Bridge

OF ETA KAPPA NU

SUMMER, 1962

Bridge

of ETA KAPPA NU
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the cover

Our cover this issue is our artist's representation of the basic mechanism of a magnetohydrodynamic generator. The current status and future prospects of this jaw-breaking equipment is described in **"Magnetohydrodynamic Power Generation—The Concept and the Outlook,"** beginning on page 3.

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

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Real and Imaginary

AMERICANA -- Fourth of a Series

One of the loveliest images on the American scene is the GRADUATION exercise. It is a time of sweet-sadness with implications of life in new adventures, and death in the parting of cherished friends. In honor of the several million young people who will graduate this month we present the following CLASS POEM. It was published originally in the ARENA of Athens, Ohio, High School, 1940.

GRADUATION

by

Norma Gibson

The guiding friends who gave us what we know,
The cares and joys that came throughout the years,
Are gone now, as are lilacs under snow.
But who are we to think that shedding tears
Could lift the by-gone days from stately biers,
Or keep away the future from our mind.
Are we unlike the soldier? Through his fears
In someone's war, he presses on to find
One cannot have the things he leaves behind.

Our gay and carefree days that seemed so long;
We see them quickly fade away from sight.
We're caught, entangled in the rushing throng
And soon our awe becomes bewildered fright.
Just memories are left to soothe the plight
Of youth forever striving to attain
The end which now is just a beam of light.
Are we to battle safely through the rain
And rise to see the shining sun again?

After having gained success and love,
Living out a life that was a dream —
Mature, we know we're free to see above
Our fears. The path of fame is but a scheme
On which some lose their way; cannot redeem
The road. So soon the crowd will clearly see
That happy aims are all that they may seem.
We ask that others treasure youth as we
And enter life with truth, the golden key.

Magnetohydrodynamic Power Generation — The Concept and the Outlook

John A. Tillinghast,
Head, Mechanical Engineering Division
and
Paul Dragoumis
Nuclear Power Section
American Electric Power Service Corporation

About eighty years ago, when Thomas Edison first operated his initial power plant at Pearl Street, his generator effected the conversion of mechanical to electrical energy by subjecting a solid conductor to varying flux linkages. At that time, Edison's load consisted of 400 lamps or a total of 33 kw. Since that time the electrical industry has grown tremendously, largely through its own initiative in reducing the cost of its product, while material, labor costs, and taxes increased exponentially. Much of this progress can be attributed directly to technological advances, especially regarding increased temperatures, pressures, and reheat in the steam cycle. However, the next increases in overall efficiency, even increases of one or two percentage points, are becoming increasingly difficult, because it appears that we have reached the economic limits of pressure and temperature in the exploitation of the thermal steam cycle—barring a new breakthrough.

Increased temperatures, of course, offer the route to higher thermal efficiencies, as described over one hundred years ago by Sadi Carnot.[1] The concept of a magnetohydrodynamic (MHD) generator utilizes high fluid working temperatures and, therefore, promises high inherent efficiency, with a potential for simplication of the cycle by virtue of high power densities and the reduction in number of rotating parts.

Motivated by a desire to continue improving the efficiency of the thermal-electric energy conversion processes, and, therefore, the cost of electricity, the American Electric Power Service Corporation participated in an evaluation study of the potential of MHD with Avco Corporation. The results of that study [2,3] were significantly encouraging, and a group of utilities*, including three subsidiaries of AEP, have been working together with Avco for two years to develop the MHD concept for the large-scale generation of electric power.

On the basis of this Avco-Utility program and specific advances made therein[4], we are highly optimistic over the potential of MHD. At the time of this writing, our Mark II experimental MHD generator has achieved a short-duration output of 340 kw.

The Magnetohydrodynamic Concept

Whereas the conductor that traveled through the magnetic field in Thomas Edison's generator was of the solid metallic type, the Law of Electromagnetic Induction applies to any type of conductor, solid or fluid, passing through a magnetic field. When electric energy is generated by passing a hot, conducting gas through a magnetic field, we have, conceptually, a magnetohydrodynamic interaction for directly converting heat energy to the form of electricity.

In searching through old patent disclosures, it is interesting to note that the idea of an MHD generator is not new, but that over one hundred twenty-five years ago, Michael Faraday tried to measure the voltage

*The present utility group consists of American Electric Power Service Corporation and AEP subsidiaries—Appalachian Power Company, Indiana & Michigan Electric Company, and Ohio Power Company; The Dayton Power and Light Company; Illinois Power Company; Indianapolis Power and Light Company; Kansas City Power and Light Company; Louisville Gas and Electric Company; Boston Edison; Union Electric Company; and The United Illuminating Company.

induced by the flow of the River Thames (his moving conductor) through a magnetic field (that of the earth). His efforts were unsuccessful only because the quantities he was trying to measure were very small, but his basic idea was certainly valid. More recently, in the late nineteen twenties and early thirties, Dr. Slepian and his associates at the Westinghouse Research Laboratories were attempting generation by passing the exhaust from a gas turbine through a magnetic field. We now know that these attempts were unsuccessful because gas conductivity was far too low at the 900°F temperature used. So, although the idea has been appealing for many years, practical application of the MHD interaction has awaited a better understanding of gas conductivity and for materials advances to provide confinement for these high temperature gases.

The physical configuration with which MHD power generation may be achieved is shown in Figure 1. Basically, high temperature gases (the conductor) are accelerated to a high velocity and passed through a channel section in which there exists a strong magnetic field, oriented at right angles to the axis of flow. Along the sides of this channel section are located electrodes through which the generated current enters and leaves the gas, passing through an external load.

$$\text{OUTPUT Emf} = u\,B\,y - IR_{gas}$$

$$\text{Gas Power Dissipation} = I^2R_{gas}$$

$$\text{Internal efficiency} = \frac{h - h_{f\ actual}}{h - h_{f\ isentropic}} \quad \text{value approximately } 85\%$$

$$\text{Energy Conversion} = \rho\, u\, dh/dx = j_m \cdot E_m$$

where: u = fluid velocity
h = enthalpy
y = electrode spacing
ρ = fluid density
j = current density

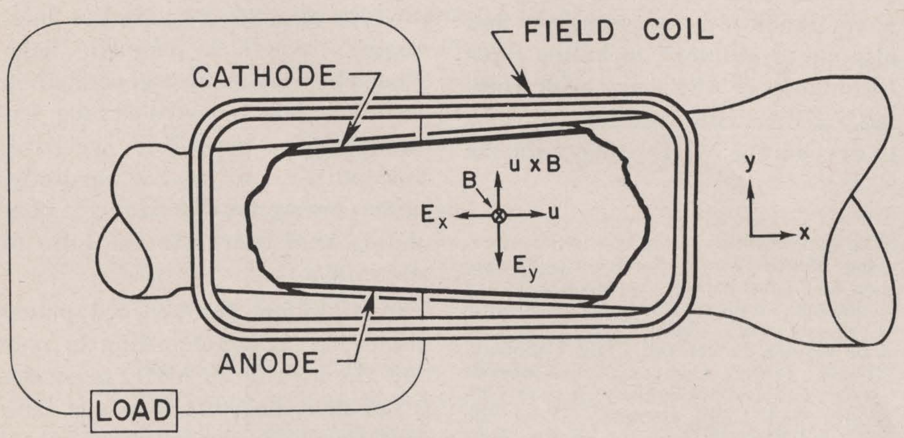


FIGURE 1. A linear MHD generator. Vectors show positive directions for indicated quantities.

Of critical importance at the present time is the fact that with a fixed magnetic field and constant gas velocity, the output of the MHD generator will be direct current. There are only limited applications where DC can be utilized directly and, therefore, the DC output will have to be inverted to AC for transmission. Today mercury arc rectifiers appear best for this application. For several reasons it seems unlikely that AC generation will be promising in the near future.

Gas Conductivity

The primary requirement for an MHD interaction is a hot, ionized (conducting) gas. Moreover, if this fluid is to be economically practical it must be produced from the combustion of commercially available fuels. Therefore, the simplest practical working fluid available is that produced from the combustion of coal, oil, or gas in air, the simplicity arising from the fact that no heat transfer equipment is required to put heat into the fluid. The burning of these conventional fuels can take place in a combustion chamber and the resulting gases immediately accelerated through an MHD channel around which is wrapped a magnetic field coil.

If such a scheme were attempted, electricity could not be generated in significant amounts because of the very slight degree of gas ionization present at the temperature normally created by the combustion process. Moreover, theoretical computation of the temperature required to produce adequate conductivity would be very discouraging because of the extremely high temperatures necessary. Combustion products, or for that matter other gases, considered for use as the working fluid, can be made electrically conductive at lower temperatures by the addition of some easily ionizable impurity, or "seed."

The prime requisite for such a material is a low ionization potential, yet it must be reasonable in price and readily available. The alkali metals – cesium, rubidium, potassium, sodium, lithium – all have low ionization potentials and certain compounds of these can be made to satisfy the economic requirements.

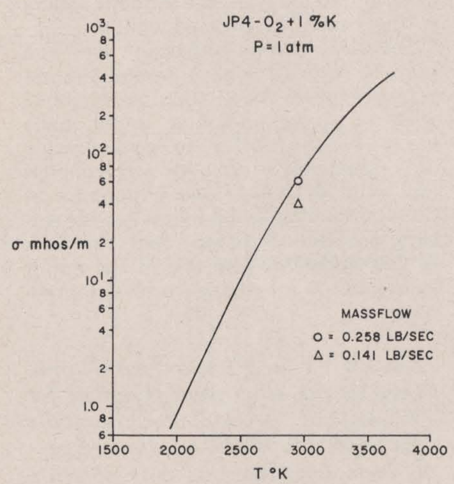


FIGURE 2. Comparison of measured and calculated electrical conductivity of gases produced by stoichiometric combustion of JP-4 and oxygen with 1 mole-% potassium.

Figure 2 shows a theoretical conductivity versus temperature plot for the combustion products of JP-4 (jet fuel) in O_2 plus 1 molal per cent potassium added as seeding. Superimposed on this plot are two points which represent a series of conductivity measurements made by Avco in the joint program.

It is presently believed that temperatures of approximately 5000°F will provide adequate conductivities for oil or coal combustion products when properly seeded. However, when fossil fuels are burned stoichiometrically with air, temperatures of only about 3000°F result, so there is an obvious need for preheating, which can be accomplished by passing the hot MHD exhaust gases through a heat exchanger to preheat inlet air. Noting the 5000°F inlet temperature required and the 3000°F adiabatic combustion temperature achievable with commercial fuels, one might assume the need for only 2000°F of preheat. However, at these temperatures endothermic dissociation of combustion products precludes complete combustion so that all the heat is not released until after the gases are in the channel, thereby requiring preheat temperatures of up to 3600°F rather than the 2000°F apparently needed. Because of the almost insoluble materials problems relating to high temperature (3600°F) preheater requirements, the oxygen cycle was conceived to circumvent these obstacles. This will be discussed further below.

Hall Current

The conceptual generator configuration shown in Figure 1 indicates the generated emf, and, therefore, the current flow, in a direction perpendicular to both the magnetic field and the axis of fluid flow. This is an idealization for whereas in a weak magnetic field an electron tends to move nearly at right angles to the axes of the magnetic field and gas flow, the presence of a strong

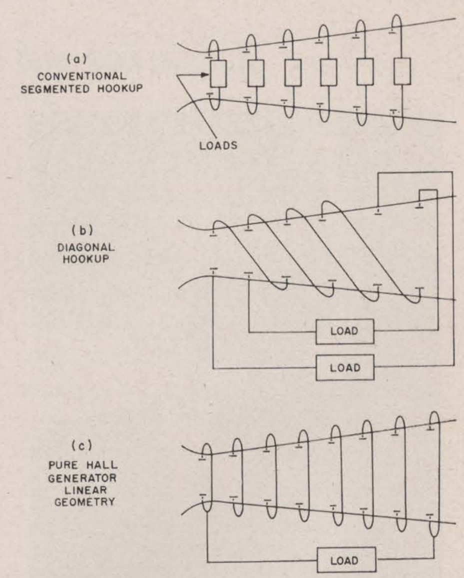


FIGURE 3. a) Linear generator with separate pairs of electrodes. b) Linear generator with diagonal connections. c) "Pure" linear Hall generator.

magnetic field, such as is required in the MHD generator, causes electrons to try to spin around magnetic field lines. This force acting simultaneously with the transverse force imposed on the electron by the strong electric field causes the conductivity to be a tensor quantity, yielding a component of current flow in the direction of the velocity. This component, known as Hall current, appears in the last term of Ohm's law:

$$\bar{J} = \sigma(\bar{u} \times \bar{B} + \bar{E}) - \frac{\omega\tau}{B}(\bar{J} \times \bar{B})$$

where σ = conductivity
u = gas velocity
ω = electron cyclotron frequency $\times 2\pi$
B = flux density
J = current density
τ = mean free time between collisions

The presence of the Hall potential gives rise to three possible types of generators as are shown in Figure 3. The first of these utilizes segmented electrodes, with each pair connected to a separate electrical load, to minimize the flow of Hall current and to utilize the transverse current flow for supplying the loads. In Figure 3c an arrangement is shown which utilizes only the Hall effect for supplying the load, while the sketch labeled 3b shows a diagonal generator hookup which utilizes approximately the vector sum of the axial and transverse potentials. In this arrangement the electrode pairs are connected in series.

The belief that Hall current can be reduced or eliminated in the transverse or linear generator configuration indicates this arrangement to be very promising from the viewpoint of maximizing MHD generator to electricity. For these reasons our work has been directed along these lines.

Components of the MHD Generator

The terrific temperatures and high operating velocities in the MHD generator pose some severe technical and economic problems. Channel walls must contain the plasma, electrodes have to operate in abrasive, hot atmospheres, and high magnetic field strengths must be obtained.

Specifically the problem areas are as follows:

1. *Magnetic field* – The duct length is inversely proportional to the square of the magnetic field strength and, since minimization of duct length is synonymous with minimizing heat losses to channel walls, there is strong motivation for achieving the highest possible field strength. Cryogenic operation alleviates the coil power dissipation problem but at increased costs to cover capital investment in refrigeration plant and expenses for producing the power dissipated in the coil. For these reasons, the recent development of high-current-capacity superconductors (conductors exhibiting no resistance under certain low temperature conditions) is exciting and, if material costs are reduced sufficiently, may be of tremendous significance to the MHD program. If a coil could be fabricated from superconducting material and enclosed in a cryogenic Dewar of high efficiency, cooling could be effected in the fabrication plant or at the site of a sufficiently large cryostat. Assuming the heat loss from the Dewar to be very limited, the necessary supplementary refrigerating (cryostatic) equipment would be quite small compared with the size of the cryostat required for the cryogenic magnet.

The problem areas are evident: large-scale Dewars and accompanying support structures must be built and the assembly designed for virtually no heat loss. Moreover, the satisfactory technical and economic performance of either a superconducting or cryogenic magnet remains to be demonstrated.

2. *Walls* – In the basic discussions above, it was stated that 5000°F gases are accelerated through a channel where the electrical power is extracted. One of the major problems in the development of the MHD generator was to design a wall capable of long-term operation under the very severe conditions imposed by the hot gas.

The presence of a boundary layer between the high velocity stream and the wall serves to lower the operating wall temperature below that present in the combustion chamber, but even at these somewhat lower temperature levels many ceramics become electrically conductive or are incompatible with seeded combustion products. Although progress is being made with ceramic-type insulating walls, the potential for quick development of this type of wall is questionable.

In order to allow the rapid development of the MHD concept, the Avco-Utility program has worked toward circumventing the need for immediate solution of the high-temperature ceramic problem. This has been done by the development of a heat transfer-type channel, which permits wall temperatures to be kept at reasonably low levels via heat removal. The heat extracted can then be recovered in the steam cycle. A wall of this type has been designed, several models built, and some testing already underway, with preliminary data indicating that the design is adequate.

3. *Electrodes* – The design of electrodes for application in MHD generators poses several problems, but most of these are not unique with MHD. A substantial technology has been established through the many uses, both industrial and experimental, of various types of electrodes, and much of this is directly applicable to the MHD situation.

Successful electrode operation obviously depends on the ability of these electrodes to emit (or collect, depending on an anodic or cathodic application). Proper emission, however, occurs only when the electrode is heated to the point where electrons can be freely emitted. The problem, therefore, is to design electrodes that run hot in an erosive, fast-moving atmosphere and which produce a very low voltage drop. If the electrode material selected is of the consumable type, electrode feed apparatus must be supplied and the cost of this material included as a fuel or operating charge. Evidently, there is strong motivation for the development of non-consumable electrodes and efforts are being expended in this direction.

4. *Combustor* – The chamber in which the fuel and oxygen-enriched air are to be burned faces all the problems existing in commercial burners and, because of the high temperatures involved, encompasses some of the problems encountered by jet and rocket engine designers. The requirements include durability, minimum heat loss to the walls and injection nozzles, and relatively maintenance-free performance. The joint Avco-Utility program has resulted in a development of an adequate burner for fuel oil and is presently engaged in designing a coal-burning combustor.

5. *Seed Recovery Equipment* – Choice of a seed material among the many alkali compounds that would suffice technically for the purpose

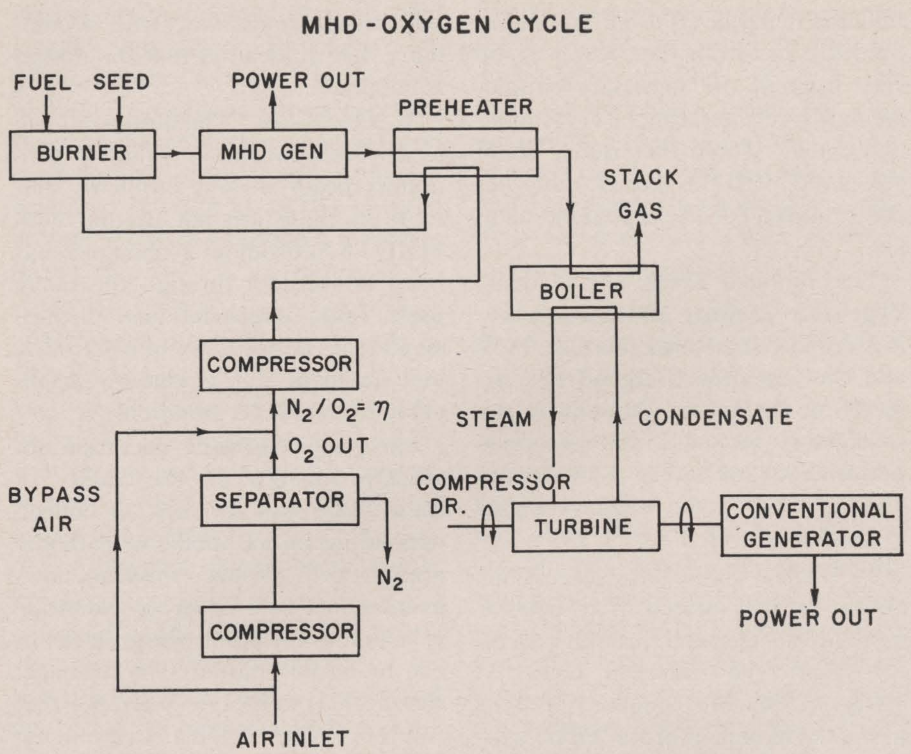


Figure 4. Oxygen Cycle Block Diagram.

must depend on the economic consequences of the utilization of this material. The cheapest available seed material preferred earlier, was KC1, a compound which was low enough in price to justify once-thorough-type operation with the seed being considered an expendable material. However, conductivity tests with KC1 added have shown that the dissociation of this compound at operating temperatures results in a drastic reduction in conductivity due to the electro-negative nature of the chlorine ion. This affinity of the chlorine ion for electrons precludes the use of KC1 as a seed material.

Unfortunately, the compound which appears most suitable as an alternative is significantly more expensive than KC1, necessitating consideration of some method of extraction of seed material from the hot gases after they have gone through the MHD generator. Much effort is being directed at solving the seed recovery problem, with a system that is efficient, cheap, and easy to operate. There are several promising methods under consideration.

The Commercial Plant

As was pointed out in the section on gas conductivity, preheat temperatures can be significantly reduced by enriching the air in oxygen content. This is directly related to the fact that most of the input preheat goes to heat nitrogen which does not aid the combustion process. By decreasing the ratio of N_2/O_2 in air, lower preheat temperatures can be achieved at the expense of greater capital cost for including an air separation (oxygen) plant. This development serves to circumvent the need for solution of the severe problems associated with 3600°F preheat and allows concentration of effort on the development of the MHD generator itself. The compressor work required for the oxygen plant slightly reduces plant efficiency and results in higher costs, but neither of these factors are sufficiently larger to alter the potential of the concept significantly in large-scale commercial-type plants.

Because of the temperature (4000°F) of the MHD generator effluent gases, the generator itself does not provide for efficient conversion of energy, even when the exhaust heat is used to preheat combustion air. The true potential of MHD can be realized only if the waste heat is passed through a heat exchanger to generate steam for additional power generation through conventional steam-cycle techniques.

A typical oxygen-MHD cycle is shown in the block diagram in Figure 4. Efficiencies of more than 50% may be achieved with this type of cycle.

One major problem associated with commercial plant operation is corrosion of heat exchanger and preheater tubes due to the relatively high alkali content of MHD exhaust gases. There is evidence to indicate that conventional boiler-tube corrosion is in part directly attributable to alkali content of commercial fuels. Because of the intimate relation between the seed recovery and corrosion areas, the solution of both these problems is being pursued simultaneously.

The Outlook

A little more than two years have passed since the Avco-Utility program for the development of MHD was initiated. As has been indicated in the various sections above, much progress has been made since the inception of the research program. The major part of the first year's work was the construction of a large experimental generator driven by combustion products. This generator, called the Mark II and shown in Figure 5, has been eminently successful in increasing the detailed knowledge of the fluid dynamics in an MHD generator. The first successful run of this generator occurred in December 1960 when a power output of 30 kw was achieved. At the time of the writing of this article, the maximum output has reached approximately 340 kw, with negligible change in mass flow through the generator as compared with the 30 kw run. The increased output represents technological progress solely.

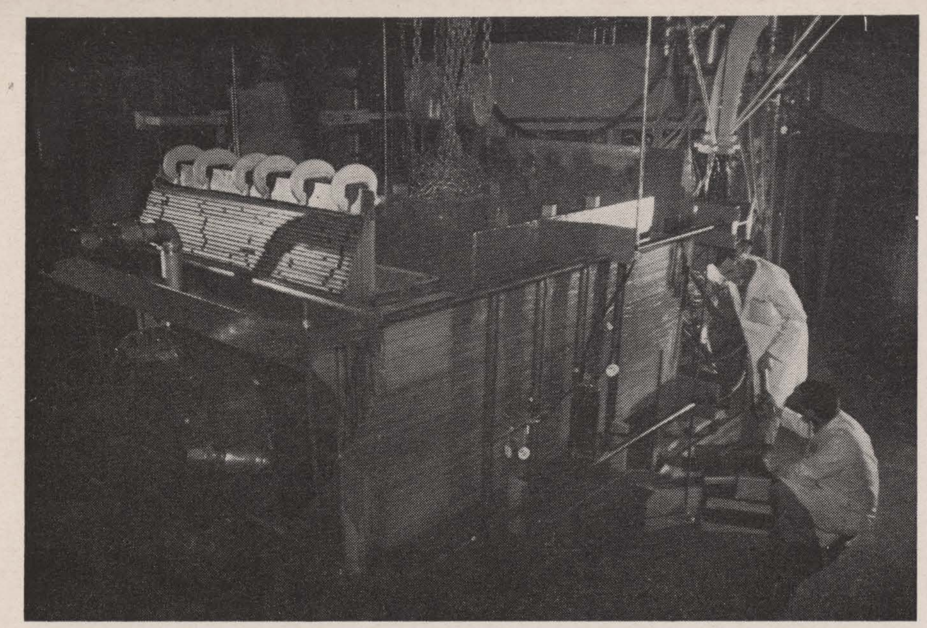


Figure 5. Mark II MHD generator.

This generator will hopefully soon be reaching levels as high as 750 kw.

These achievements with the Mark II generator, when coupled with successes in circumventing the severe preheater problem by the introduction of the oxygen cycle, and the quick development of a promising wall design, and the continuing advances all give rise to optimism.

Successful operation of an experimental plant, the design and performance of which can be extrapolated to a large-scale commercial prototype plant, is the next major objective in the long-range development of this idea. Contrary to even a year ago, the state-of-the-art is now sufficiently advanced that we believe we are midway between the initiation of the work and the decision to construct the experimental plant. If the rate of advance of technology continues at its present pace, it may be possible in the year 1963 to render a favorable decision to construct the experimental plant. By 1972 it is conceivable that a 100 mw-range plant will be ready for operation.

Although optimism and enthusiasm for the MHD concept are being based on a record of successful achievement, the authors remain sobered by the array of theoretical, engineering, and economic problems to be solved. These areas include continued investigation of fluid mechanics in the Mark II generator, continuing effort in the area of improving the gas conductivity, heavy testing of channel materials and electrodes in the newly completed long-duration test facility, a thorough investigation of seeding and recovery problems, boiler tube corrosion, and the development of more efficient 5000°F burners. In magnet development, a choice must be made between cryogenic and superconducting coil designs. Finally, all these ideas must be tied to a plant design that will provide the economic, efficient, reliable service demanded by utilities for commercial application.

This is the status, the challenge and the outlook.

REFERENCES

1. S. Carnot, *Reflections On The Motive Power Of Heat*, American Society of Mechanical Engineers, 1943.
2. American Electric Power Service Corporation and Avco Research Laboratory, *The Application of The Magnetohydrodynamic Concept to Large-Scale Generation of Electric Power*, April 8, 1959.
3. Philip Sporn and Arthur Kantrowitz, *Large-Scale Generation of Electric Power By Application of The Magnetohydrodynamic Concept*, Power, November 1959.
4. T. R. Brogan et. al. *Progress In MHD Power Generation*, presented at the Second Symposium on the Engineering Aspects of Magnetohydrodynamics, March 9, 1961, Philadelphia, Pennsylvania.

Delta-Rho at North Dakota

Delta-Rho Chapter was installed at the University of North Dakota. Seated are Mrs. G. W. Starcher; Dr. George W. Starcher, president of UND; John E. Lagerstrom, national director and installing officer for HKN. Standing are Professor John D. Dixon, chapter adviser; James Miller, chapter president; and C. J. Thomforde, chairman of the EE department.

Eminent Member Awards

Berthold Sheffield
Member of Arrangements Committee,
New York Alumni Chapter

Four distinguished electrical engineers were scheduled for presentation of the award of Eminent Membership at a well-attended luncheon which was held at the Belmont Plaza Hotel in New York, on Thursday, 29 March 1962.

Those nominated for the awards were:

Dr. John Bardeen, professor of E.E. and Physics at the University of Illinois. He shared the Nobel Prize in Physics in 1956 for his work on the development of the transistor.

Dr. Lloyd V. Berkner, president of the Graduate Research Center of the Southwest, Dallas, and past president of the Institute of Radio Engineers.

Dr. Edward M. Purcell, Gerhard Gade Professor and Senior Fellow in the Society of Fellows at Harvard University. Dr. Purcell shared the Nobel Prize in Physics, in 1952, for his research on atomic nuclei.

Dr. Jerome B. Wiesner, special assistant to President Kennedy for science and technology. Dr. Wiesner is on leave from his position of Director of the Research Laboratory for Electronics at MIT.

The Eminent Member Induction ceremony was conducted by Eta Kappa Nu officers as follows: John H. Craig, National President, John A. M. Lyon, National Vice-President, Willard B. Groth and Winston E. Kock, Directors, and Harlan J. Perlis, President of the New York Alumni Chapter.

Following the ceremony and lunch, Dr. Bardeen greeted the luncheon guests with an appropriate address in which he highlighted the shortage of highly trained technical administrators in Government. He recommended that salary structures be revised so as to attract suitable personnel, now in industry. Favorable action may be difficult to obtain, Dr. Bardeen said, while there is feeling in some circles against "Caviar for the Kings and peanuts for the peons." He urged persons in industry to contact their Congressmen in support of legislation to upgrade salaries, and, thereby, quality of Government administrators.

Dr. Berkner compared similarities and differences between science and engineering. Science, he said, deals primarily with ideas; engineering, with the provision of products or services to humanity. He concluded that engineers should always keep in mind this idea of service, as they apply the ideas of science.

Dr. Purcell and Dr. Wiesner were unfortunately unable to attend the luncheon, and will receive their Eminent Member Awards at a later date.

The significance of the Award Luncheon was enhanced by its concurrence with the international convention and Golden 50th Anniversary of the Institute of Radio Engineers. HKN was honored at the luncheon by the presence of many distinguished guests including Dr. Patrick E. Haggerty, president of the Institute of Radio Engineers and president of Texas Instruments Co. In keeping with the IRE event, the HKN program was imprinted in gold and decorated with a golden tassel. Superb coverage, especially by Electronic News, publicized details of the HKN award nationally.

Reprinted from Electronic News

At the induction of Eminent Members in New York on March 29, 1962 are from left: Willard B. Groth, HKN director and a manager of systems engineering, Radio Corp. of America, New York; John A. M. Lyon, HKN national vice-president and professor of electrical engineering at the University of Michigan; Dr. John Bardeen, recipient of HKN'S Eminent Member Award, and a professor of physics and electrical engineering at the University of Illinois; Dr. Lloyd V. Berkner, also an Eminent Member Award recipient and president of the Graduate Research Center; John H. Craig, national president of HKN and Director of Marketing for Ohio Bell Telephone Co.; and Dr. Winston Kock, an HKN director and Director of Research for the Bendix Corp., Detroit.

The Competition for Quality

John Bardeen, Theta '28

This address was given at the luncheon where Dr. Bardeen was inducted as an Eminent Member of HKN. Dr. Bardeen is a professor of electrical engineering and of physics at the University of Illinois and is a Nobel laureate, having been honored as one of the inventors of the transistor. He is also a member of the President's Science Advisory Committee.

It is a great honor indeed to join such distinguished company. I am very grateful for being privileged to be one of those chosen for eminent membership. It was nearly thirty-five years ago that I first joined HKN as a student at the University of Wisconsin. I hardly need to remind you of the tremendous changes that have taken place in the electrical engineering profession since that time. It was only a few years earlier that the pioneer educational radio broadcasting station, WHA, was established at the University. Electronics was beginning to come into the curriculum, but the course was predominantly concerned with power engineering. Now the pendulum has swung around, fashions have changed, and it is difficult to get students interested in power, even though there are many opportunities and new technology to be developed and exploited.

Since HKN is concerned with quality, I thought it might be worthwhile saying a few words about the crisis in quality in the U. S. Government Civil Service. This is a problem which has been brought strikingly to my attention through my participation in the President's Science Advisory Committee, of which Jerry Weisner is chairman.

It has been amply demonstrated that the stimulation and growth of an area of science or technology usually depends on a relatively small fraction of key individuals who are the real innovators, the ones who supply the spark and inspiration for others. Such a person may be a creative scientist whose discoveries open up new areas of research, or an inventor whose ideas give new opportunities for industrial growth. Such people of course are in very great demand. Perhaps even rarer, and in at least equally great demand, are the highly talented technical administrators who supply a different form of leadership. They contribute enormously to the success of present-day large-scale industrial and government laboratories.

To achieve a balanced growth of our economy, it is desirable to have such highly qualified individuals widely distributed among the different scientific and engineering disciplines as well as among the different sectors of the economy: the universities, government and industry. In our free society, this balance is difficult to attain. There is a current crisis in the government sector. The large expansion in government sponsored R and D programs and the growth of industrial laboratories since the war, particularly during the past few years, has given rise to an intense competition for quality. In this competition, the government is losing out.

The government sponsors about two-thirds of the total R and D in this country, of which about 85% is done in the private sector. To manage its programs effectively, the government must maintain a good in-house competence. Largely because of inadequate salaries at the upper levels, the government is losing many of its most highly qualified technical personnel. Surveys indicate that those entering government service at the beginning levels are on the whole not as good as those entering some years ago, so that the quality lost at the top is not being replaced at the bottom.

In an attempt to help remedy this very serious situation, the Kennedy administration has proposed legislation which would raise salaries of professional personnel and others in the top ranks of the service. In past rounds of government pay increases, salaries of clerks and others in the lower ranks were increased relatively more than the upper, so that the latter were squeezed. The proposed bill is to reverse this trend. It gives some raises for all, but the larger ones are for the top grades. This feature is running into opposition from labor circles, who call it caviar for kings and peanuts for peons. To get the bill passed will require widespread support. I hope that you will study this legislation, and if you feel as I do that it is very essential for government to be in position to compete for its share of quality, that you will let your congressman know. To summarize, we need HKN's in government as well as in universities and industry.

The Lessons of the First Ten Years

C. J. Baldwin, Westinghouse Electric Corporation

In his speech of acceptance of the award for the Outstanding Young Electrical Engineer on January 29, Clarence J. Baldwin offers some valuable experience from his own career. A detailed biography appears in the Winter, 1961, issue of the BRIDGE.

I think each of you must know the mixed emotions of pride and humility, of gratification and gratitude, I feel on receiving this award. I am deeply indebted to you and your officers for a most distinguished honor. I thank you for it.

When a young man is given such an extraordinary opportunity as this—the privilege of speaking his mind before an audience of mature industrialists and senior members of his profession—he feels a strong desire to repay his hosts and reward his sponsors by saying something that is really earth-shaking. After some hours of work on the matter, he decides that he will be satisfied if he can manage to say something that is merely brilliant. After still more consideration, he is willing to settle for something—anything—that will make a little sense and prove moderately useful.

I have gone through this painful process, and it has occurred to me that I might contribute something moderately useful if I spoke to you as a member of my generation—the generation that was graduated during the Korean War—and if I told you about a most important lesson I have learned from my first ten years' experience in engineering and industry.

The lesson I learned was simply this: That in our day of great and rapid change, a man's knowledge begins to become obsolete as soon as he gets his diploma. To illustrate this, I must use a personal reference.

I was graduated from a Texas campus in 1951 with the latest and best engineering education I was capable of absorbing. Being from Texas, I am sure that it was the best. Like anyone else, I was inclined to say on June 2, "Well, that takes care of *that*." But in a very short time I realized that unless I did something about it, I would be competing in in a jet-plane world with a Model T education.

Some of us have lately asked ourselves this question: If, by some twist of the time machine, we were to enter the engineering world today with only the knowledge we had in 1951, how would we get along? The answer is very simple. We would be lost. I have, for example, been carrying on work for some time now using digital computers. In 1951 I had never seen a digital computer. Very few of us had.

It follows, I think, that today's engineering graduate will be lost in the same way in 1971 if he depends on his 1961 skills and knowledge. And it follows that from the day we enter business, we must not only adjust ourselves constantly to new and changing conditions, but must engage in a never-ending process of education simply to stay abreast.

Today's young engineer is like the small boy in the story I read recently. His young parents had spent some weeks preparing their son psychologically for his first day of school. Ricky entered the schoolhouse without a whimper, and when his parents questioned him anxiously later that day, he replied that he liked school just fine. The next morning his mother wakened Ricky at an early hour with the words, "Time to go to school." Ricky opened one sleepy eye and said indignantly, "What—*again*?"

I'm afraid that's the situation facing today's young engineering graduate.

If my own experience is valid, and we can generalize from it, what useful conclusions can we draw?

I believe, first that the young engineer must do everything he can—more than that, all that is *necessary*—to keep abreast of technical developments in his own discipline.

This means continued education, of course, in his own special field. It means continued education in other technical fields which are related and new. Without such education, we find ourselves listening to a language and to ideas which convey no meaning. For example, have you ever heard of Synnoetics? I hadn't until recently. "Synnoetics is the science of treating of the properties of composite systems—consisting of configurations of people, mechanisms, plant or animal organisms, and automata—whose main attribute is that their ability to invent, to create, and to r e a s o n — their 'mental power' — is usually greater than the 'mental power' of their components."

As the young graduate continues his education in related technical fields, he becomes more valuable to his employer. For years, the colleges turned out rather narrow specialists. This increasing specialization has produced a counter-need for a man—an integrating generalist—who can master a broad area taking in many diverse specialties, so as to combine their achievements for wider application.

The young engineer who follows this course of continuing education will be receptive to new ideas and eager to seek out those activities in his industry and profession where the newest developments are taking place. Fortunately, there are good opportunities for this today in almost every industry—in those which are well-established as well as in those which are new and glamorous and involve rocket travel to the moon. My own field, utility engineering, has been considered by some a rather staid and prosaic one, concerned solely with equipment that rotated and equipment that lighted. In only ten years, I have seen it galvanized by some of the most exciting developments of our time—with automated control of power stations, operations research application, powercasting by digital computer, new developments in engineering economics, extra high voltage transmission, nuclear - powered central stations, and other new energy sources. How could one take effective part in these with a 1951 education that had not been updated?

The second major conclusion I would draw from what I have seen is that the young engineer must also struggle to keep abreast of new developments in the broader fields which lie outside his own immediate profession. Great, rapid, and continuing changes are taking place in the social sciences, in community development, in medicine, in art, in politics. It is a truism that we, as professional people, are involved in these activities, because, in the words of the poet, we are "involved in mankind."

As we are told so very often, our responsibilities as professionals extend beyond our profession. Yet I am not tired of hearing this; I grant its validity: I recognize that much of the pleasure of my work lies in the fact that the product I work with—electric power—adds to the happiness of people, lifts the burden of toil from their backs, and raises their standard of living. I derive considerable satisfaction from working with an industry which generates power primarily for peaceful and constructive purposes. My efforts are supposed to help it to do a better job through improved systems engineering. For the past four years I have been specifically concerned with system economics and long-range planning. If our forecasts and studies are correct, new policies could reduce utility revenue requirements by several per cent, and so lead in turn to more prosperous companies and continued reduction of rates in real dollars. This directly encourages the increased use of electric power to the benefit of mankind.

I am especially encouraged by the work we are doing to bring new power system planning techniques to foreign countries. We have had discussions with the engineers from a half-dozen or more countries and have just finished a limited study for Korea. The potentialities of electric power in meeting human needs in foreign lands are tremendous, and I am deeply gratified that I have some small part in this work.

I am gratified because I believe such a contribution can help us to meet the enormous problems we face in dealing with these lands — and especially with the underdeveloped nations. We obviously face great and rapid change in our relationships with these nations and must adapt ourselves to this change, just as we face change and adjustment in our professions and in our own economy. We must work to provide these people with the ideas and motivations of freedom, and help them to build the basic means for subsistence and growth which make freedom possible. We have been doing this, but in our hearts we know that we must do it better, faster and in greater degree. Mr. George Romney told us a few weeks ago that one of the two or three greatest problems facing our country is "the failure to exercise our responsibility to the yearning millions of the world who are not as fortunate as we."

To sum up, I would repeat that the young engineer must engage in a never-ending process of self-education if he is to keep abreast of developments, adjust to changing conditions, and make his maximum contribution in his profession and to society.

It is good that industry offers so many opportunities for the young engineer to obtain this education. The schools and laboratories are standing; the company programs have been set up; there are scholarships and fellowships and professorships both for the teaching and the learning. I don't know if many of my generation have ever taken the trouble to thank you for doing this. We tend to take such facilities for granted—to assume that, since they are there, they must always have been there and will continue to be. But we know, if we think about it, that these had to be planned, created, and paid for. And so I would like to express a collective word of thanks now to you, and to all others responsible, for what you have done and are doing to make continued and advanced engineering education possible.

Why Eta Kappa Nu?

Address by John H. Craig, National President of HKN, on the occasion of the installation of Delta-Xi Chapter at Air Force Institute of Technology, March 2, 1962.

It is always a pleasure to get back to a college campus–I guess I can call this a campus–especially for occasions like this. The enthusiasm and buoyancy one finds on campus is an inspiration. Certainly it is reassuring to know that the country has a hard core of enthusiastic and knowledgeable young people to tackle the problems we face on all fronts.

For just a few moments tonight I would like to share some thoughts with you on what Eta Kappa Nu is, how it fits into our present day society, and why I feel it is a worthwhile, even necessary, organization.

Have you ever really wondered why there is an Eta Kappa Nu? Why was it started? What are its real objectives? Or have you just assumed that because it exists after 58 years and reaches across the country into 84 schools that it must be desirable?

At the outset I would like to say Eta Kappa Nu is a complex organization and I doubt that an accurate lasting definition of all of its many functions can be made. However, I believe there are some very basic facts about Eta Kappa Nu that will stand the test of time.

First–Eta Kappa Nu is composed of two separate groups. You here at the Air Force Institute of Technology in the college chapter represent the first. There are now some 84 such chapters, each organized locally similar to you. Second, there is the growing number of alumni loosely organized in some of our principal cities. For administrative purposes, Eta Kappa Nu is a corporation with a President, Vice President, Executive Secretary, and a six man Board of Directors. This executive group is responsible for the national organization, setting policy on various operational matters, including the finances.

Second–As an organization, we are dedicated to some rather specific purposes, the principal one being to bring into closer union for their mutual benefit those electrical engineers who have demonstrated outstanding ability or performance in this field.

Third–Eta Kappa Nu fosters a spirit of liberal culture in engineering colleges.

Fourth–Eta Kappa Nu through its selection of student members recognizes and rewards those in electrical engineering who have achieved high scholastic standing, demonstrated leadership in campus activities, and possess exemplary character.

Fifth–Eta Kappa Nu through its selection of professional and eminent memberships recognizes and rewards in the profession of electrical engineering those who have made outstanding contributions to electrical engineering and society as a whole.

I feel those are the principal points to remember when thinking of Eta Kappa Nu.

In meeting these objectives, there are many activities carried out by the Alumni and College Chapters. For example, the following are some picked at random from the College Chapter activities reports.

– Organizing and participating in engineering shows and "open houses" on campus.

– Conducting freshman orientation courses in engineering careers, slide rule usage, etc.

– Constructing laboratory equipment.

– Conducting prize paper contests.

– Honoring outstanding electrical engineering students.

– Working up programs to stimulate engineering interest at high school level.

With a much smaller number of alumni chapters and being loosely organized, there are only a few important alumni activities. There are two which are perhaps the most important–the award to the Outstanding Young Electrical Engineer, and a film entitled *Engineering–A Career for Tomorrow*.

The Award is given each year to that electrical engineer under 35 years old who has made the most meritorious record to date. Considered in this evaluation are his on-the-job performance, his contribution to society, and his cultural and esthetic achievements. In order to win, the young engineer must be truly well rounded.

The movie is a 27-minute story presenting the principal reasons for being an engineer, and some of the kinds of work an electrical engineer performs. Privately owned copies of the film are available for loan and are located throughout the country. A directory is available to indicate the location of these films. The film has been seen by thousands of high school students throughout the country.

There are other miscellaneous local alumni chapter activities such as the induction of eminent members, monthly luncheons, joint meetings with local college chapters, etc.

Our National Headquarters performs a multitude of functions designed to keep Eta Kappa Nu a well running organization. They have one particular activity I will mention–that of publishing the BRIDGE. This is our national magazine which is published 4 times a year. It has maintained a policy of presenting worthwhile articles of a broad nature, especially those bearing on the improvement of our profession, both on and off campus.

Eta Kappa Nu has not always been as you know it today. It has been evolving along with the profession of electrical engineering. When Eta Kappa Nu was first formed, its basic purpose was to act as an employment aid. It soon changed to the basic type of organization we have today–one recognizing and demanding high scholastic achievement. In its course of evolution, Eta Kappa Nu has lost a lot of its former mysticism–mysticism associated with secret societies–the secret grips, whistles, and verbal challenges are gone. Today I believe we are a sound, forward looking, dynamic organization, well adapted to the current situation.

Perhaps this is enough for me to say about what Eta Kappa Nu is. Let me now say why I feel it is a worthwhile organization.

I can remember one of my fellow workers making some caustic comments about the value of Eta Kappa Nu. "What else do you fellows do except pat each other on the back in a mutual admiration society? Clearly, he felt Eta Kappa Nu was not a worthwhile organization. Obviously I don't share his superficial view. Ask yourself these questions:

Is it worthwhile to encourage students to higher scholastic attainments?

Is it worthwhile to encourage students to participate in extra curricular activities, both of a professional and non-professional nature?

Is it worthwhile, then, to develop well-rounded Electrical Engineers?

I think you will all agree that these are all worthwhile aims.

Is it worthwhile to recognize outstanding performance in graduate electrical engineers by professional and eminent membership?

Is it worthwhile to recognize and honor the Outstanding Young Electrical Engineer each year?

Again I think you will agree these are worthwhile aims.

But since this is all a matter of personal opinion, my skeptical friend might ask, "Why do you feel this way?" I would probably reply that my feeling is based on the beneficial results these objectives have on both the student and society as a whole. One of the principal benefits is the injection of competition in an otherwise routine situation. Competition is a vital part of our way of life. Being selected to join Eta Kappa Nu is a competitive process. Being chosen to be honored by professional or eminent membership is competitive. Being chosen Outstanding Young Electrical Engineer is the result of highly competitive process. So it seems to me that Eta Kappa Nu is performing at least two valuable functions here –

First–it is creating an environment of constructive competition, and

Second–it is rewarding the successful competitors.

Why do I feel this is beneficial? It is human nature to covet recognition. Wouldn't you like to be singled out by your fellow students or workers for doing an outstanding job? Is it wrong to capitalize upon this by offering recognition and rewards? I hardly think so. On the contrary, I feel we are doing a valuable service in stimulating and rewarding outstanding performances–the competitive spirit will produce results otherwise unattainable.

A few moments ago I mentioned the desirability of having well-rounded engineers. What is one and why are they desirable?

Again, we have plenty of room for a large variety of personal opinions and definitions. However, to me, a well-rounded engineer is *first* one who is well founded in electrical engineering. He is a top engineer. In addition, he has other strong interests and aptitudes outside of those in that particular field. For example, he is active in several campus organizations such as Eta Kappa Nu, an athletic team, a social fraternity, etc., and is an acknowledged leader in some of them. His electives go beyond technical subjects. They include philosophy, art, economics, history, etc. In other words, a well-rounded engineer is a well educated leader with the broadness of interests and abilities to be more than just an engineer. This is not said to degrade the man who finds complete satisfaction in being an engineer. We need these men, too. However, it seems to me that in the world today, and even more so in the future, we need leaders who are technically trained, ones who are well-rounded so as to understand and react properly to the increasingly complex problems of business. Eta Kappa Nu fosters the development of such people.

I have dealt with some rather broad generalities in defining what Eta Kappa Nu is and why I feel it is worthwhile. Its aims are eternal and proper; it will continue to grow and prosper. I am proud to be a part of it and am most happy to have had this opportunity to welcome you into our growing ranks.

Chapter Activities

ALPHA CHAPTER, University of Illinois—The annual Engineering Open House in March is the high point of the spring semester. This year's event found Alpha Chapter on hand ready to be of service to the Electrical Engineering Department with an Information Booth, a tour service, and awards for the top EE exhibits. A group of judges from industry and the University gave the number one award to a display dealing with the history and principles of microphones.

In the early part of May, the Junior Academy of Science holds its annual exhibition at Champaign, Illinois. It is customary for the Engineering College to provide the scientific-minded high school students with the opportunity to tour the various departments. On behalf of the EE Department, they conducted some of these students through the research facilities of the University.

At this time HKN is organizing a program whereby graduating EE seniors could evaluate the course material of EE subjects. This is not to be confused with the instructor rating forms devloped earlier.

Upsilon Chapter president Ina Dementjev, which makes Upsilon a candidate for the chapter we would most like to visit.

Also on the list of activities are the Professional Engineering Exam Refresher Course, the preparation of a small EE handbook and the Initiation and Banquet.

BETA CHAPTER, Purdue University—This spring 42 new members were initiated into the chapter. The spring initiation banquet was held April 15, 1962, on the eve of initiation ceremonies. At the banquet, Prof. Ludwig Kruhe gave the address, "Inside Russia Today." During the same evening an award was presented to Mrs. E. F. Sherwood. A presentation was also made to the present head of the E.E. School, Dr. T. F. Jones, and to a past head of the E.E. School, Prof. D. D. Ewing.

On April 14, HKN, IRE, and AIEE combined efforts in presenting an Open House. Interesting demonstrations reflected almost every phase of Electrical Engineering. During the same day, a six man installation team from Beta Chapter traveled to Notre Dame University to take part in Delta-Sigma installation ceremonies and banquet.

The "EE-GLE," Beta Chapter's newspaper for the EE School, has continued to bring its readers many interesting accounts of research here at Purdue, sketches of instructors, and thought provoking articles.

This spring's Pledge Essay Award went to R. Asato for his essay on tunnel diodes.

Beta chapter has been periodically sponsoring help sessions for sophomore circuits courses and presenting lectures to freshman engineering students on the purpose and aims of Eta Kappa Nu.

A report on this chapter's activities over the past semester would be incomplete if it failed to mention the enthusiastic participation and interest of the officers and members of Beta Chapter during this spring semester.

GAMMA CHAPTER, The Ohio State University—is sponsoring a series of tours of research facilities in the engineering college. To date, tours of the electron device laboratory and the antenna laboratory have been conducted. Turnouts were good for both trips, and a good deal of enthusiasm for future tours was expressed by those who participated.

The yearly alumni newsletter has been prepared, and is in the process of being mailed. The twofold purpose of the newsletter is to keep alumni posted on current happenings in the E.E. Department, and to encourage contributions to the Tang Memorial Fund, which will provide a scholarship and library volumes.

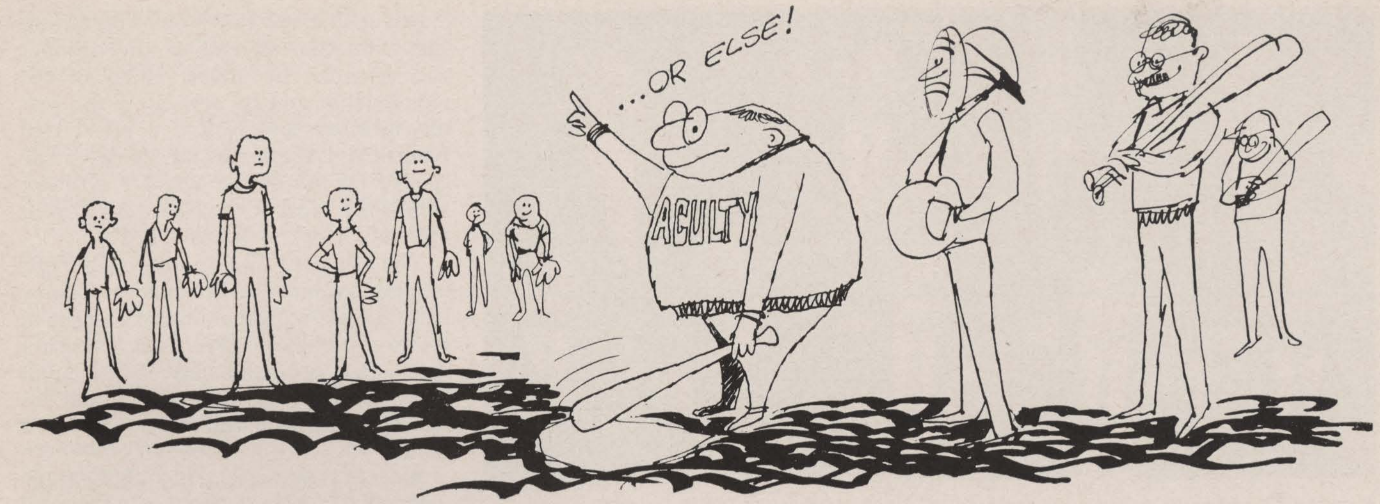
On April 18th, Gamma chapter joined with AIEE-IRE to present an evening program to acquaint sophomore pre-engineers with the department. Faculty members gave short talks, department facilities were shown, and student counseling was made available.

A smoker was held April 27th, to which 25 candidates were invited. Initiation ceremonies for those elected will be held in the near future.

Perennial activities, such as the tutoring program and the morning coffee hours, are being continued.

ZETA CHAPTER, Case Institute of Technology—ended the Spring semester with the initiation of 12 undergraduates and two professional men. The new professional members are Dr. Osman K. Mawardi of Case and Mr. Harold L. Williams of the Cleveland Electric Illuminating Company. Professor John R. Martin, retiring head of the EE Department, was feted at the initiation banquet on May 10.

Zeta Chapter's department newsletter, the **Eta Kappa Nu's,** enjoyed increased popularity in its second year of publication. The Nu's features articles by faculty and students on current areas of interest in the department.



Paul Oversmith was chosen the outstanding EE sophomore for '61-'62 and was presented with a book by Dr. Jerome Meisel at the May initiation banquet.

IOTA CHAPTER, University of Missouri—at the spring, 1962, initiation honored twelve undergraduates by accepting them into its ranks according to the rules set up in the bylaws of HKN. The banquet in honor of the new members immediately followed the formal initiation.

Iota Chapter's Award to the most outstanding sophomore of the school year 1960-61 went to Mr. Walter R. Bowles. The Award is presented at the Engineering Convocation which climaxes Engineering Week festivities.

Other projects of Iota Chapter include the recent mounting of a Bridge and Paddle display in the new Electrical Engineering building; the construction of a 22-inch wide by 18-inch long Nichol's chart to be used by instructors in future courses in control systems design; and construction of a new electronic symbols display.

KAPPA CHAPTER, Cornell University—pledges started this spring a project to install a portable FM transmitter-receiver-speaker system to aid lecturers in the school's main lecture room. In addition, pledges and brothers prepared and presented to the faculty this term course evaluation sheets of the entire E.E. curriculum for their consideration.

With the advent of the two year Engineering Basic Studies program, our outstanding student award will now go to a Junior. This year's recipient is C. Allan Buzzard.

Twelve pledges were initiated May 6 with a banquet featuring Dr. John Summerskill, Vice-President of Student Affairs, as speaker.

XI CHAPTER, Auburn University—has completed a successful and active year. One of the major activities of this year was the presentation of an eight week course in the use of the slide rule to all interested freshmen and sophomore students. This course was offered first in the fall quarter and interest was so high that it was repeated during the winter quarter and again in the spring quarter. Also, Eta Kappa Nu took an active part in Auburn University's High School Visitation Program with the members serving as guides and demonstrators. The initiation this spring was highlighted by the initiation of two faculty members: Prof. T. D. Slagh and Prof. R. E. Littleton.

OMICRON CHAPTER, University of Minnesota—"Who's got a 45,000 volt transformer?" was one of the comments heard as members of Omicron prepared their curiosity-tittilating exhibits for the annual Engineering Day. (The transformer was to produce a "Jacob's Ladder.") As the older members worked, they had the advantage of the fresh ideas of the new initiates.

The new members were welcomed in at the Spring banquet held at a beautiful inn on the shores of the Mississippi. After congratulations and a gift for the outstanding junior in electrical engineering, the members heard an excellent talk by a Special Agent of the F. B. I. As the river wended its way just outside of the large glass wall, the Agent wove a picture for us of the many varied activities of the F. B. I. When asked about his own experiences, he said that about the only amusing thing in his career happened the time he handed **his** identification card with his finger print and picture on it to a kindly old lady in Minneapolis. After carefully scrutinizing his picture, she said, "He sure looks like a criminal . . . you can tell by the face every time!"

UPSILON CHAPTER, University of Southern California—Highlight of the Spring semester activities was the initiation banquet, held on April 13, 1962 at a Hollywood restaurant. A record number of twenty-eight undergraduate, graduate, and professional candidates were initiated into Eta Kappa Nu that evening.

Upsilon Chapter was honored to induct 9 electrical engineers who have made outstanding contributions to their profession: Mr. Bernard S. Benson, President of the Banson-Lehner Corporation; Mr. Franklin M. Dorey, General Electric Industrial Application Engineer; Mr. Vincent A. Giroux, Asst. Prof. of Engr. at Los Angeles State College; Mr. George F. Miller, Chief Engineer for Pacific Telephone; Mr. Robert Milmoe, Supervising Project Engineer with Bechtel Corporation; Mr. John H. Morecroft, Engineering Specialist, Jet Propulsion Lab of the California Institute of Technology; Mr. Robert J. Schlesinger, Section Head for Litton Systems, Inc.; and Mr. David F. Burdett, Project Engineer for Litton Systems, Inc.; Mr. Lee List, also employed by Litton Systems, was initiated on behalf of Gamma-Sigma Chapter of the University of Utah.

Henry R. Howard was awarded as outstanding pledge with a book and certificate. Past President Theodore R. Miller received a gavel in appreciation for his services, despite protests of his wife, Marge, that she did all the work.

Guest speaker of the evening was Mr. Bernard S. Benson. His extremely interesting topic was "Potential Uses

Upsilon Chapter inducted nine professional members on April 13, 1962.—1st row, l. to r.: Mr. David F. Burdett, Mr. E. Lee List, Mr. Robert J. Schlesinger, all of Litton Systems, Inc.; Mr. Franklin M. Dorey, General Electric; Mr. Bernard S. Benson, Benson-Lehner Corp. 2nd row, l. to r.: Mr. John H. Morecroft, Cal Tech Jet Propulsion Lab; Mr. Robert Milmoe, Bechtel Corp.; Mr. Vincent A. Giroux, Los Angeles State College; Mr. George F. Miller, Pacific Telephone.

and Abuses of Gigantic Machine Memories." He originally presented this talk in Paris at the International Conference on Information Processing, which was sponsored by UNESCO in June of 1959.

Mr. Benson said that the main preoccupation of scientific personnel is in advancing the boundaries of scientific accomplishment. He feels that there should be equally serious consideration to determine means of insuring that the new accomplishments will be beneficial to mankind. He listed the vast quantities of personal data which are fed into machines and raised some thought-provoking questions: "What about the influence of gigantic machine memories on the liberty of the individual in 1984 (only 22 years from now)? Who will own them? Who will fill the store? Who will control the integrity of the information which fills it? Who will use it? And who will abuse it?"

PSI CHAPTER, The University of Texas—has closed its 1961-62 program of activities with the election of officers for the coming fall term and formation of tentative plans to be carried out at that time.

Interest was maintained in all of the activities for the past semester. The most successful endeavor was the conducting of classes on the use of the 1604 digital computer. Approximately 60 students, mostly sophomores, participated in the program. The classes consisted of programming problems and actually obtaining the solutions. Most of the problems were homework assignments in sophomore EE courses. The use of the computer illustrates the validity of many of the assumptions made in normal types of solution. HKN tutored each student and when extreme problems were faced, aid was given to the student.

The annual spring Power Show was considered one of the most successful in recent years. Members of HKN were in charge of sign-making for the EE projects and coordinators of many of the varied projects of the show.

Psi Chapter initiated 14 undergraduate members and 3 graduate students at the spring initiation ceremonies on April 28. The pledge project for this semester was the maintenance of an exhibit in the "Forty Acres Roundup Showcase." The exhibit consisted of a relay door lock system and an electroencephalograph demonstration.

Each year the Psi Chapter names an outstanding Senior student. The selection for 1961-62 is Lee Thomas. Lee, an outstanding committee member and ex-officer in HKN, was graduated in January and is now doing graduate work at M.I.T. He had conducted slide rule courses and served as editor of FEEDBACK, the EE periodical.

BETA-ALPHA CHAPTER, Drexel Institute of Technology—initiated 18 undergraduate members and also 9 men from the graduate school of the evening college of Drexel. At this same initiation we also initiated three Professional Members—Dr. Harry L. Krutter, Dr. Nurimdra Puri, and Dr. Dennis LeCroissette. The initiation ceremony was followed by a dinner-dance at a nearby downtown restaurant. The initiation ceremony and dinner was attended by almost 100% of the membership and by several of the faculty members and deans connected with Electrical Engineering at Drexel. The speaker at the dinner was Dr. Krutter, who is the head of the Naval Air Development Center at Johnsville, Pa.

The Chapter also sponsored an afternoon softball game and barbeque, held at Drexel's Suburban Lodge in Newtown Square, Pa. Fair weather drew out approximately 40 couples from the student body and about 15 faculty members and their wives or guests.

At our last meeting we elected the new officers for the coming year. For the first time in the chapter's history the officers were inducted by a formal ceremony to their respective offices. It was felt by the present officers that such a ceremony adds dignity to the office and impresses the elected man with the responsibility of his position.

Several committees were active during the spring term. The Technical Information Committee did a good job of securing current technical information from industry for the members. Also a committee was set up to look into the possibility of obtaining a computer for student use in problem solving and research.

The May issue of the Eta Kappa News, the monthly paper published by the Beta-Alpha chapter, featured essays by some of the members and a description of the spring initiation.

The last planned activity of the chapter is the Student-Faculty Tea, held May 16.

BETA-THETA CHAPTER, Massachusetts Institute of Technology—Under the leadership of President Harold H. Heggestad, Beta-Theta Chapter has increased its activities and its membership. For the first time, we are compiling and publishing a list of the equipment available from one of our instrument stock rooms. The list includes the type, operating specifications, and number available for over one hundred instruments. Besides working on the instruments, we assisted an existing department committee in obtaining and compiling information on graduate schools. We also continued our publication of a list of thesis topics.

While we tried to keep busy with work, we found time to have pledge socials and very enjoyable initiation banquets. For our fall banquet, we were honored with the attendance of Provost Townes, discoverer of the maser, who spoke on the changing demands placed on the engineer.

BETA-MU CHAPTER, Georgia Institute of Technology—Activities during the spring quarter centered around initiation of new members, Engineers Week, the annual banquet, and election of officers.

Engineers Week exhibits were coordinated with IRE and AIEE groups with Beta-Mu responsible for all but the purely passive displays. This year's exhibits were selected to best demonstrate current activities within the department, and included the basic areas of communication, analysis and synthesis, controls, and energy conversion. The electrical engineering displays received third place award from the judges.

In an effort to promote more effective activities and administration within Beta-Mu Chapter, by-laws are being revised to provide for annual rather than semi-annual election of officers, so more experienced leadership will be available. In conjunction with this change of by-laws, it is expected that the Chapter will select a higher percentage of members from the eligible juniors, consistent with national and chapter standards. This should provide a pool of experienced and eligible members from which our officers can be chosen.

BETA-SIGMA CHAPTER, University of Detroit—held fifteen meetings in the current school year. Mr. Edward Ranke of the University of Detroit electrical department, was the guest speaker at one of the meetings. He spoke on the need for post-graduate work for the electrical engineer.

Six new members were initiated in the fall semester and twenty-eight men were initiated in the spring. The guest speaker at the fall initiation banquet was Professor W. Joyce, of the University of Detroit Law School, and Dr. E. Lamier, of the English department was the speaker in the spring.

The members, with the help of the Electrical department have compiled a file on the various graduate school programs, fellowships, and assistantships which are available to the senior electrical engineer throughout the country. The upperclassmen of Eta Kappa Nu have offered a tutoring service for the juniors in their circuit analysis courses. The Beta-Sigma Chapter again sponsored a booth for the University of Detroit Spring Carnival this May.

Delta-Xi Chapter Installed

The Delta-Xi Chapter of Eta Kappa Nu was officially installed at the Air Force Institute of Technology, Wright-Patterson Air Force Base, on 1 March 1962 by President John H. Craig.

There were eight charter members chosen from the undergraduate class, and eight graduate electrical engineering students. The sixteen professional members represented the Air Force Institute of Technology electrical engineering staff, the University of Dayton, Wright-Patterson Air Force Base Electronics Laboratories, and industrial firms located in Dayton. In addition to the new members and their wives, several members from the Dayton area attended the ceremony.

Major General Cecil E. Combs, Commandant of the Air Force Institute of Technology, addressed the group to accept the challenge of Eta Kappa Nu's preamble and to live up to the high academic and professional standards expected of its members.

President Craig explained the purpose of Eta Kappa Nu and mentioned many of the worthwhile projects accomplished by Eta Kappa Nu members. All the members and guests became acutely aware of the requirements for membership in Eta Kappa Nu as Mr. Craig spoke. They heard the responsibilities of being a member and they realized that there was a great challenge accompanying the honor of being a member of Eta Kappa Nu.

A charter was presented to Delta-Xi president, Karl L. Craton, by President Craig. Accompanying the charter came the charge to lead the chapter into a progressive program—and of course that annual report.

Captain Craton, the rest of the officers, and Prof. James H. Johnson, Faculty Adviser, fully realize the task before them and are preparing to carry forth an effective program.

National President John H. Craig presents the charter of Delta-Xi Chapter, Air Force Institute of Technology, to Karl L. Craton.

BETA-CHI CHAPTER, South Dakota School of Mines and Technology—initiated twelve new members on January 12. After the initiation, a banquet was held at Schimmels restaurant. Guest speaker was Ralph Branning, head of Northrup's field engineering department at the T-2 Titan Site.

This year's election of officers was held May 2. Russell Buyse was elected president of the Chapter.

Current projects include a drive to obtain slides from graduates of the department describing their work in industry. These slides will be used as part of a program to be presented to high schools in the area, in an effort to give a true picture of the engineering profession. The program will be brought up to date each year with the addition of new slides.

BETA-PSI CHAPTER, University of Nebraska—Fourteen new members were initiated at the initiation banquet. Dr. Theodore Jorgensen, physics professor, spoke of his World War II experience at Los Alamos, New Mexico. A few weeks later, new officers were elected and were later installed at a luncheon in the student union.

Spring chapter activities were primarily devoted to project work for making the annual E-week open house a great success.

GAMMA-BETA CHAPTER, Northwestern University—undertook and has successfully completed a full program of activities during the academic year 1961-1962.

The chapter feels that students of greater ability have greater obligations to the rest of the student body. Free tutoring is provided to all students who have failed electrical engineering courses to prepare them for an examination which removes the deficiencies. A synopsis of all companies interviewing electrical engineers on campus was prepared and distributed to the senior EE class. The pamphlet contained the interviewing dates and pertinent comments. A synopsis of all universities and colleges offering graduate work in EE, the requirements for admission, financial aid available, etc., was prepared and distributed to upperclassmen. Gamma-Beta feels that the professional society is an important part of our undergraduate program, and as such assists in every way possible the ventures of the Northeastern student chapter of AIEE-IRE.

In addition to its obligations to the student body, Gamma-Beta believes it has a strong obligation to Eta Kappa Nu itself. The student body holds HKN in the highest regard, due to the type of men who wear the bridge and how they perform in all their activities. Gamma-Beta is careful to initiate only people of good character, scholarship only being used as one requirement, not the deciding factor. The membership committee conducts an intensive interview series to enable the members to better evaluate the candidates.

To make the chapter more efficient, a constitutional committee was set up to streamline the chapter by-laws. After several chapter meetings of considerable discussion, Gamma - Beta passed a new set of by-laws which removed many of the problems inherent in our old by-laws.

The Chapter has held an outing, attended a school dance as a group, and has added an informal social atmosphere to both fall and spring initiation banquets. The fall banquet included dancing after the program; the spring banquet included a tour of the Museum of Science in Boston. In addition get-togethers are held after every meeting.

GAMMA - GAMMA CHAPTER, Clarkson College—On April 7, cooperating with the other departmental honoraries, sponsored an "Engineering Day" for junior and senior high school students and their advisors from the nearby area. Displays, designed to present basic concepts, were prepared by the members and ranged from digital techniques to electrostatics. These student projects were supplemented by displays from General Electric Company, New York Telephone Company, and N.A.S.A. Particular emphasis was given to informal discussions between high school students and chapter members on college life. "Engineering Day" was an outstanding success and plans are already being made for expanding it for next year.

GAMMA-THETA CHAPTER, Missouri School of Mines — On May 5, 1962, seventeen new members, including two graduate students, were initiated into our Chapter. The entire evening was a success highlighted by an inspiring and timely speech by Mr. Harold Hertenstein of the McDonnell Aircraft Corporation. The title of his talk was "Preparation for the Space Age." He discussed numerous problems facing us and the role that the electrical engineer and every engineer should and must play in the future. Mr. Hertenstein pointed out that all of our techni-

Engineering Day exhibit at Gamma-Gamma, Clarkson College.

cal training is merely a building block for our future learning, and we must continually strive to gain more and more knowledge in this rapidly changing world.

The new slate of officers for the fall semester of the 1962-63 academic year were elected on April 26, 1962. The chapter expressed its appreciation to the outgoing officers for their fine leadership that resulted in a successful semester.

The annual science fair was held on our campus to which students from the surrounding high schools bring their various science projects. This year our chapter in co-operation with the science fair committee awarded a plaque recognizing the outstanding electrical enginering project.

In addition our lab insurance program was continued with a profit showing on the books. This program is heartily recommended to the other chapters as it is a source of income and for the nominal fee of fifty cents, the EE student is protected from any accidental damage to laboratory equipment.

GAMMA - IOTA CHAPTER, The University of Kansas—initiated 17 new members in the Spring 1962 initiation ceremonies May 9, 1962. The initiation banquet was held May 10 in honor of the new members.

Gamma-Iota Chapter displayed a small digital computer during the annual University of Kansas Engineering Exposition held on April 20-21, in order to publicize the purpose of HKN to the students and visitors of the Exposition. Many members of Gamma-Iota Chapter were kept busy with the Electrical Engineering Department's display, "Cable Testing," which won the academic honors for the Exposition.

GAMMA-XI CHAPTER, University of Maryland—ushered in the spring semester with many successful activities. Thirteen new members were initiated at the Spring Initiation Banquet-Dance. At his annual event, which was held at the Dodge House, Robert Russell received the chapter's second annual Outstanding Senior Award for his 4.0 average in E.E. subjects and his contributions to the chapter's activities. Officers for the 1962-63 school year were elected.

The tutoring service established by Gamma-Xi proved to be a valuable aid to students in their first E.E. course. This semester a list of summer jobs previously held by seniors was prepared as a guide to juniors interested in obtaining similar positions. The Chapter also erected a bulletin board on which was placed pictures of the EE faculty and a list of their achievements.

In conjunction with the IRE-AIEE Association a field trip was taken to the Patuxent River Naval Air Station. Also, the IRE-AIEE-HKN picnic was a huge success. The traditional soft ball game between the two associations ended in a 10-10 tie.

After commencement, a social function is planned at which the newly graduated senior HKN members will be united as a group for probably the last time.

GAMMA-PHI CHAPTER, University of Arkansas—initiated fifteen new member in its Spring initiation ceremonies held Sunday, May 6, 1962. Ronald Chun was chosen as the outstanding pledge because of his high score on a test administered to the pledges.

HKN will give an award to the outstanding sophomore E.E. student. The award will be presented during the University's Honors Convocation.

GAMMA-CHI CHAPTER, New Mexico State University — Dr. Kaiser Kunz, research professor at NMSU, and Mr. John F. Armstrong, Vice President of El Paso Electric Company, were initiated as professional members into Gamma-Chi chapter this spring.

One project that has been started this spring will be obtaining 8½ by 11 inch-size tube curves to be used in graphical analysis work in the electronics classes. There will be about 20 different tube and transistor characteristic curves in the set. This project will be continued each year.

Six members are now learning how to program the analog computer available in the department. Next fall these six members will instruct as many students as possible that are interested in using the computer. Those that complete the class will then be able to act as instructors so that all students that are interested in learning the procedure in programming will have the opportunity to do so.

The annual spring picnic with the faculty will be held in May. The faculty is feverishly practicing for the softball game, determined that they are going to win this year for they haven't won a game in years. However, the students are sure that the faculty will lose once again, regardless of the threats of F from the faculty.

GAMMA-OMEGA CHAPTER, Mississippi State University—recently initiated three new members into the chapter bringing the total number of initiates for the year up to fourteen undergraduates and two professional men.

Following the initiation the members and initiates attended a banquet held in honor of the new initiates. At this banquet the chapter was priviliged to have Dr. Terry T. Crow of the physics department speak on the development of nuclear physics over the last twenty years. His talk was very interesting and educational and was enjoyed by all.

The Chapter presented to last year's outstanding freshman in electrical engineering its annual award of an "Electrical Engineering Handbook" at the engineers' awards banquet on March 24. The recipient of the award was Robert A. Sheely.

On May 4 the members had a picnic at the residence of Prof. P. B. Jacob, Jr. during which time the officers for the coming year were installed. Everybody had a wonderful time, being in full fellowship for possibly the last time.

DELTA-GAMMA CHAPTER, Louisiana Polytechnic Institute—began the Spring semester with a new slate of officers who lost no time in arranging an informal smoker in order that the members could meet the students eligible for membership in HKN. Three of these students were selected as candidates for membership and were formally initiated on May 8, 1962, at a very impressive ceremony.

Delta-Gamma's annual Outstanding Electrical Engineering Sophomore Award was given this year to John Max Howard who has a very impressive straight A average, as well as being active in college athletics and religious affairs. He was presented with a copy of "Reference Data for Radio Engineers." Also, an award was given to the best electronics project in a recent district high school science fair. The award was a slide rule which was given to Phillip Ray Lawson.

Approximately 75% of the members of Delta-Gamma took part in Louisiana Tech's annual Engineers' Day, which was held on April 7, 1962. This year it was hailed by many as the best yet, and we can't help but feel proud that HKN had a big part in showing the public how Electrical Engineering serves them.

DELTA - DELTA CHAPTER, University of Denver—has named Donald B. Fuller as the recipient of the First Annual Award for the graduating Electrical Engineering student with the highest scholastic average. A plaque with his name engraved will be placed in the University's almost completed Boettcher Center for Science, Engineering and Research.

Three initiates were honored at a banquet on May 19, 1962. Professor Samules of the Philosophy Department of Denver University and a native of Pakistan was the speaker for the evening. With these new initiates the undergraduate members of the chapter totals 14. The University of Denver (smallest chapter title holder?) will have five members to start activities next fall.

DELTA-EPSILON CHAPTER, Ohio University—held its meeting for the purpose of electing new members on February 20. Eleven new members were elected, seven juniors and four seniors. For a pledge project most of the initiates constructed active displays to be used at the annual Engineering Open House. Those that didn't make projects were required to spend ten hours of their own time working in the store room.

Initiation was held in the Engineering Building on April 21. The initiation banquet was held on the same date.

The major project of the Chapter for this semester was that of being one of the sponsors of the annual Engineering Open House, which was held on April 26.

At the present plans are being made to have a picnic for the members of the chapter and their guests.

DELTA - XI CHAPTER, Air Force Institute of Technology—On March 1, Delta-Xi Chapter was installed into Eta Kappa Nu Association. John H. Craig, National President, was the presiding official. Seventeen student members and fifteen professional members were initiated. Major General Combs, Commandant of the Air Force Institute of Technology, was the guest speaker at a banquet following the installation ceremony. He expressed his pride and satisfaction in having a chapter of Eta Kappa Nu Association established at the Air Force Institute of Technology, and pledged his support in meeting the aims and goals of the association.

The only project undertaken by the Chapter at this date is the requested review of the undergraduate curriculum; the findings and recommendations of which are to be presented to the head of the Electrical Engineering Department in May.

BOSTON ALUMNI CHAPTER—The Boston Alumni Chapter at its Spring Meeting enjoyed a tour of the facilities of a modern brewery in Natick, Massachusetts.

The recently concluded "Engineers Week" program in the Boston area was a tremendous success and many members of the chapter were fortunate to be able to serve their profession in this endeavor. The chapter's plans for the future include participation in another Eminent Member induction, continuation of its program for providing interesting speakers, films, tours, etc. for its general meetings, and service to the community and engineering profession.

All HKN members in the Greater Boston Area are invited to contact the Chapter President, listed in the Directory, for further information.

LOS ANGELES ALUMNI CHAPTER—The first meeting of the year for the new Officers and Executive Committee of the Los Angeles Alumni Chapter was held January 26, 1962 at the home of President Tom Rothwell. New officers, in addition to Brother Tom, include Brothers Larry Hamilton—Vice President; Gene Mleczko—Secretary; and Walt Gasio—Treasurer.

This first meeting is traditional with the Los Angeles Alumni Chapter, in that it serves as the kickoff meeting for planning the year's activities. A program planning form was originated at this meeting to poll the 550 active members of the Los Angeles Alumni Chapter on their preferences concerning activities to be held during the coming year. Approximately 30 different possibilities were presented for consideration and at the close of the polling it was determined that the following activities would be on the schedule for the Los Angeles Alumni Chapter during 1962.

A joint Alumni Chapter—Upsilon Chapter, meeting at which the undergraduate members of the Upsilon Chapter were guests of the Alumni Chapter. This meeting took place at the Grandview Gardens in Los Angeles' new China Town, on March 16, 1962, and included dinner, entertainment and dancing. The members' ladies were also present to enjoy the festivities.

Among additional activities planned for the year was an atomic power plant field trip to Atomics International's reactor in the Santa Suzanna Mountains. This reactor was built under the auspices of the Atomic Energy Commission for experimental purposes and the heat from this reactor is used by the Southern California Edison Company to generate 5,000 kw of power for use in the local area. This trip was made on May 17, 1962 and proved to be very interesting, with a good turnout by the membership. A combination rally, caravan-picnic, and field trip to the Astronomical and Television Installations on Mt. Wilson in California is planned by the Chapter for late June, and a luau, stag beer party, and theatre party are other events which have been planned for the balance of the year.

The Los Angeles Alumni Chapter is planning a special activity and has under consideration a number of candidate special projects which will result in a program of great interest to all members of Eta Kappa Nu throughout the country. Announcement concerning the details of the activity finally selected for implementation will be forthcoming in the not too distant future. The aim of this activity by the Los Angeles Alumni Chapter is to stimulate and encourage electrical engineering education and to enhance recognition for electrical engineering as a vital profession.

A new set of By-Laws was drafted by the Chapter Executive Council during the past year. These were submitted to the membership for approval, and were unanimously accepted. These By-Laws for the Los Angeles Alumni Chapter are in accord with the National Organization Constitution, but provide for the proper organization and operation of the Chapter at the local level. They have been submitted to the National Executive Council for approval and ratification prior to being placed in operation.

Eta Kappa Nu members throughout the country are reminded that an Alumni Chapter handbook has been prepared by the Los Angeles Alumni Chapter and is available in reasonable quantities upon request to the Secretary of the Chapter, E. L. Mleczko, 710 West Adams Park Drive, Covina, California. Members interested in establishing new Alumni Chapters will find this handbook extremely helpful.

The Los Angeles Alumni Chapter maintains an active mailing list of 550 Eta Kappa Nu members in the Southern California area, and has just carried out a verification of its mailing list in order to ensure the accuracy of its mechanical addressing system. In the event there are any members in the Southern California area who wish to be placed on the active mailing list of the Los Angeles Alumni Chapter they may do so by sending their request to the secretary.

PHILADELPHIA ALUMNI CHAPTER—The March luncheon meeting was held at the Faculty Club of the University of Pennsylvania. Mr. Dennis LeCroissette, of Drexel Institute, gave a very interesting and enlightening talk on the educational system in England and the ways in which it is like and unlike our system in America. Having been educated in England, his knowledge was first-hand and his talk evoked

CHAPTER DIRECTORY

Chapter	*Name of School and Faculty Advisor*	*Chartered*
Alpha	University of Illinois, James P. Neal	1904
Beta	Purdue University, E. M. Sabbagh, L. A. Kramer	1913
Gamma	Ohio State University, Gordon Hame	1907
Delta	Illinois Institute of Technology, Elton Jones	1909
Epsilon	Penna. State University, Clifford Holt, Jr.	1909
Zeta	Case Institute of Tech., Walter J. Fahey	1910
Theta	University of Wisconsin, R. A. Greiner	1910
Iota	University of Missouri, Lloyd Benningfield	1911
Kappa	Cornell University, Robert Osborn	1912
Lambda	University of Pennsylvania, S. Reid Warren	1913
Mu	University of California, G. L. Turin	1915
Nu	Iowa State College, John Lagerstrom	1916
Xi	Auburn University, D. O. Noneaker	1920
Omicron	University of Minnesota, Donald Anderson	1920
Pi	Oregon State College, John Engle	1921
Rho	University of Colorado, William J. Hanna	1922
Sigma	Carnegie Inst. of Tech., Robert A. Mathias	1922
Tau	University of Cincinnati, Carl H. Osterbrock	1923
Upsilon	University of S. California, James Arnett	1925
Chi	Lehigh University, Joseph Teno	1926
Psi	University of Texas, E. C. Lowenberg	1928
Omega	Oklahoma State University, Buck F. Brown	1930
Beta-Alpha	Drexel Inst. of Tech., H. H. Sun, W. A. Holland	1935
Beta-Beta	Polytechnic Inst. of Brooklyn, J. J. Bongiorno	1936
Beta-Gamma	Michigan Tech., Walter T. Anderson	1936
Beta-Delta	University of Pittsburgh, Robert C. Gorham	1937
Beta-Epsilon	University of Michigan, Raymond F. Mosher	1937
Beta-Zeta	New York University, Charles Rehberg	1938
Beta-Eta	North Carolina State College, Norman R. Bell	1938
Beta-Theta	Massachusetts Inst. of Tech., John Tucker	1939
Beta-Iota	State University of Iowa, Richard W. Kelly	1939
Beta-Kappa	Kansas State University, R. M. Kerchner	1939
Beta-Lambda	Virginia Polytechnic Inst., R. R. Wright	1940
Beta-Mu	Georgia Inst. of Tech., Frank Nottingham	1941
Beta-Nu	Rensselaer Polytechnic Inst., Charles Close	1942
Beta-Xi	University of Oklahoma, Frank Kern	1942
Beta-Omicron	Marquette University, Harold S. Merrill	1945
Beta-Pi	The City College of New York, L. Echtman	1946
Beta-Rho	West Virginia University, E. C. Jones	1947
Beta-Sigma	University of Detroit, George Chute	1947
Beta-Tau	Northwestern Technological Inst., James Van Ness	1948
Beta-Upsilon	University of Kentucky, Lyle Bach	1948
Beta-Phi	University of Tennessee, G. W. Hoffman	1948
Beta-Chi	South Dakota School of Mines & Tech., C. W. Cox	1949
Beta-Psi	University of Nebraska, Robert Combs	1949
Beta-Omega	University of Connecticut, Vinton B. Haas	1949
Gamma-Alpha	Manhattan College, Robert Weil	1950
Gamma-Beta	Northeastern University, Laurence F. Cleveland	1950
Gamma-Gamma	Clarkson College of Tech., Richard Sanford	1950
Gamma-Delta	Worchester Polytechnic Inst., Russell Krackhardt	1950
Gamma-Epsilon	Rutgers University, J. R. Rankin	1950
Gamma-Zeta	Michigan State University, Herman Koenig	1951
Gamma-Eta	Syracuse University, John Brule	1951
Gamma-Theta	Missouri School of Mines & Met., J. I. Latham	1952
Gamma-Iota	University of Kansas, William Smith	1952
Gamma-Kappa	Newark College of Engineering, R. Anderson	1953
Gamma-Lambda	Columbia University, Thomas E. Stern	1955
Gamma-Mu	Texas A. & M., John S. Denison	1955
Gamma-Nu	Texas Technological College, Leonard Grigsby	1956
Gamma-Xi	University of Maryland, Robert M. Ginnings	1957
Gamma-Omicron	Southern Methodist University, Kenneth Heizer	1957
Gamma-Pi	University of Virginia, William J. Gilpin	1957
Gamma-Rho	South Dakota State College, William Gamble	1957
Gamma-Sigma	University of Utah, Paul O. Berrett	1958
Gamma-Tau	North Dakota State University, Donald E. Peterson	1958
Gamma-Upsilon	Johns Hopkins University, Thorstein Larson	1958
Gamma-Phi	University of Arkansas, N. H. Barnette	1959
Gamma-Chi	New Mexico State University, Harold Brown	1959
Gamma-Psi	Lafayette College, Albert P. Powell	1959
Gamma-Omega	Mississippi State University, Paul B. Jacobs, Jr.	1959
Delta-Alpha	Wayne State University, R. O. Sather	1960
Delta-Beta	Lamar State College of Tech, L. B. Cherry	1960
Delta-Gamma	Louisiana Polytechnic Inst., David L. Johnson	1960
Delta-Delta	University of Denver, H. D'Angelo	1960
Delta-Epsilon	Ohio University, G. E. Smith	1960
Delta-Zeta	Washington University, R. J. Koopman	1960
Delta-Eta	University of Massachusetts, Carl Roys	1960
Delta-Theta	Pratt Institute, Haroun Mahrous	1961
Delta-Iota	Louisiana State University, R. T. Nethken	1961
Delta-Kappa	University of Maine, Walter W. Turner	1961
Delta-Lambda	Duke University, James T. McKeel	1961
Delta-Mu	Villanova University, Joseph J. Hicks	1961
Delta-Nu	University of Alabama, Russell E. Lueg	1962
Delta-Xi	Air Force Inst. of Tech., J. H. Johnson	1962
Delta-Omicron	University of New Mexico, Donald C. Thorne	1962
Delta-Pi	Colorado State University, John E. Dean	1962
Delta-Rho	University of North Dakota, John D. Dixon	1962
Delta-Sigma	University of Notre Dame, Lawrence F. Stauder	1962
Delta-Tau	Univ. of Southwestern Louisiana, W. Hansen Hall	1962
Delta-Upsilon	Bradley University, Philip Weinberg	1962
Delta-Phi	Univ. of South Carolina, S. T. Moseley	1962

Alumni Chapters and Presidents	*Chartered*
Boston, Bruce D. Wedlock, MIT, Cambridge, Mass.	1947
Chicago, M. F. Kanne, Westinghouse, Merchandise Mart Plaza, Chicago 54, Ill.	1909
Cleveland	1920
Denver, R. Morgan Wilson, G-E Co., 650 17th St., Denver, Colo.	1938
Los Angeles, Tom Rothwell, 13223 S. Wilton Pl., Gardena, Calif.	1923
Milwaukee	1915
New York, Anthony Gabrielle, AEP Service Corp., 2 Broadway, NYC	1910
Philadelphia, O. M. Salati, 27 Rosemary Circle, Rt. 2, Media, Pa.	1908
Pittsburgh, J. E. Rupp, Union Switch & Signal, Swissvale, Pa.	1908
San Francisco	1925
Schenectady	1913
Washington	1936

WELCOME to the nine new chapters installed in 1962— Our Greatest Year

considerable discussion and questions.

Our April meeting, held at the Engineers' Club of Philadelphia, featured the appearance of Mr. Gerald Gordon, representing E T S C o (Engineering Technical Societies Council of Delaware Valley). He explained the activities of this organization, with emphasis on its excellent sphere of activity in promoting interest in science and engineering at the high school level.

Radio Corporation of America was host to the group at our May meeting, held in Camden, New Jersey. Jack Cassidy, of RCA, gave a talk on the history and growth of closed-circuit television, after which the group returned to the television studio of RCA for a demonstration and inspection of the many types of specialized equipment used in the field of closed-circuit TV.

Officers elected to serve the Philadelphia Alumni Chapter for the ensuing year are: President, Emil Kasum; Vice-President, Dr. H. H. Sun; Secretary-Treasurer, Robert A. Markel; BRIDGE Correspondent, Robert H. Groff.

Our regular monthly meetings will resume on October 3, 1962, at the Engineers' Club.

Alumni Notes

will return next issue in double measure. A lack of space forces their omission this issue, but continue to send us notes on your activities.

Happy Vacationing !

No two are the same

And the molecules in any two elements are never the same either. At Cal Tech's Jet Propulsion Laboratory, these molecular differences will soon add up to a better understanding of what the Moon is made of.

When the first Surveyor spacecraft soft-lands on the Moon in 1963, it will drill into and extract samples from the Moon's surface. After an electric oven decomposes these samples, their molecules in the form of burned-off gas will pass through a column to a detector. The detector response rate — and the amount of molecules — will be recorded and transmitted to earth.

Since JPL scientists and engineers know what molecules cause what kinds of responses (fingerprints), they will then know what elements are on the Moon. Most important, they may detect pre-life molecules on our satellite — a first clue to life in outer space.

At JPL it takes many good, curious, searching, dedicated minds to determine what instruments will measure what on the Moon and planets. Many many minds that work as one. Minds such as yours, perhaps. Will you write us today? If you have a mind to?

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