EES NOTES

ENGINEERING EXPERIMENT STATION • GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

In This Issue:

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Martha A. Deadmore

PRESIDENT HANSEN CHALLENGES EES

In his inaugural address, "Challenges to Higher Education in a Time of Change," on November 20, President Hansen outlined questions that are applicable to EES. To quote in part:

> Has the university contributed to the worry of the world or kept us from being even closer to the edge of despair? Has the university been more self-seeking than society-serving? Has the university clung to the outmoded values of the past, unwilling to change, or is it the leader in creating new values for the future? Has truth and its high pursuit been tempered by expediency or is the display of truth unrecognized for what it is? Is the mission of the university the same today as it was at the time of its creation? Does it have a new role and a new mission, not yet articulated, that once set forth will make it more able to serve a society searching for values, and a way of life commensurate with man's deepest needs and desires?

President Hansen's address calls for a review of our goals. In 1960, the General Assembly of Georgia recommissioned EES

> . . . to aid in the promotion of scientific, engineering and industrial research; . . . to promote the general welfare of the people of the State of Georgia through a program of scientific, engineering and industrial research . . . to render assistance to national programs of science, technology and preparedness. . . .

(For a more complete description, see "Functions of Experiment Station as Defined by General Assembly of Georgia," Procedure No. 0-2, EES Procedures Manual.)

The job description for the EES director states in part:

> . . . he is responsible for initiating and conducting research programs which are not primarily academic in nature, but which contribute to the fulfillment of the Institute's commitments to the state, region and nation; he is charged with the proper and effective use of the facilities and staff of the Station for the advancement of graduate research at the Georgia Institute of Technology.

In view of our responsibilities to the Institute, state, and nation, I have been using the following goals as guidelines:

1. Development and pursuance of forefront research programs relevant to the needs of the Institute and the state. This embraces an ultimate goal of being at the forefront of applied research undergirded by strong basic research programs.

2. Assistance in obtaining solutions to technological problems critical to the state, region, and nation.

3. Provision of research internships for students to give them experience in solving research and development problems.

4. Forecasting, promoting and supporting the various stages of technological and industrial growth in the state. Implicit is the need to develop, from other than state funding, technical competence that is considered to be of future benefit to the state.

5. Cooperation with the faculty and school directors in the use of the staff, facilities, and laboratories of EES to facilitate the development of educational programs.

6. Assistance with administration of interdepartmental research programs.

I wish to encourage continuing dialogue helpful for developing and maintaining, through change, meaningful goals. This dialogue, in combination with well-planned program development activities, should provide a strong base for sustained growth oriented toward the needs of society. To paraphrase President Hansen: recognizing, then, the qualities that have merit and should be preserved let the EES restructure that which needs restructuring, plan with optimism, and have the courage to pursue objectives well-defined and relevant to our day and time.

M. W. Long

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CATALYTIC EXHAUST GAS CONVERTERS

A brief industrial project to evaluate a "fume-filter" automobile muffler evolved later into a full program of development of catalytic diesel engine exhaust converters. After the "fume-filter" proved useless, we began from "scratch" and in about one year developed a practical diesel converter which also serves as an effective muffler. This unit is capable of eliminating a substantial amount of unburned hydrocarbons and essentially all odors and lachrymators from diesel exhausts. In appearance, the device looks much like a conventional engine muffler except for its distinctive stainless steel case. The converter does, in fact, muffle engine noise even more effectively than most standard mufflers.

This small project has added substantially to our analytical measurements capabilities. For example, we have developed a "microconverter" device for continuously measuring the performance of a catalytic bed. Both temperature and conversion are measured. We have learned to perform gas analysis by infrared simultaneously for paraffin hydrocarbons, unsaturated hydrocarbons, and carbon dioxide. Furthermore, we have refined our capabilities for gas analysis by vapor chromatography. From our experience in the experimental preparation of catalysts, we have gained confidence in our ability to prepare and evaluate heterogeneous catalysts for industrial processes.

Perhaps the most important value of this project has been our acquisition of a better understanding of practical engineering aspects of a range of technical problems in the air pollution field. We are developing new project proposals to attack some of these problems.

W. Raymond Tooke, Jr.
Chemical Sciences
and Materials Division

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IEEE IN ATLANTA

The Atlanta Section of the Institute of Electrical and Electronics Engineers (IEEE) has been active for a number of years. Affiliated with the international Institute are 35 Professional Groups with Group publications available to the members. The Groups participate in the national meetings and organize local Chapters to concentrate on the special interests of the members of the Institute.

The Atlanta Chapter of the IEEE Electromagnetic Compatibility Group was organized in 1967 through a cooperative effort of staff members of the Electronics Division and interested persons from the local electronics industry. This chapter has been active since its inception, and has held five technical meetings each year. William R. Free recently was elected to serve on the national Administration Committee of this Group for a term of three years, beginning January 1, 1970.

The Atlanta Chapter of the IEEE Electromagnetic Compatibility Group was host to the 1969 Southeastern Electromagnetic Compatibility Symposium which was held at the Regency Hyatt House October 27-29, 1969. About 125 registrants from 23 states and Canada attended the meeting, which included 24 technical presentations and a special panel discussion on cable coupling. Three members of the Electronics Division served on the symposium committee, and Division personnel also chaired one session and presented two technical papers.

Another major development in the Atlanta Section of IEEE is the formation of a combined chapter of the Microwave Theory and Techniques and the Antennas and

Propagation Groups. The School of Electrical Engineering spearheaded the effort, and Electronics Division personnel and local industry cooperated in establishing this chapter. At the first meeting, which was held on September 10, 1969, G. P. Rodrigue and R. W. Larson of the School of Electrical Engineering were elected Chairman and Vice-Chairman, respectively, and A. P. Sheppard of the Electronics Division, Arrangements Chairman. The first of an anticipated six technical meetings per year was held on October 15 at the Hewlett-Packard facility and featured a talk on "Pretersonics" by R. W. Damon of the Sperry-Rand Research Center.

H. A. Corriher, Jr.
Electronics Division

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PLASMA SPRAYING CAPABILITIES AT GEORGIA TECH

Plasma spraying facilities have been available commercially for nearly a generation. Georgia Tech was one of the first to purchase this equipment. With a plasma spraying facility, gas is passed through the electric arc between electrodes, and with high power input to the system, the gas is heated to a highly active state. Gas temperatures above the temperature at the surface of the sun ($6500^{o}K$) can be achieved, and the active gaseous stream can be used to melt and deposit a wide variety of materials on a broad diversity of substrate structures. This technique offers a method of depositing ceramic materials at high rates.

The physical properties of plasma-sprayed coatings can be altered within wide limits by varying the operating parameters. In addition to the preparation of the material being fused and sprayed, adjustments include the amount of power supplied to the electrodes, the composition of the gas stream, and the flow rate of the gas stream. The stand-off distance between the plasma and the substrate to be coated, and the rate and the manner in which the spraying gas stream is moved in relation to the workpiece also are important. Because plasma spraying is a complicated process, until recently it has been an art rather than a science.

Last year the HTMD researchers were able to mechanize the application of the plasma spraying operation. The area covered by the spray is a fraction of an inch and the temperature of the substrate rises rapidly. Accurate control of the successive sweeps is needed to cover even a flat area uniformly. The mechanism for traversing the sprayer has been developed to provide uniform coverage over all surfaces of complex shapes.

Paul Boland
High Temperature Materials Division

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GEORGIA CERTIFIED CITY PROGRAM

The Georgia Certified City Program, designed to help the state's cities and towns increase their attractiveness for business and industry, was initiated by the Industrial Development Division (IDD) in 1964. Cosponsors of this program are the Georgia Municipal Association and the Georgia Power Company's Community Development Division.

The Certified City Program is based on the requisite -- generally recognized by the state's industrial developers -- that a community, to attract business and industry, must first be attractive in itself. Involved is more than mere physical appearance, important as that may be; a city or town also must be able to provide those public facilities and services basic to successful operation of business and industry, as well as those amenities necessary to good living. In short, the Certified City Program recognizes this vital relationship between community attractiveness and economic progress and seeks to stimulate and give guidance to Georgia communities desirous of achieving this dual goal of civic improvement and economic advancement.

The program is based upon a set of objective Civic Progress Standards, developed by the author, which consist of a detailed and comprehensive series of questions designed to point up any weaknesses or deficiencies which may be handicapping a community's economic progress. This 55-page questionnaire, which all entrant cities are required to complete and document, examines a total of 19 areas of community activity, including industrial development, travel accommodations, transportation, communications, housing, municipal services (water, gas, sewerage, police and fire protection, schools, health, etc.), commercial development, physical appearance, municipal government, planning, and recreation. The standards established for these several areas have been derived from various social, technical, and governmental sources and represent practical, achievable levels of community development.

After an entrant city submits its completed set of Standards, these are scored on the basis of the submitted data, plus the findings of an on-the-ground inspection of the city by a team from the Industrial Development Division. Depending on the resultant score, a city may obtain certification at one of three levels -- the Bronze or basic rating, the Silver or intermediate rating, and the Gold or top rating. Of some 70 Georgia cities and towns which have participated one or more times in the program over the past five years, only 14 have achieved a rating, all at the Bronze level. In the current 1969-1970 program, three previously certified cities are again participating in an effort to obtain the Silver rating and an additional five

which earlier failed to be certified are again trying for certification. Each certified city, in addition to the award of a handsomely engraved plaque at the annual convention of the Georgia Municipal Association, is permitted to publicize itself as a Georgia Certified City for five years.

Each entrant city is furnished a critique of its local situation, as revealed by the Standards' findings, with special emphasis on the indicated weaknesses or deficiencies. For those cities which fail in their initial try, a work program to correct or improve their shortcomings is mutually agreed upon between the sponsors and the responsible municipal officials and, if this follow-up program of improvements can be satisfactorily accomplished within a two-year period, certification at the Bronze basic level is awarded.

The certification of a city or town is recognition of its superiority as a location for business or industry, as a forward-looking city dedicated to the good life. In short, the Georgia Certified City, at the higher rating levels, is a modern, progressive community that affords good transportation and communication facilities, plus adequate and economical municipal services which reflect equitable and efficient city government, in combination with convenient and up-to-date shopping areas, a variety of residential subdivisions, and a diversity of recreational opportunities.

The promotional advantages of certification are obvious. It assures the industrial prospect that the city has adequate facilities and services essential for his projected operation and that it is a progressive community affording the conveniences for comfortable living. This concept of city certification, once it achieves national recognition, will add tremendously to the effectiveness of any state industrial development program, and the idea is spreading. Only recently, a university bureau of business research in Indiana sought permission to adapt the Georgia program to an area in that state. Several other states have started or are considering programs related to this certification concept being pioneered here in Georgia.

George I. Whitlatch
Industrial Development Division

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RADIOBIOLOGY LABORATORY

One of the mysteries of the effect of penetrating radiation is the astonishingly small total energy required to do irreversible damage to a living cell. On the other hand, the use of radiation to provide a readily controlled change in a cell provides an important tool to explore life processes. Furthermore, the effects of radiation can be compared with chemically induced changes.

The primary program of the Radiobiology Laboratory is the study of the effects of both radiation and certain chemicals on genetic changes in carefully controlled groups of reproducing cells. Over the years a number of different cell systems have been used, but in the last four or five years attention has been concentrated on mammalian cell cultures, including man.

A breeding colony of Chinese hamsters has been established because of the unusual cytological characteristics of these animals which makes them uniquely useful in cytogenetic investigations. These animals permit both classical genetic breeding experiments and a detailed cytological analysis of chromosomes -- something which has not been previously available in other laboratory animals, such as rats, mice, and guinea pigs. Currently, six graduate students are using these animals in their thesis research -- five in the School of Biology and one in Nuclear Engineering.

Over the years this laboratory has conducted research and published the results of work on the effects of ozone, monochloramine, nitrogen mustards, and 250-KV X-rays under a variety of different experimental conditions.

Research has been supported by grants and contracts from the Atomic Energy Commission, Arctic Aeromedical Laboratory, National Institutes of Health, Aerospace Medicine Laboratories, and the Public Health Service.

R. H. Fetner
Nuclear and Biological
Sciences Division

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IN MEMORY OF PROFESSOR BELSER

(The following resolution in memory of Professor Richard B. Belser, Principal Research Physicist and Research Professor of Textile Engineering, was passed by the Academic Senate on November 4, 1969.)

On September 6, 1969, Georgia Tech lost a dedicated member of the faculty in the untimely passing of Professor Richard B. Belser. His service to Tech began in 1950 when he joined the staff of the Engineering Experiment Station as a Research Physicist. During his career at Tech he directed over 25 major research projects and gained an international reputation in the field of aging quartz crystal resonators. Since 1965 he served part-time in the Textile School on research projects and as thesis advisor to numerous graduate students.

A graduate of The Citadel and Emory University, he was a former Atlanta high school science teacher who continued working with high school students while at Tech.

A retired lieutenant colonel in the Army Reserve, Professor Belser spent eight years in military service as an instructor and staff officer at Ft. Benning, and as an officer in the Mediterranean Theater during WW II.

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His characteristic relentless pursuit of truth and quality were traits that endeared him to all his associates.

The faculty of the Georgia Institute of Technology mourn the passing of a long-time associate and friend and express everlasting gratitude for his service and dedication to the Institution.

It is the wish of this faculty that our expression of sympathy be conveyed to Mrs. Richard B. Belser and members of the family, and be included in the minutes of this Academic Senate meeting.

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RADIO FREQUENCY MANAGEMENT

The radio frequency spectrum is a limited resource which must be shared by civil, government, and military users. The spectrum extends from approximately 3 kHz to 300 gHz. The upper 90% of the spectrum is unusable because of the inability of present-day technology to exploit this region. Of the remaining 10% of the spectrum, only 1% is fully utilized.

The type of radio service, whether it be long- or short-range communications, broadcast, radio-navigation, or fixed, determines the portion of the spectrum which may be used. The actual number of separate and distinct channels of communication available within any portion of the spectrum is constantly changing and increasing with improvements in equipment, operating techniques, propagation prediction data, and the effectiveness of radio frequency management. The demand for radio frequencies, however, has increased at a pace which exceeds the expanding use of the spectrum.

The Rich Electronic Computer Center has developed a frequency management and assignment system for radio relay operations in a field army for the Electromagnetics Directorate, Office of the Assistant Chief of Staff for Communications-Electronics, Department of the Army. The system, designated as the GIT system, consists of two versions, an automated and a manual version. The manual version serves as backup for the automated version or can be used when computer services may not be available.

The GIT system provides for suitable protection from interference, efficiency in spectrum utilization, and flexibility for adapting to changing conditions.

Recently a team from the Computer Center, consisting of E. T. Hungerford, John P. McGovern, Karl E. Hoenes, and Ollie Francis, visited Germany to install the system in the Seventh Army. During October, E. T. Hungerford, Ray Pinkerton, and Karl E. Hoenes conducted a one-week training course for personnel of the U. S. Army and the Federal Aviation Administration. In November a one-day briefing of the

members of the Radio Frequency Working Group of Project MALLARD was given by John P. McGovern, E. T. Hungerford, and Irwin E. Perlin.

Project MALLARD is a joint four-nation -- United States, Great Britain, Canada, and Australia -- undertaking for the development of a completely digital communication system for the 1975-1985 period. The Rich Electronic Computer Center, with the cooperation of the Electronics Division, participated in a concept development study for Project MALLARD in a consortium consisting of Sylvania Electronics, Operations Research, Inc., IBM, and Georgia Tech.

I. E. Perlin
Rich Electronic Computer Center

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MATERIALS SPECIALIST JOINS PSD

Louis G. Klinker has joined the staff of the Physical Sciences Division, where he will be engaged in planning and program development. In addition, he will be active in broad interdisciplinary programs in which the Division is involved. As an example, our THEMIS project on "Interface Phenomena in Engineering Materials" has as a primary goal the strengthening of the graduate program in several departments.

The new staff member is a graduate of Purdue University and did advanced work at Youngstown University. He is the author of 14 technical and scientific articles and holds 10 patents. His technical society memberships include the American Society for Metals, the American Institute of Mining, Metallurgical and Petroleum Engineers, the American Chemical Society, the American Ordnance Association, and the Verein Deutscher Ingenieure.

Before his recent retirement with the rank of Colonel, Lou Klinker was Special Projects Staff Officer for the Physical and Engineering Sciences Division of the Office of the Chief of Research and Development, Department of the Army, and Military Deputy to the Chief of the Materials Sciences and Technology Branch. He was the Army representative to the National Materials Advisory Board of the National Academies of Science and Engineering. Mr. Klinker's broad experience has been recognized by a series of civilian and military awards, citations, and medals.

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SCHEIBNER NAMED TO INTERIM DIRECTORSHIP

In November the Board of Regents approved the appointment of Edwin J. Scheibner as Interim Director of Georgia Tech's new Bioengineering Center. Dr. Scheibner, currently Chief of the Physical Sciences Division, assumed the additional duties on December 1. An Executive Committee made up of representatives from cooperating

institutions and the Tech faculty will be appointed early next year. This committee will undertake a search for a permanent director.

According to Dr. Scheibner, "The Bioengineering Center, operating out of the Office of the Vice President for Academic Affairs, will have the responsibility for promoting and coordinating research throughout the campus and with the cooperating institutions." Emphasis will be placed on those programs which lead to the improvement of health in the populace by applying engineering methods in life sciences studies or by developing further fundamental understanding of life systems.

For the present, the office and associated facilities of the Bioengineering Center will be located in the new EES building.

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PROFESSIONAL ACTIVITIES

Speeches

Robert B. Cassell, IDD, addressed a meeting of the Northeastern Industrial Developers Association in Washington, D. C., on September 29 on "The Role of the University in Industrial Development Activity."

At a meeting of the Radiation Health Specialist Training Program Directors in Philadelphia, Pa., on November 10, F. W. Chambers, NBSD, spoke on "Expanding the Program to Include Non-ionizing as Well as Ionizing Radiation."

A paper on "Impact Scoring Radars" by H. A. Corriher, Jr., and R. C. Johnson, ED, was presented at the Fourth Naval Training Device Center/Industry Conference in Orlando, Fla., November 18-20, and will be included in the proceedings of that conference.

Ross W. Hammond, IDD, gave a speech on "Regionalization" in Rochester, Minn., on September 30 at Minnesota's 13th Annual Industrial Clinic. He presided at the Georgia Chamber of Commerce's annual Green Carpet Program in Atlanta on November 21. The program consisted of a series of presentations on Georgia's industrial assets to engineering and management consultants to industry from other parts of the country. William C. Howard, IDD, also participated, giving a talk on "Georgia's Manpower Resources."

David C. Morgan, IDD, was on the program of the Governor's Conference on Industrial Development held in Atlanta on September 12. His topic was "Technical Support in Industrial Development."

Clyde Orr, CSMD, gave six lectures on micromeritics at the Symposium on Particulate Technology in Kyoto, Japan, October 6-9. He also presented a paper on "Particle Phenomena Requiring Further Exploration" to the Fine Particle Research Society of Japan in Osaka on October 10.

At the ASTM F-4 (Surgical Implant Materials) Meeting in Memphis, Tenn., November 20, J. D. Walton, Jr., HTMD, gave a talk on "Mechanical Properties of Ceramics."

George D. Woodard, Jr., IDD, delivered a speech entitled "Gathering Information before Going into Business" at a Small Business Administration seminar held in Atlanta on October 30-31 in connection with the Fifth Annual Southeastern Own Your Own Business Show.

A paper on "A comparison of Electronically Scanned Lenses and Phased Arrays," prepared by R. P. Zimmer and H. A. Ecker, ED, was presented at the Nineteenth Annual Symposium on USAF Antenna Research and Development, held at the University of Illinois October 14-16.

Publications

E. E. Donaldson, ED, "The Use of Switching to Reduce Mixer Interference Susceptibility," 1969 IEEE Southeastern Electromagnetic Compatibility Symposium Record, Atlanta, Georgia, October 1969, pp. 301-324.

H. A. Ecker and J. W. Cofer, ED, "Statistical Characteristics of the Polarization Power Ratio for Radar Return with Circular Polarization," IEEE Transactions on Aerospace and Electronic Systems, AES-5, No. 5, September 1969, pp. 762-769.

H. H. Jenkins and R. W. Moss, ED, "The Tilted Loop: An Error Reduction Technique for Loop Direction Finders," IEEE Transactions on Aerospace and Electronic Systems, AES-5, No. 6, November 1969, pp. 1005-1006.

R. C. Johnson, H. A. Ecker, and R. A. Moore, ED, "Compact Range Techniques and Measurements," IEEE Transactions on Antennas and Propagation, AP-17, No. 5, September 1969, pp. 568-576.

Raymond D. Kimbrough and Royce N. Bramlett, NBSD, "Phosphorus Pentachloride for the Replacement of Benzylic Hydrogen with Chlorine," J. Organic Chemistry, J4, No. 11, 1969, p. 3655.

K. Sudarsanan and R. A. Young, PSD, "Significant Precision in Crystal Structural Details: Holly Springs Hydroxyapatite," Acta Cryst., B25, August 1969, pp. 1534-1543.

Samuel B. Chyatte, M. D., and J. D. Walton, Jr., HTMD, "Quo Vadis Bio-Engineering in Georgia?" Journal of the Medical Association of Georgia, November 1969, pp. 462-465.

C. S. Wilson, ED, "Active Cancellation Filter Techniques for Co-Channel Interference Suppression at UHF," 1969 IEEE Southeastern Electromagnetic Compatibility Symposium Record, Atlanta, Georgia, October 1969, pp. 324-339.

R. A. Young, W. van der Lugt, and J. C. Elliott, PSD, "Mechanism for Fluorine Inhibition of Diffusion in Hydroxyapatite," Nature, 223, August 1969, pp. 729-730.

Awards

Ross W. Hammond, IDD, was named the Outstanding Industrial Engineer for 1969 in AIIE Region IV at the AIIE Regional Conference in Savannah October 24.

In the Literature Awards Competition held in conjunction with the Southern Industrial Development Council Annual Conference at St. Louis, Mo., November 2-4, three IDD publications received awards. The Handbook on Community Development for SBA Personnel received a superior rating; Industrial Plant Financing: A Guide for Georgia Communities, excellent; and Georgia 1975: Employment Outlook by Industry Group, honorable mention.

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SUBMISSION OF ARTICLES

Contributors in the divisions should submit their articles to the appropriate division coordinator listed below. Others may send their contributions via campus mail to Martha Ann Deadmore at the Industrial Development Division.

Division Coordinators

Chemical Sciences and Materials Division	Walter H. Burrows
Electronics Division	H. A. Corriher, Jr.
High Temperature Materials Division	Nick E. Poulos
Industrial Development Division	Martha Ann Deadmore
Nuclear and Biological Sciences Division	Geoffrey G. Eichholz
Physical Sciences Division	Robert L. Bullock
Rich Electronic Computer Center	John P. McGovern