Zachry Engineering Center

ChE department

CHE AT TEXAS A&M

R. E. WHITE and K. R. HALL
Texas A&M University
College Station, TX 77843

CHEMICAL ENGINEERS ARE an exceptionally visible professional group in Texas. Young people searching for careers frequently encounter chemical plants, petroleum refineries and natural gas facilities. They are also likely to have some contact with chemical engineers in their everyday lives. Because of this visibility, many freshmen entering universities in Texas choose chemical engineering as a major course of study.

Other factors are also working at Texas A&M to increase the chemical engineering enrollment which has become one of the largest in the United States. The State of Texas is increasing in population and is currently the third most populous in the country. In addition, Texas A&M has traditionally attracted large numbers of engineering students and the university enrollment has doubled over the past seven years. Fortunately, Texas A&M has had the resources to keep pace with this enrollment increase.

Another growth factor at Texas A&M has exceeded the enrollment increase—an explosion of the research commitment. For the period 9/1/77 through 8/31/78, the research expenditures were $60 million. This total places Texas A&M well within the top twenty institutions on the NSF list (18th for 1977) and makes our university number one in the South and Southwest. The Chemical Engineering Department has also increased its research commitment both in terms of funding and diversification.

This dynamic atmosphere makes Texas A&M an exciting place to work or study. To be sure,

there are problems associated with such phenomenal growth, but they are challenges to be met and overcome—often with active assistance from concerned former students.

TEXAS A&M—BRIEF HISTORY

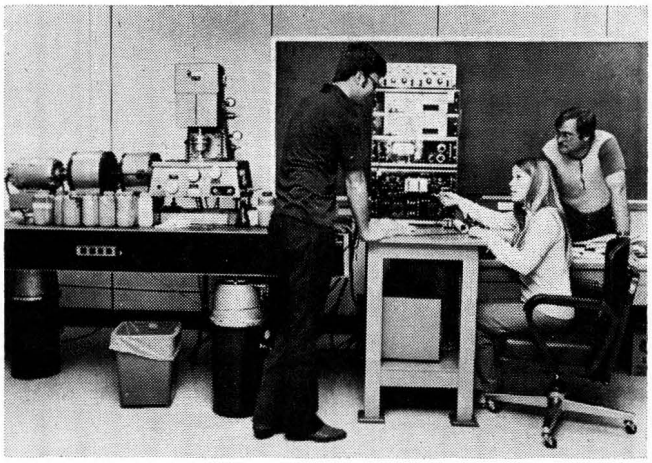
TEXAS A&M IS THE OLDEST public institution of higher learning in Texas. Founded as a land grant college in 1876, Texas A&M originally was named the Agriculture and Mechanical College of Texas. In its first century, Texas A&M built a rich tradition and grew steadily in pride and achievements. In 1963, the Texas Legislature recognized the diversified and expanded character of the school and changed the name to Texas A&M University. In 1965, membership in the Corps of Cadets became voluntary; also, women were admitted with restriction until 1971, when coeducation became official. Texas A&M still provides more reserve officers than any other institution in the nation. The University became one of the first Sea Grant Colleges in 1971 in recognition of achievements in oceanographic and marine resources development.

At this time, the campus covers 5200 acres with a physical plant valued at over $300 million. Fall 1978 enrollment was 30,901 including 4,731 graduate students and 10,563 women (including Miss USA 1977). The library currently contains one million volumes; however because of anticipated enrollment pressure, the library is being expanded and will, upon completion, provide space for two million volumes.

CHEMICAL ENGINEERING AT TEXAS A&M

A FORMAL CURRICULUM IN Chemical Engineering was first offered at Texas A&M during the school term 1908-09 as an option in the chemistry program. The first two degrees were awarded in June, 1911. In 1940, the Chemical Engineering Department became a separate program and moved from the College of Arts and Science to the College of Engineering. Professor J. D. Lindsay became the first department head and served in that capacity until 1964 when he retired. At that time, Dr. C. D. Holland assumed the position of department head and continues to hold that position.

The Chemical Engineering Department occupies about 37,000 square feet of the Zachry Engineering Center. This space contains: faculty, student and departmental offices; a small machine shop to complement the larger engineering facility; the unit operations laboratories (part of which is a 40x60x20 foot bay area) ; and research laboratories. The unit operations laboratories contain all the usual undergraduate experiments but some are rather large scale—35 feet tall adsorption towers, for example. The large bay area also contains research projects requiring long or tall runs such as a methacoal flow project.



Weissenberg Rheogoniometer

Our research laboratories contain many items of specialized equipment including: a Weissenberg rheogoniometer, a transient rheometer, two Burnett PVT apparatuses, high pressure autoclaves, gas and liquid chromatographs, solar energy collectors, methanol-fueled vehicles, a Meta-IV digital computer (equivalent to an IBM 1800), potentiostats and a coulometer for electrochemical studies, and several microcomputers for data acquisition and manipulation. A time sharing system provides on-line access to the University's Amdahl 470V/6 computer (a 4th generation machine with about 2½ times the memory and speed of an

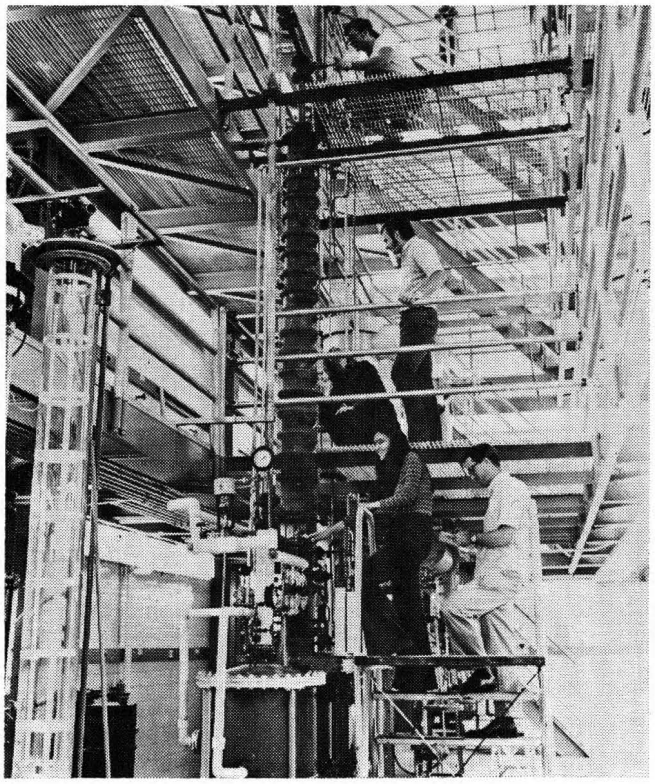
Other factors are also working at Texas A&M to increase the chemical engineering enrollment which has become one of the largest in the United States. Texas A&M has traditionally attracted large numbers of engineering students and the university enrollment has doubled over the past seven years.

IBM 370/168). In addition, space is available at the Texas A&M University Annex, located about 10 miles from the main campus, for large scale projects or for research projects requiring specialized environments.

The department maintains close contact with industry. We have offered an extension program for several years in which engineers working in industry may complete requirements for masters degrees with minimal absence from their jobs. The department also sponsors an annual Symposium on Instrumentation for the Process Industries at Texas A&M. This symposium attracts about 700-800 attendees each year. In addition, we gratefully accept monetary grants to the department from thirty-two companies, foundations and industries. Industrial acceptance of our graduates has always been good and, at this time, about thirty major oil and chemical companies have executive officers (vice presidents and higher) who are graduates of our department.

THE UNDERGRADUATE PROGRAM

THE UNDERGRADUATE ENROLLMENT in chemical engineering for the fall semester 1978 was 847. We graduated 115 during 1978-79. The



Unit Operations Laboratory

The department also sponsors an annual Symposium on Instrumentation for the Process Industries at Texas A&M. This symposium attracts 700-800 attendees each year.

average S.A.T. score for entering freshmen at Texas A&M is about 200 points above the national average (the university has not chosen to use this as an excuse for grade inflation—in fact several professional schools in the Texas area upgrade Texas A&M grade point averages by 0.2). Chemical Engineering receives a "top cut" from these people according to the university administration. We feel justified in having pride in our graduates, a feeling shared by industrial recruiters and their companies.

The undergraduate program in chemical engineering begins with a unique treat for our freshmen (as part of their introductory course). During the second week of classes in the fall semester, chemical engineering freshmen take a plant trip to Dow Chemical Company in Freeport, Texas. The students divide into groups of three with a Dow engineer hosting each group for the day. The Dow employee guides his group on a tour of the plant, takes them to lunch, and generally attempts to acquaint them with the responsibilities of a chemical engineer at Dow Chemical. This activity influences the students' concepts of chemical engineering in practice. During their subsequent studies, the students can recall this experience and relate classroom material to chemical plant activities.

Our entire undergraduate curriculum emphasizes traditional, practical chemical engineering. Because the vast majority of our graduates enter industry, we feel that this approach is appropriate. Our graduates complete a minimum of 139 semester hours that include: mathematics through differential equations plus a numerical methods course and a computer science course, chemistry through physical chemistry (including quantitative analysis), usual courses in physics and other engineering disciplines, 12 hours of electives, and 32 hours of chemical engineering. Of course, required humanities courses are part of the curriculum. Students anticipating graduate study may use the electives to enhance their preparation.

The undergraduate program is periodically under review by the faculty. Currently, we are planning a major revision which should further strengthen the curriculum. The final result will

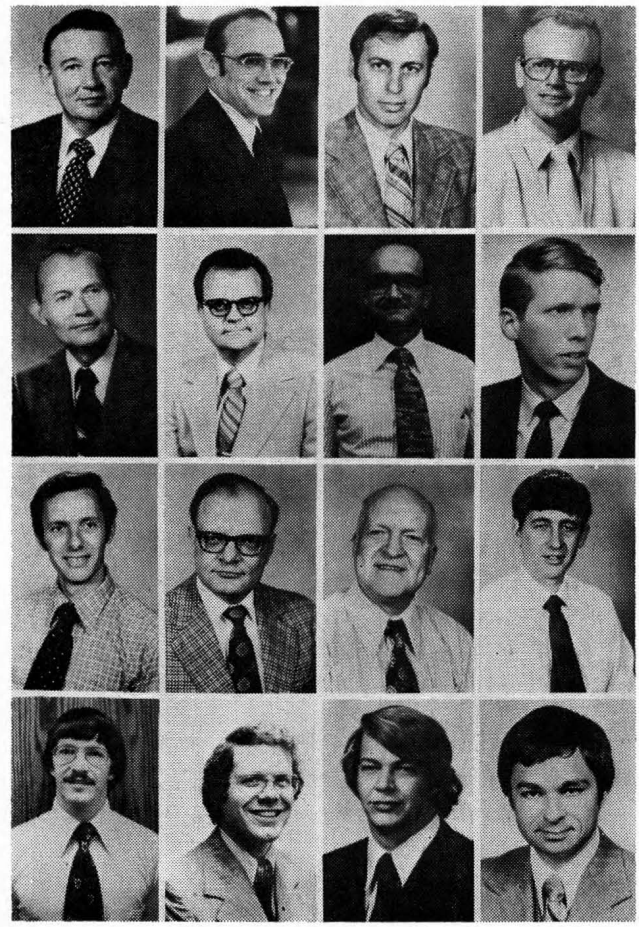
be a student better prepared for industry or graduate school. Other features of the program are: an industrial co-op option in which the student works in industry every other semester (about 20% of our students select this option), an active student AIChE section to encourage professional development, the largest Omega Chi Epsilon Chapter in the United States, and a student chapter of S.W.E. (Society of Women Engineers) to accommodate the 160 women in our undergraduate program. The overall program is flexible but rigorous and produces a quality product—our graduates. As a further indication of the lack of grade inflation here, the average chemical engineering student has a grade point average in chemical engineering courses which is 0.3 lower than his overall average.

THE GRADUATE PROGRAM

The graduate program in chemical engineering offers students the opportunity to earn one or more of four different degrees: Master of Science, Master of Engineering, Doctor of Philosophy, and Doctor of Engineering. At this time, the enrollment in the graduate program is 78 students, of which 59 are U.S. citizens.

The M.S. degree requirements consist of 24 semester hours of course work, submission of a research thesis, and a final oral examination. The time required to complete the requirements for this degree is, typically, 16 to 20 months. The M.E. in Chemical Engineering degree requirements consist of 36 semester hours of course work, submission of a written report on an engineering project, and a final oral examination. Completion of the M.E. requirements takes approximately 12 months.

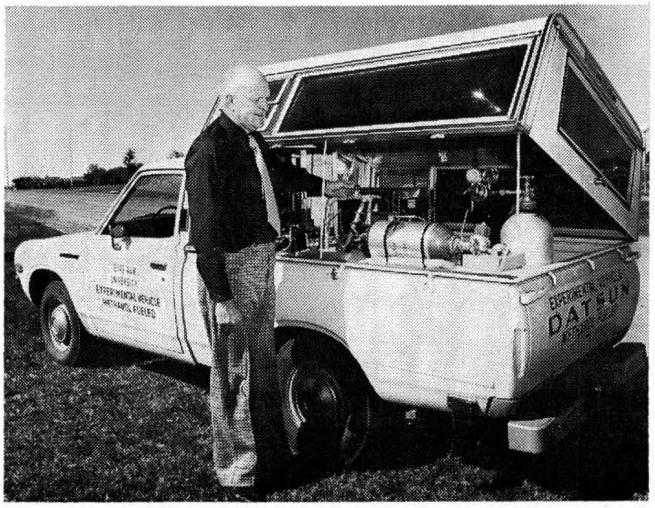
The Ph.D. requirements are as follows: 30 semester hours of course work beyond the M.S. requirements, a three hour technical writing course, a preliminary examination with written and oral sections, submission of a dissertation proposal describing an original research project, completion of a dissertation, and a final oral examination. Students typically complete these requirements in three to four years. A non-research doctorate, the D.E. in Chemical Engineering, can



FACULTY AND RESEARCH SPECIALTIES

(Left to right) C. D. Holland—Separation processes and distillation; R. G. Anthony—Reaction kinetics, polymer kinetics, coal liquefaction; J. A. Bullin—Lignite processing, process analysis, atmospheric simulation; R. Darby—Fluid mechanics, rheology, fuel cell technology; R. R. Davison—Solar energy applications, fuel utilization, thermodynamics; L. D. Durbin—Process dynamics and control; P. T. Eubank—Thermodynamics of fluids, phase transitions, properties of coal; C. J. Glover—Polymer properties, tertiary oil recovery; K. R. Hall—Thermodynamics, data reduction techniques, properties of coal fluids; D. T. Hanson—Water pollution abatement, biochemical engineering; W. B. Harris—Flow through porous media, solar energy, methanol automobile; J. C. Holste—Precise property measurements, microprocessor applications, polymer thermodynamics; A. D. Messina—Heat transfer; R. D. Ostermann—Biomass applications; A. T. Watson—Tertiary oil recovery, computer simulation; R. E. White—Electrochemical systems.

The undergraduate enrollment in chemical engineering for the fall semester 1978 was 847. The average S.A.T. score for entering freshmen at Texas A&M is about 200 points above the national average. Chemical Engineering receives a "top cut" from these people. . . .



Methanol Fueled Truck

be earned by completing the following requirements: 96 semester hours of course work beyond the B.S. degree (emphasizing engineering design and business management courses), an internship in industry (9-12 months), a written report describing the internship experience, and a final oral examination.

The department also offers a special program for students who hold B.S. degrees in disciplines other than chemical engineering (primarily chemists). These people must complete about 27 semester hours of undergraduate coursework (usually in two semesters plus one summer term) consisting of essentially all undergraduate chemical engineering courses plus two courses from other engineering fields. Students completing these courses with a "B" average or better enter the M.S. program. Although this is difficult and time-consuming (especially compared with programs at many other schools), we feel it is essential to ensure a *bona fide* M.S. for the student and a quality product for Texas A&M. Students completing this program are accepted as M.S. chemical engineers by industry.

Course work in the graduate program provides the student with a well-rounded background in chemical engineering beyond research expertise. Of the courses listed in Table 1, those denoted by * are core courses which we feel are necessary background material. They are offered yearly while the other courses are offered upon demand (usually every other year). The core courses are part of the requirements for each degree: the M.S. requires four core courses, the M.E. five, and the Ph.D. all eight. Each graduate course is three credit hours unless noted otherwise.

The department provides 12 month appointments with stipends for all qualified students in the M.S. and Ph.D. programs. These appointments are either fellowships, research assistantships, or in special cases, teaching assistantships. The current stipend is $600/month; however, students selected to teach regular courses (dependent upon departmental needs and student qualifications) are paid at a higher rate. Graduate students receiving stipends are considered Texas residents and pay tuition and fees amounting to about $200/semester. Financial aid is not available for M.E. or D.E. students.

Students on fellowships carry 12 hours of course work and 4 hours of research per semester. Those on assistantships carry 9 hours of course work and 4 hours of research. Graduate assistants are expected to assist the department with laboratory instruction or grading. Since 1940 when the Chemical Engineering Department began granting graduate degrees, the totals for each category are: M.S.—147, Ph.D.—57, M.E.—94, D.E.—1.

National awareness of the quality of our program has risen steadily over the past ten years. This is reflected by our appearance in several "graduate program quality" surveys . . . in the one claiming to be "objective" we achieved the 83rd percentile. These rankings reflect our publication efforts (we are #21 in total publications in the most recent ACS Directory of Graduate Research) including five textbooks authored by members of our faculty. We are able to maintain this level of activity because our faculty attracts many

TABLE 1

Graduate Courses

***Unit operations**
***Heat transmission**
***Distillation**
Unsteady state processes
Corrosion and materials of construction
***Applications of thermodynamics**
***Chemical engineering kinetics**
***Transport phenomena**
***Process dynamics**
Theory of mixtures
***Rheology**
Introduction to bioengineering
Electrochemical processes
Biochemical engineering
Enzyme engineering
Seminar (1 hr.)
Problems (variable credit)
Special topics (variable credit)
Research (variable credit)

research grants—this year totalling something near $750,000.

RESEARCH

OUR LARGE, GROWING AND diversified faculty generates a research program with the same qualities. The program is augmented by outstanding facilities in the Zachry Engineering Center. The remarkable quality of the research laboratories is due in part to the fact that they were designed by the members of the faculty who originally utilized them.

The principle areas of research here are thermodynamics, kinetics, catalysis, coal conversion, rheology, electrochemical applications, process control, pollution abatement, solar energy, alternate fuel sources, heat transfer, separation operations, biomass conversion, tertiary oil recovery, transport phenomena, and polymer studies. The specialized equipment mentioned above forms the hardware base for these projects. Specific topics range from engineering practice and development to fundamental theory and modelling. In general, members of our faculty work together on various projects. This cooperation increases progress and reflects the congenial atmosphere in the department.

Research efforts also take the form of specialized centers at Texas A&M. Two which receive direct involvement by the Chemical Engineering Department are: The Polymer Research Center and the Thermodynamics Research Center. The polymer group is a relatively recent grouping of various faculty members from chemistry, physics and chemical engineering. The thermodynamics group is a well established and respected data correlation and evaluation center best known, perhaps, for its API-44 activities.

THE FORESEEABLE (?) FUTURE

WE THINK OUR UNDERGRADUATE enrollment has finally plateaued and we have stabilized the faculty size at about 20 members. Our goal is to maintain a permanent faculty of about 20 with one or two visitors each year. We are still seeking an increase in graduate enrollment. We hope to have about 5 graduate students per faculty member—we stress personal contact here and prefer to keep the ratio small enough to assure faculty interest and availability. We also expect a small increase in numbers of postdoctoral associates—currently there are six.

Two very important events will have a direct bearing on the future of the Chemical Engineering Department at Texas A&M. The first will be the newly announced J. D. Lindsay Lecture Series. This activity will bring prominent men from our profession to Texas A&M for personal contact with faculty and students and for presenting lectures to the academic community. The series will honor our first department head as both a chemical engineer and as a genuinely appreciated person. The second major event will be construction of the Engineering Research Center. This project will commence in 1981 and will add research space equal in area to the Zachry Engineering Center.

Overall, faculty, students, research associates, and staff are proud of both the Chemical Engineering Department and Texas A&M University. The department and the university are committed to increased quality and productivity. This commitment coupled with a traditional can-do attitude promises a truly bright future. □

LETTERS

Continued from page 103.

University of Michigan, Ann Arbor, MI 48109.

I hope that you will bring the availability of this publication to the attention of the readers of **Chemical Engineering Education.**

Dr. D. R. Woods, Chairman
Chem. Eng. Ed. Projects Committee

ChE news

PIGFORD HONORED

Dr. Robert L. Pigford, University Professor of Chemical Engineering at the University of Delaware, received the first Francis Alison Faculty Award as the most outstanding member of the faculty, at the university's 130th commencement exercises held June 2.

Named in honor of the colonial scholar who established the Academy of Newark to which the university traces its origin, the new $5,000 prize was established last year by the university's Board of Trustees in recognition of the scholarship, professional achievements and dedication of the faculty of the university.

A native of Meridian, MS, he received his bachelors from Mississippi State College and his masters and doctoral degrees from the University of Illinois.