering amber exudes aromatic fumes.

She presents interesting background. For example: amber jewelry has always been treasured and available mostly to the wealthy; and amber of the Baltic fields was so highly valued that in 1826 in Koenigsberg (E. Prussia) an executioner was appointed to put local fishermen to death for collecting amber without a license.

Amber has astrological and talismanic significance, and the ancient myths are entertainingly presented. Historians value espe-



cially amber samples with inclusions of tiny prehistoric animals, reportedly aeons old. The inclusion-type specimens have been known to be simulated and sold at premium prices by artful imitators, and Dr. Rice describes how imitations can be detected. She points out that gem imitation is frequently not intended as fraud, but to cater to a market where amber is scarce. Thus, the search for amber substitutes led to the development of synthetic materials for making jewelry, such as celluloids, casein, bekelite, polystyrenes, glass and horn.

If you ever wondered about the origins of the words "amber" and the German "Bernstein", you will

find them discussed in depth in the section on their etymology.

About one-third of the book relates to scientific aspects of amber, including physical, chemical optical and other properties and appropriate tests. Interestingly, amber and fossil resin deposits are found not only in the Baltic, but also in other regions of the world, even in the United States. Resins resembling amber come from Zanzibar, New Zealand and other regions.

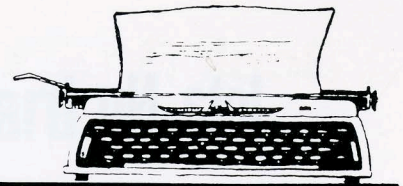
In the last chapter, (no. 10) is a stimulating introduction to amber jewelry making—cutting, polishing, drilling and faceting, and making a variety of jewelry known as "Polybern".

Appendices cover the "Care of Amber", "Amber Facts and Fancies", and "Charts for Comparing Amber with Commercial Substitutes".

The book is replete with interesting and informative black and white illustrations, and has also 16 pages of 55 lovely plates, in color, of amber jewelry and other amber artifacts.

Each chapter has references which are collected in an impressive bibliography of over 150 titles. For calling this fine book to my attention I am indebted to my amber collector/dealer friends, Lester and Marilyn Sayetta of St. Thomas, US Virgin Islands.

High Five



"Why don't you take your handkerchief all the way out of your pocket when you use it?"

"That ain't my handkerchief. That's my shirt tail."

This great dame stood nervously in front of the puddle. "Spread your coat for me," she ordered her escort.

"I will not," he replied.

"Raleigh spread his coat for a lady," she reminded him.

"He can afford it," said the man, "with that big tobacco business he's got."

The Secretary of the Navy should be addressed as Your Warship.

As usual, the woman was the last to arrive and quite tardy at that. "I beg your pardon for coming so late," she told the host.

"My dear," said the gentleman. "No pardons are needed. You can never come too late."

"Suppose you were in my shoes. What would you do?"
"I'd shine 'em."

What does one send to a sick florist?

If you drop a fork it's a sign company's coming. . . if a fork is missing it's a sign company's going.

Goofy: "You can lose all your worldly possessions and still remain a gentleman."

Goofier: "Well, I challenge any guy to lose his pants and remain one."

Success formula: Be nice to people until you make a million. After that people will be nice to you.

"Do you think if I have a slice of onion with my hamburger that I'll get heartburn?"

"For a lousy quarter you get a hamburger, not medical advice."

A man consulted a doctor. "I've been misbehaving, Doc, and my conscience is troubling me," he complained.

"And you want something that will strengthen your willpower?" asked the doctor.

"Well, no," said the fellow. "I was thinking of something that would weaken my conscience."

Economist John Kenneth Galbraith is noted for the lengthiness of his speeches. He's aware of this, of course, but if he should ever forget it, his wife will be there to remind him. "She says," Galbraith reported, "that people may not be a great deal *wiser* after my talks, but they are always a great deal *older*."

Most of us were taught that a preposition is not a good word with which to end a sentence. A small boy, home sick with a cold, managed to come up with a sentence that ends with five of them in a row:

"Mom, what did you bring that book I didn't want to be read to out of up for?"

Sheer laziness has probably been responsible for more shortcuts, not to mention valuable inventions, than we are ready to admit. Most of us are continually on the lookout, at least subconsciously, for easier ways to perform onerous or routine tasks.

An example of imagination spurred on by outright lethargy is contained in the story of an old mountaineer and his wife who were sitting in front of the fireplace one evening just whiling away the time.

After a long silence the wife said: "Jed, I think it's raining. Get up and go outside and see."

The old mountaineer continued to gaze into the fire for a second, sighed, then said, "Aw, Ma, why don't we jest call in the dog and see if he's wet."

The tragedy of life is not that we die, but is rather, as Albert Schweitzer said, "... what dies inside a man while he lives."

The psychology instructor had just finished a lecture on mental health and was giving an oral test. Speaking specifically about manic depression, she asked, "How would you diagnose a patient who walks back and forth screaming at the top of his lungs one minute, then sits in a chair weeping uncontrollably the next?"

A young man in the rear raised his hand and answered, "A basketball coach?"

Doctor: You've been working too hard. What you need is recreation. If I were you, I'd go home and take my wife to a show.

Patient: Thanks, Doc, thanks a lot. By the way, what's your address?

The walls of this room are all covered with spots. The last man who lived in this room was an inventor—he invented some sort of an explosive. Oh, the spots on the walls are explosive? No, the inventor.

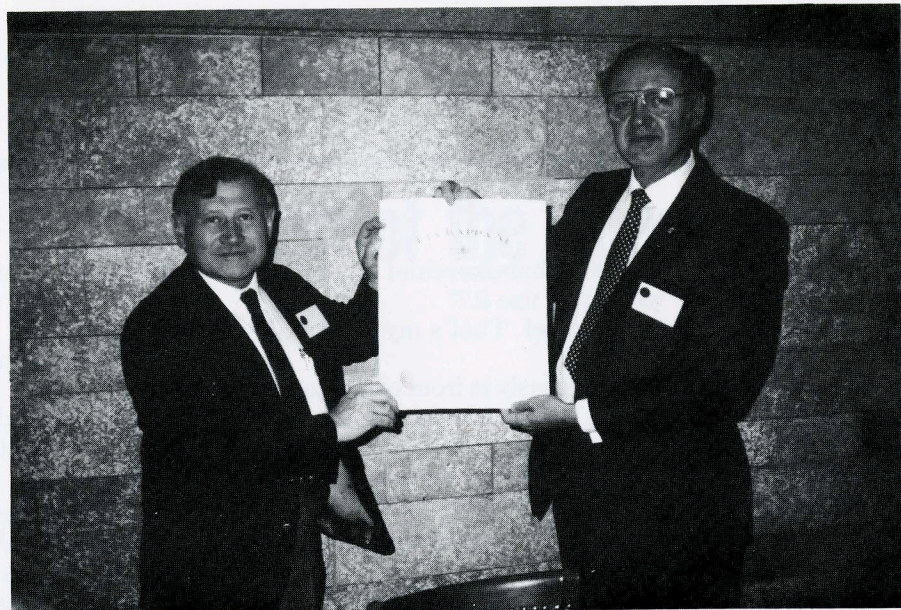
Iota Nu

Gannon University

On April 28, 1987 the 176th chapter of Eta Kappa Nu was installed at Gannon University in Erie, Pennsylvania. Erie is located on the shore of Lake Erie in the northwest corner of Pennsylvania. Gannon University is located near the center of downtown Erie. Gannon's colleges include: Business Administration, Education, Humanities, Science and Engineering, and the University College (part time and life long learning).

Twenty-five students were initiated into the Iota Nu chapter of Eta Kappa Nu. A pre-dinner reception was held in the Spiteri Center in the Science and Engineering building. Among others attending were Charles Agnew, Gannon's Vice President for External Affairs and Dr. Halit M. Kosar, Dean of Science and Engineering. Dinner and the initiation ceremony were held at the Masonic Temple in downtown Erie. The evening was presided over by Professor Alfred L. Arnold, international director. Assisting with the ceremony was Professor Frank J. Bogacki, Eta Kappa Nu member and the new faculty advisor. Among others attending the event were Dean Kosar and Dr. Mehmet Cultu, chairman of the electrical engineering department.

Under the guidance of Professor Bogacki, the Iota Nu chapter has already been organized. Election of officers has been held with Patricia Irwin as president, Richard Grisier as vice president, Matthew Piglowski as Bridge Secretary, Mary Mastandrea as secretary and David Landfried as treasurer.



Outstanding Junior Award

by Laureen Parker

Rice University student John M. Steinke has been selected as the winner of the 1986 Norman R. Carson Outstanding Junior in Electrical Engineering Award. Mr. Steinke was presented with the award on the Rice University campus in Houston on April 14 during a reception sponsored by the Theta Rho Chapter of Eta Kappa Nu. The presentation was made by Laureen H. Parker, a member of the International Board of Directors of HKN.

Mr. Steinke, who is an officer of the Theta Rho Chapter, is planning to graduate with a triple major in electrical engineering, applied physics, and mathematics. He has a perfect academic record at Rice, and has had two first author papers on the role of light scattering in whole blood oximetry published in the IEEE Transactions for Biomedical Engineering.

His wide ranging interests in things electrical, mechanical, and mathematical have led him into such diverse areas as solid state physics, auto mechanics, and international mathematics competitions. In 1983, he was the first place winner in the USA Mathematical Olympiad (from an original field of 400,000 students), and later won an individual bronze medal in the International Mathematical Olympiad in Paris. In 1984, he ranked 10th in the nation in the William Lowell Putnam Mathematics Competition.

Mr. Steinke plans to do graduate work in solid state physics, electrical engineering, and mathematics. He has not yet decided which university he will attend, but an individual with his abilities and attitude would be welcomed anywhere.

The Norman R. Carson Award was established two years ago to recognize the outstanding junior electrical engineering student in the United States. The award consists of a certificate and a monetary gift of \$1,000. Winners of the award are chosen by HKN's Lone Star Alumni Chapter in Austin, Texas. Nominations are solicited from each of the 175 student chapters of HKN. The nominees are evaluated on their academic achievement, participation in college and community activities, initiative and leadership.

The competition for this award in 1986 was intense. The runner up for the 1986 award was Vikram Verma from Zeta Epsilon Chapter at Florida Institute of Technology. Honorable Mentions went to Myra L. Ensor from the University of Maryland, Carol S. Jorgenson from California State University at Long Beach, David H. Terry from Johns Hopkins, and Paul F. Wysocki from the University of Illinois.

Each of these individuals is to be congratulated for his or her outstanding academic and personal achievements.



Rice University Junior Student John Steinke receives his Certificate and \$1,000.00 gift from Ms. Laureen Parker, International Director of Eta Kappa Nu.

Overhaul the System

Leon W. Zelby

School of Electrical Engineering and Computer Science
University of Oklahoma

All the debates on the quality of education and the suggestions for its improvement remind one of Thoreau's observation that "thousands will hack at the branches of evil to one who would strike at its roots." More money, apparently universally considered as panacea for all problems, may put up another building, or buy another computer, or even increase teachers' salaries; more stringent requirements for accountability will produce more detailed rules, more forms, and more reports; more hours, or semesters, in some specified courses or topics may result in more credit hours in those subjects. None of these, however, will really solve the problems of functional illiteracy, of the inability to communicate effectively or to reason logically and systematically. None of these suggested solutions by themselves will reverse the real or imagined issues associated with decreasing rates of technological innovations and decreasing interests in the sciences; nor will they eliminate other problems ascribed to education.

The reason is that our educational system consists of a patchwork of rules and requirements meant to satisfy more the persuasions of its constituencies than those of education. As a result, the system is replete with requirements which are frequently inimical to the educational process. Consequently, in order to really solve the problems ascribed to education it is necessary to address at least three of the basic and major factors responsible for them: first, the attitude of the society at large which is responsible for the attitude of the students and for much of bureaucracy; second, the educational numeraire, the credit hour, substituted for the demonstration of competence, coupled with the teaching-examining-grading sequence by the same individual, a chain which fosters inconsistency through personalized grading and variations in standards; and third, the inordinate growth of administration responsible, in large measure, for the growth of educational costs.

The most significant aspect of the first factor is the society's preoccupation with money for its own sake. As a consequence, education became confused with and replaced by training because training leads quickly to the very specifically advertised skills and the associated jobs. Many educational institutions became training and degree awarding institutions

because of the pressures from students for the acquisition of **immediately** marketable skills on the one hand, and pressures from legislators, boards, etc. for the institutions to meet students' interests on the other. The growth of "continuing education" programs amply attests to the replacement of education with training. As a result of these trends, education is viewed only in terms of immediate economic returns which, presumably, are the only factors which enhance the quality of life. This point is eminently clear in Caroline Bird's "The Case Against College."

The fact that education is not a short-term activity which leads mainly to immediately applicable skills but is a long-term investment in the ability to acquire whatever skills may be necessary is not generally appreciated, even though more than 2000 years ago it was noted in the Book of Master Kuan: "When you give man a fish, you have given him one meal; when you teach him how to fish, he will feed himself the rest of his life." This view was recently affirmed more eloquently by Eric Hoffer: "The central task of education is to implant a will and facility for learning: it should produce not learned but learning people. The truly human society is a learning society where grandparents, parents and children are students together. In time of drastic change it is the learners who inherit the future. The learned usually find themselves equipped to live in a world that no longer exists."

The lagging rates of technological innovations are directly attributable to the replacement of education by training. The decreasing ability to communicate effectively is directly attributable to the pursuit of specific skills to fill specific jobs by virtue of a specific diploma in the pursuit of which most "not relevant" subjects were eliminated. The demands for immediately applicable skills such as "computer literacy" fail to recognize that such literacy requires no more than the ability to read, understand, and follow instructions. As a matter of fact, if the touted computer literacy is developed on a specific machine with a specific language, that skill will have to be relearned for a different machine or a different language. On the other hand, having learned to read and understand one can learn to operate any computer in any appropriate language given an operating manual written in an intelligible fashion.

Another element which aided in the replacement

of education with training is that education requires more effort and more thought and "Men fear thought as they fear nothing else on earth—more than ruin, more even than death," according to Bertrand Russell. Training, on the other hand, can get by with memorization and repetition. This, memorization, is at best the first and the easiest step to education. Unfortunately, all too often it frequently becomes **the** goal. And whereas education requires active and often independent participation on the part of the learner, training can be accomplished more passively on the part of the trainee.

Consequently, the first step towards the remedy of the problems ascribed to education would be to return to education, and leaving training to the respective industries, or to vocational schools. This is not only reasonable, but also sound practice because most industries within any given class develop their own operating procedures.

The second factor, the credit hour, is clearly just another manifestation of society's attitude toward education: a purported need to find a numeraire, a common factor by which "education" can be **easily** evaluated. As a result, so many credit hours in a given subject here are considered equivalent to so many credit hours in a given subject there, irrespective of possible different emphases in the different institutions and possible different predilections and standards of the different teachers in the same institution. These differences are exacerbated by the teaching-testing-grading sequence by the same teacher.

All that may be said against standardized tests pales by comparison with the advantages they offer in such basic subjects as effective communication and reasoning. Therefore, in such basic subjects as reading and understanding, different levels of mathematics and natural and life sciences, standardized tests should be substituted for credit hours. Furthermore, tests in lower division courses and in those courses which represent essential prerequisites for the more advanced courses should be prepared, administered, and graded by a third party not by the instructor, without necessarily taking away the instructor's prerogative for awarding final grades.

And finally, the third factor—the growth of administrative staffs in educational institutions: Some ascribe it to the growing demand for "accountability" by the various governmental agencies, by special laws, and the like. It seems, however, that the growth of the staffs exceeds that needed to fulfill such obligations, an excess manifested by an inordinate growth of internal rules and regulations (Parkinson's Law), by administrative control of many traditionally academic functions.

The growth of administrative staffs, or at least their influence, is also manifested by the fact that many department heads and deans do not regularly teach nor do research. As such, they are too frequently sequestered in their offices—not unlike their counterparts in many of our industries—and lose first-hand knowledge of the students' demeanor and attitudes, of their quality, their interests, and the like. The administrators tend to rely all too much on

computer printouts without, on many occasions, having the time to analyze the data on which the results are based. As a consequence, many of the industrial woes are reflected in academia, woes that result from equating the quality of research with amounts of grant money, and the quality of the institution with changes in total enrollments and total credit hours. Like industry, academic institutions want to show their success through growth in enrollments and in credit hours, a trend developed—at least in the public institutions—by the criteria for funding used by the respective legislatures and other governing bodies.

It is not easy, nor fast, to change the attitude of the society. But it is possible to improve the quality of education by steps that can be implemented within the system, and do it rather rapidly. The first change might be the shift from credit hours to competency examinations in such basic subjects as freshman English, basic mathematics, and basic sciences. Coeval with this, examinations in the lower division prerequisite subjects should be taken out of the hands of the respective instructors to assure proper material coverage at appropriate levels and standards. And finally, department heads and deans should be expected to participate regularly in some educational activity such as teaching a standard course, preferably a required course at an undergraduate level; or in research in their respective disciplines.

Changes of this type would do much farther toward the improvement of education, and with a lesser expense, than simply pouring more money into an ailing system. The latter seems analogous to moving an unresponsive patient to a more elaborately appointed room instead of modifying or changing the treatment.

If you plant a tree, don't keep pulling it up by the roots to see how it's growing.

A small town is a place where there's no place to go where you shouldn't.

Burt Bacharach

To err is human. To blame it on the other guy is even more human.

Weissman had a very good season the year before and had moved to a very high-class neighborhood. One night, while entertaining, the guests spoke of Mozart. "Oh yes," said Mrs. Weissman, "I saw him on the number five bus with his wife. They were going down to the beach."

There was an embarrassing silence and finally the guests left.

"Haven't I told you when you don't know what you're talking about to keep quiet?" yelled Weissman.

"But what did I say that was wrong?" cried the protesting missus as she dabbed away a tear.

"Look," he replied. "You've been here long enough to know the number five bus does *not* go down to the beach."

University of New Mexico

The Delta Omicron Chapter of Eta Kappa Nu at the University of New Mexico has been busy during the 1986-1987 school year. Some of this year's activities have included free tutoring for freshmen and sophomores in electrical engineering, and Hanging of the Greens, a Christmas tradition at the University of New Mexico. The major activity that the Delta Omicron Chapter is currently undertaking is that of documenting the basket-

ball message board, that was built and is maintained by the chapter members. The spring pledge class played a part in this project by putting together an introductory user's guide for the system.

At this year's spring initiation banquet two awards of recognition were given out. Richard Owens, a Delta Omicron alumni, was awarded for his past work on the message board, and Dr. Martin Bradshaw, a professor in the EECE department

at the University of New Mexico, was awarded for his dedication to the teaching profession.

Elections for next year's officers have taken place, and projects for next year are being planned. It looks as if it will be another busy year for the Delta Omicron Chapter.

The 1986-1987 officers (from left to right: Michael Otero, Suzi Fehrenbach, Richard Goodwin, Melissa McVicker, Lars Wells, Carrie Strong, and Dr. Harold Knudsen, advisor).

