FROM THE COLLEGE OF ENGINEERING
UNIVERSITY OF MICHIGAN

Winter 1983

FROM THE DEAN

The level of activity in the College continues to accelerate. Two more of our academic departments (Mechanical Engineering & Applied Mechanics and Industrial and Operations Engineering) completed their moves to the North Campus in August (see p. 4). A $3.5 million construction project was begun in November to complete the renovation of North Campus space for the Department of Civil Engineering. The $30 million Electrical Engineering and Computer Sciences Laboratory (Engineering Building I) has entered the final design stage, with ground breaking scheduled for early next spring. The College has also been given authorization to proceed with a campaign to raise private funding for a $12 million North Campus Engineering Library as a key component of the recently announced Campaign for Michigan.

In addition, the College has taken a major step toward building the most advanced computing environment for student and faculty of any university in the nation through its *Computer Aided Engineering Network* (see p. 2). This fall five clusters of personal computers (networked to both mainframe and superminicomputers) were opened up for student use containing 220 IBM XT-PC and Apple Lisa computers. Additional computers (including 30 powerful Apollo engineering workstations) will be added into the student computer environment over the next several months.

Changes have also occurred in academic programs. The Department of Humanities was formally discontinued by the Regents in September. While the technical communication program conducted by this Department will be retained (and strengthened) in the College, all other instruction of engineering students in humanities (e.g., literature, history, philosophy) will be transferred to the College of Literature, Science, and Arts. This action will provide engineering students with access to the diversity, breadth, and depth of education which can only be provided by a great university with strength in the liberal arts. It will also provide them with the opportunity to take classes with students from other disciplines.

On the other side of the ledger, the College will soon be gaining a new department. The University Executive Officers recently approved the transfer of the Department of Communication and Computer Sciences from LSA to Engineering. This department will be merged with the Department of Electrical and Computer Engineering to form a new *Department of Electrical Engineering and Computer Sciences.* This action will bring together for the first time at Michigan all aspects of research and instruction in computer science and engineering.

While these changes probably look rather dramatic (perhaps even traumatic to some), even more important changes are occurring in the faculty of the College. We continue to believe that the key to excellence lies not with bricks and mortar (or computers) but rather with people, with their abilities, enthusiasm, and commitment. Hence we are placing our primary emphasis on the recruitment of outstanding faculty to continue the tradition of excellence of the College. To lay the foundation for this effort, we have taken a number of actions including decoupling the College salary program from the rest of the University to allow competitive salary offers, a major expansion in equipment and technical support staff resources, and significant modifications in the research environment.

Over the past two years we have been fortunate to add 30 new faculty to the College (see p. 2). We believe all of these individuals to be characterized by an extraordinary degree of achievement and potential. While we place some emphasis on programmatic requirements in determining recruiting areas, we have adopted a policy in which roughly 50% of our new faculty are determined essentially by quality alone. That is, we set aside a pool of faculty positions (roughly 10 - 15 each year) allocated on the basis of absolute *quality* of candidates — at any rank, in any discipline. We believe that this is the quickest method to build essential singularities of excellence among our programs. We will then be able to use the flexibility provided by anticipated faculty retirements over the next several years to adjust for possible staffing imbalances which may arise in particular academic programs.

Some things are changing, to be sure — but the most important things stay the same: the quality of students and faculty and the commitment to excellence in engineering education and research of the College of Engineering.

NEW FACULTY

Name	Department	PhD (Previous Position)
P. Kabamba	Aerospace	Columbia (Belgium)
C. Kravaris	Chemical	Caltech
R. Ziff	Chemical	Rockefeller
W. Hansen	Civil	Illinois
R. Kapuscinski	Civil	Harvard (U Vermont)
A. Naaman	Civil	MIT (U Illinois)
J. Hayes	Computer	Illinois (USC)
R. Jain	Computer	ITI (India)
D. Smith	Computer	Cornell
P. Bhattacharya	Electrical	Sheffield (Oregon St. U
J. Breitenbach	Electrical	UCLA
M. Elta	Electrical	Michigan (Lincoln Labs
G. Hansell	Electrical	MIT
K. Shin	Electrical	Cornell (RPI)
W. Stark	Electrical	Illinois
D. Kelton	Industrial	Wisconsin
W. Keyserling	Industrial	Michigan (Harvard)
J. Liker	Industrial	Cornell (U Mass)
C. Yano	Industrial	Stanford (Bell Labs)
R. Gibala	Materials	Illinois (Case Western)
J. Wallace	Materials	Stuttgart
E. Kannatey-Asibu	Mechanical	UC-Berkeley
A. Schultz	Mechanical	Yale (U Illinois)
S. Slezak	Mechanical	Illinois
J. Stein	Mechanical	MIT
I. Beier	Naval	Berlin
A. Perakis	Naval	MIT
D. Wehe	Nuclear	Michigan (Oak Ridge)

FROM THE COLLEGE

THE COMPUTER AIDED ENGINEERING NETWORK

On a hot day in late August two large semi-trailer trucks rolled up to a College laboratory and unloaded almost 1,000 boxes of computer equipment — 130 new Apple Lisa computers. Subsequent weeks have seen the delivery of 100 IBM XT personal computers. These massive shipments represent the first step in an extraordinary challenge: to provide Michigan students with the most advanced and up-to-date computing environment of any university in the world.

Engineering education and practice are entering an era of unprecedented change. Developments in computer and communications technology already have had major impact on engineering practice through applications in such fields as computer-aided design (CAD), computer-integrated manufacturing (CIM), and distributed intelligence computer and communication networks. The disciplines of computer science and engineering are now focusing on enhancing the *productivity of people* rather than simply the productivity of operations. As a result, engineering education faces a twofold challenge: to undertake creative research and development in these fields and to integrate the resulting technologies into academic programs.

To respond to this challenge, an increasing number of universities are requiring all entering students to purchase a personal computer, typically costing $1,000 - $2,000, for use during their studies. However, while this approach may indeed address the need for "computer literacy" among general college students, we do not believe it is appropriate to meet the needs of most engineering students who require more powerful personal computers (costing in the $5,000 to $20,000 range) capable of supporting sophisticated languages and operating systems (e.g., FORTRAN, Pascal, C, and UNIX), powerful graphics, and communications with mainframe hosts. Furthermore, the rapid evolution of personal computer technology will almost certainly make those machines typically selected for student purchase obsolete during the several years of their studies.

Hence the College of Engineering believes a more effective way to approach the challenge of providing "personal computing" resources to its students is for the educational institution itself to assume the primary reponsibility for acquiring, installing, maintaining, and upgrading such computer/communications technology. We intend to respond to this challenge through the development and implementation of our *Computer Aided Engineering Network,* a distributed-intelligence, hierarchical computing system linking together personal computer workstations, superminicomputers, mainframe computers, function-specific machines, and gateway machines to supercomputer installations. The Network is being designed to support not only general scientific computing, but computer-aided engineering activities, computer-aided instruction, and administrative activities (wordprocessing, electronic mail, data base management).

Both the design and development of the Computer Aided Engineering Network are well underway. Physically the Network is being built from a collection of mainframe and superminicomputer class general purpose machines together with local area networks of the emerging generation of personal workstations. At present we are tracking two classes of personal workstations: advanced personal computers as exemplified by the IBM PC and XT and Apple Lisa; and personal engineering workstations as exemplified by the Apollo Domain, Sun Microsystems, and Hewlett-Packard 9000 computers with the powerful graphics and floating point processing necessary to support CAD, scientific computation and simulation, and software development.

The evolving capabilities of the personal computer (perhaps best exemplified by the Apple Lisa) and the decreasing cost of engineering workstations (such as the Apollo family) suggest that these two classes of machines may soon converge. Hence our strategy has been to pursue both in an integrated fashion. The personal computer and its derivatives pose interesting new approaches to providing high-access, personal computing to a large number of students and faculty. The availability of an enormous number of third-party hardware and software packages and the economy of scale of the "computer store" product line opens the possibility for the evolution of a powerful and cost-effective computing environment. This environment cannot, however, consist only of isolated personal computers. It must include the capability for sophisticated engineering applications in areas such as CAD, scientific computation and simulation, and software development. The environment must also include provisions for host-to-host communication and the shared access to large data bases. This is the intent of the Computer Aided Engineering Network.

During the 1983-84 academic year, facilities containing large numbers (400 - 500) of such personal computers and engineering workstations are being installed on both the Central and North Campus for the exclusive use of engineering students. Already five such computer clusters have been opened containing 100 Apple Lisas and 120 IBM PC/XT computers. Over the next several months, 30 powerful Apollo engineering workstations will be installed, along with additional clusters of personal computers. Resident software and peripherals (printers, graphics plotters, file servers) are supporting a variety of activities including instructional work, wordprocessing, data base management, and communication with larger host systems. Unlimited use of these facilities are being provided to all enrolled engineering students on an "open computing" basis (e.g., students present an identification card upon entering the cluster and are then allowed complete freedom in the use of the computers and associated networks).

The schedule for the installation and evolution of the Computer Aided Engineering Network is ambitious. This fall term has already seen the installation of 250 personal computers and engineering workstations (based on Apple Lisa, IBM XT, and Apollo computers). Over the next three months all faculty in the College of Engineering will be equipped with similar personal workstations/computers. Although initially installed as standalone computers, the next year will see these workstations networked together and through gateways, connected to the central University computing center (MTS) as well as several superminicomputers located throughout the College. The acquisition and maintenance of the equipment associated with the student component of the Computer Aided Engineering Network will be supported in part from the differential tuition assessment. The faculty component will be supported from research grants and discretionary funds.

By early 1984 the College will acquire an additional 200 workstations for student use. Although the type of workstation has not been determined, we anticipate these will include a mix of more powerful 32-bit computers (capable of supporting sophisticated color graphics and very fast floating-point calculations) as well as further expansion of the Apple Lisa / IBM PC/XT component of the network.

During this period the College will also add a larger number of workstations for faculty and staff use within the departments. It is anticipated that these machines will also be made available for student use on occasion.

Simultaneously with these equipment acquisitions, the College will be linking these workstations together in local area networks within given departments or facilities. Each local area network will be tied into MTS which will serve as a central electronic mail handling facility for the near term. The University will be installing the first phase of a broadband backbone network, UMNET, in parallel to the College project so that by early 1985, all University buildings (laboratories, classrooms and offices, and residence halls) should be connected by coaxial cables (with the provision for fiber optics to be added later).

During 1984 the College of Engineering will make a decision about expanding the Computer Aided Engineering Network to equip *all* engineering students and faculty with personal computer/workstations (which could be kept in offices or residences and tied into the network). This decision will be determined primarily by two factors:

- The availability of a powerful, portable, and relatively inexpensive personal computer with most of the capabilities of the machines installed in the first phase of the Network (e.g., powerful microprocessor, bit-mapped graphics, mouse).
- Progress in developing the appropriate Local Area Networks necessary to link together offices, laboratories, and residence halls.

If we should decide to take this step, it would be our intent to provide such computers to each student on a lease/buy arrangement (at roughly the same cost as the present differential tuition assessment). In this way we could relieve the student of the costs of software support and hardware maintenance and upgrading.

The Computer Aided Engineering Network represents the College of Engineering's firm commitment to build a world-class center of excellence for the use of modern computer methods in engineering education and practice and to develop an environment uniquely supportive of instruction and research in related technologies. This computing environment will provide students of the College with a unique opportunity to participate in what is sometimes referred to as "the second computer revolution," to integrate this technology into their activities, and to stay with the cutting edge of this technology throughout their studies at Michigan.

FURTHER DETAILS

- During the 1983-84 academic year, the College will put in place roughly 400 - 500 computer workstations based on both personal computer technology (e.g., the IBM XT and Apple Lisa) and sophisticated engineering workstations (e.g., the Apollo Domain and HP-9000) for general (unrestricted) use of its students.
- These workstations will be located in a number of classroom/laboratories on both Central and North Campus, each containing 30 to 50 stations together wth peripheral devices (file servers, printers, plotters) connected together through local area networks. The stations will eventually be configured as intelligent terminals into other hosts (such as MTS or the College VAX and Harris computers).
- Students will be allowed unlimited access to these workstations on an "open-computing" (without charge) basis (although access through the workstations to other mainframe hosts such as MTS would require the usual course accounts for these latter systems).
- Software and peripherals will eventually be provided to support the following activities:

  Instructional computing
  Support of a variety of languages (including FORTRAN-77, Pascal, APL, C, Ada) and operating systems (e.g., MS-DOS, CP/M, Unix, UCSD p-system)
  Sophisticated wordprocessing (including spelling and grammatical style checking)
  Financial spreadshead analysis (VisiCalc, Lotus)
  Data base management (DBII, Condor)
  Computer aided design tools (geometric modeling, mechanical CAD, CAM, VLSI, . . .)
  Computer aided instruction
  Access to other hosts (MTS, VAX, Harris machines)
  Access to large data bases (electronic libraries, design data bases)
  Electronic mail and bulletin boards
  Access to other networks (UNMET, ARPANET, CSNET, . . .)

- The estimated cost for the first generation of workstations (based on 16-bit and 32-bit personal computers) ranges from \$5,000 to \$20,000 per station. Most of the initial investment in these stations will be provided through donations and equipment discounts. Estimates of annual maintenance costs (including upgrading) for the student workstation component of the Computer Aided Engineering Network is roughly \$1.5 million per year.
- The proposed "computer user fee" level has been chosen to offset the costs of maintaining the Computer Aided Engineering Network (not to establish it). We would anticipate this charge to be adjusted each academic year, consistent with the services provided by the Network (and in a manner compatible with any future decision to require all engineering students to purchase personal computer/workstations which can tie into the Network.
- The College is prepared to provide subsidies of the computer user fee to those students requiring financial aid. Inquiries about such support should be directed to the College Scholarship Office (Student Services) on the North Campus.

NORTH CAMPUS MOVE IS PROGRESSING

by Charles M. Vest, Associate Dean

During the summer months considerable progress was made toward completion of the migration of the College to the North Campus. As is typical of all moves, we are now in a period of renewal and excitement as well as consolidation.

During these months much progress has been made toward the construction of Engineering Building I, which is to be a \$30,000,000 structure housing the Department of Electrical and Computer Engineering, the College administration, a small component of Mechanical Engineering and Applied Mechanics, and a classroom complex. It will be a four-story structure located between the G. G. Brown Laboratory and the Automotive Laboratory. On the west side it will be connected to these two buildings. It will be attractively configured about a four-story atrium rising above a 30-foot-wide corridor extending from east to west through the building. In August the schematic plans for this building, prepared by the firm of Smith, Hinchman and Grylls, were approved by the State Legislature. The legislature also reaffirmed construction authorization and funded the architects for design development. Construction will begin late next spring.

In August the Department of Industrial and Operations Engineering moved into its newly refurbished quarters in what formerly was the Research Administration Building, which has been completely reconfigured according to plans drawn up by the department. This is an efficient and attractive facility which features exceptional computer facilities and ergonomics laboratories.

The most massive portion of our $9,000,000 renovation project is in the G. G. Brown Laboratory. During the summer approximately two-thirds of this building was restructured to house the Department of Mechanical Engineering and Applied Mechanics, which has now completed its move into that building. A variety of new offices, classrooms, design rooms, computer-aided engineering rooms, and laboratories were created. During the fall a third-floor addition to this building will go into construction. In the spring work will begin on a student study/lounge addition on the south side of G. G. Brown. This latter facility will be an attractive and special gathering place for engineering students.

The most complex portion of the renovation project is the development of office, classroom and laboratory facilities for the Civil Engineering Department in the high-bay area of G. G. Brown. This project, which currently is under design, will include construction of a new mezzanine over two-thirds of this portion of the building. Unique features of this design will include a large-scale structures laboratory and new hydraulics and geotechnical facilities.

Construction also is well underway in the former Printing Services Building, which is being reconfigured to house the Industrial Technology Institute for a period of approximately three years. When Engineering Building I is ready for occupancy this building will be turned over to the College to house a variety of activities, largely related to manufacturing and computer technology.

ALUMNI SOCIETY FORMED

We are pleased to announce the formation of the College of Engineering Alumni Society affiliated with the Alumni Association of the University of Michigan. The purpose of this group is to offer a means for increased communication between Engineering alumni and the University and, more specifically, as follows:

- to stimulate among its members a continuance of interest in the College of Engineering and The University of Michigan;
- to provide an instrument for organized effort to encourage a continued flow of outstanding student candidates for the College of Engineering;
- to furnish an avenue through which its membership will become familiar with the problems and progress of the College of Engineering and the profession, and thus be better enabled to assist in advancing their programs;
- to cooperate with University faculty and staff in helping to meet College of Engineering and University of Michigan needs for financial support from public and private sources; and,
- to develop a wider acquaintanceship and fellowship among faculty, alumni and students of the College of Engineering.

The College is in the process of forming a nominations committee to seek out candidates for the Board of Directors. We welcome your ideas and names of individuals to serve on this committee. Please respond in the space provided on the alumni news form on the back of this publication. A list of the candidates for the Board of Directors and a ballot will appear in the next issue of the alumni news.

ANNUAL FUND PROGRAM EXCEEDS 1982-83 GOAL!

When the final returns from the 1982-83 annual fund were tabulated we were delighted to learn that alumni and friends of the College had made giving history — over $584,000 in gifts — outstripping the 1982-83 goal of $535,000 by almost 10%. In actual dollars, an increase of 53.6% over the 1981-82 fiscal year was realized. *Alumni* gave almost $321,000, increasing last year's total by an incredible 40.9%. Gifts from *other individuals* increased by 33.4% for a total of almost $42,000. The average gift from alumni and friends was almost $92.00. The most dramatic increase was seen in the *corporate matching gifts* from the individuals' employers. These gifts increased by a staggering 83%, for a total of over $221,000. We would like to thank our donors for making the extra effort to enclose their company's matching gift form. Doing so doubles or even triples the value of your gift. A complete list of companies that support a matching program was included in the last issue of the alumni news, but since many may have been added since then, please check with your personnel office. The added amount from your employer is counted toward your personal gift total for purposes of all University giving clubs.

	1981-82	1982-83	
ALUMNI GIFTS	$227,795.03 2607 gifts	$320,972.59 3651 gifts	up 40.9%
FRIENDS GIFTS	$31,298.89 403 gifts	$41,778.61 384 gifts	up 33.4%
CORP. MATCHING GIFTS	$120,817.84 429 gifts	$221,295.87 613 gifts	up 83%
TOTAL	$379,991.76 3439 gifts	$584,047.07 4648 gifts	up 53.6% overall

1983-84 Goals

Your efforts show that we are well on track to meet our $1 million annual fund goal in the 1985-86 fiscal year. In 1983-84 we are aiming at alumni gifts totalling $450,000, friends gifts of $50,000, and corporate matching gifts from employers of $250,000, for a total of *$750,000*. This calls for increases of 40%, 20% and 13%, respectively, or 28% overall. Since July 1, we have received over $100,000, or 13% of our goal for the year.

Today, as science advances at an overwhelming rate, with rapid addition of new information and scientific principles, we recognize the need to expand our horizons beyond information dissemination and the learning of engineering principles. Consequently, over the next few years, we will increase our nurturing of programs, courses, and teaching techniques which develop the students' creative problem-solving skills as well as life-long learning skills. The general thrust is for the College to provide the resources for us to be as creative in our teaching and in our development of young minds, as we are creative in our research. This news issue highlights some of the College's activities in teaching:

- the development of autonomous learning skills in the engineering curriculum;
- a course that focuses on the process of learning how to solve problems;
- the recognition of the outstanding teachers in the College of Engineering for 1982-83;
- a Senior Research Fellowship program which awards scholarships not on the basis of grade point average or financial need, but on the students' creativity.

We hope that you find these activities interesting, and we welcome your comments.

AUTONOMOUS LEARNING*
(Or, "Must We Find a Solution? Can't We Just Enjoy the Problem for a While?")

PANOS PAPALAMBROS
Assistant Professor of Mechanical Engineering and Applied Mechanics

Learning in the 1980's

In these pragmatic 1980's, it is at least old-fashioned, if not altogether suspicious, to talk about self-realization and growth of human potential through group processes, as I shall be doing in this article. The "Me Generation" of the 1960's and 1970's, which flourished in Tom Wolfe's "era of every man an aristocrat," is now replaced by a college student body preoccupied almost exclusively with acquiring skills that are marketable and getting a fair return on their tuition investment. Yet I find it ironical that the multitude of the currently popular, so-called "Japanese Management" seminars have surprising similarities to the human potential teachings of the past two purportedly sybaritic decades. As the subtitle above, which was found scribbled on the wall of a Big Ten engineering school, suggests to me, perhaps a challenge for educators is still there.

Changes in societal priorities affect the orientation of the educational system, and in the case of professional schools, the given response time is all too short. Among engineering students, two trends can be currently identified. One is a stronger interest in learning the skills perceived as explicitly useful in the marketplace. This often takes the form of student demand for a large flow of information transfer. Counting the textbook pages "covered" and the number of homework sets completed are typical measures of the amount of information imparted to the students during a course. Students in that trend may become excellent engineers in technological status quo maintenance, but I would hardly expect any innovations from them, if left unchallenged. Another trend, though, is the appearance of students who do not fit the traditional engineering stereotype (this includes women). These students who have drifted into engineering for reasons of job security, will still seek a broader intellectual stimulation and a more independent acquisition of knowledge — although not necessarily within the engineering curriculum. I will argue that it is very important to truly attract these students to the engineering practice, not just for the sake of plurality but because they may bring true sparks of innovation. My point then is that there are convincing arguments, for students in both trends, in favor of a curriculum supporting what we will call *autonomous learning*. Perhaps some of the same arguments may also appear convincing for us educators.

Autonomous Learning is a term that I and Jonathan Laitone have coined to signify a learning process that broadly satisfies the following two theses and corollary needs:

1) Learning by definition is an individual human process. Yet learning occurs most often in a group environment. Therefore, group interactions should be such as to promote individual learning.

2) Learning is not a need imposed from the outside, but is experienced at a personal level of involvement. Individuals must be able to relate the object of their learning to their own selves.

Our concern here is a practical one. I believe that the autonomous learner, in our case an engineering student experienced in autonomous learning, will be one who is prepared to deal successfully with at least two major career problems. One is that of coping with the organizational structure and dynamics of modern companies: realizing, for instance, the vast interdependence that often goes into decision-making and task-performance, as well as the frequent dominance of interpersonal relations and emotional issues over rational responses and decisions. The other problem is the vital need to adapt to changes and advancements in one's field, in the face of the formidable technological rate of change that is likely to occur over a career life of forty years. As obvious as these problems may be, what can we educators do, if anything, to provide our engineering graduates with the kind of education that will equip them to deal successfully with these problems?

The following report summarizes the activities that I organized (with the aid of several colleagues) in a senior mechanical design course, conducted over the past four years, with autonomous learning as my educational goal. The basic need underlying the course goal, was allowing the students to relate their object of learning to their own selves and to experience that learning in an appropriate group environment. Success in meeting this need would mean that our graduate might have a better chance to go

*Based on "Autonomous Learning in the Engineering Curriculum" by P. Papalambros, Report No. UM-MEAM-82-5. Research funded under the Spencer Foundation Grant for Research in Education, School of Education at The University of Michigan. Jonathan Laitone's participation in this research was indispensible.

beyond professional survival, throughout their lives, and achieve both personal satisfaction and social contribution.

Course Structure

Traditionally, design courses have always been objects of educational experiments. It is hard to find two educators who will agree on what design should be, so the matter is usually settled with a general statement vague enough for easy interpretation. The book description of our senior design course says that students are expected to "work on a design project and integrate knowledge from all areas of the curriculum into a coherent synthesis representing a working design."

The students were required to work in teams, preferably three members in each, on a project of *their own choice and formulation. All members of a team had to agree on the choice of a project.*

Approximately three weeks from the beginning of the term, each team had to submit a project proposal conforming to given guidelines. Progress reports followed at four-week intervals with a final report at the end. All reports were accompanied by oral presentations. The class met twice a week for a period of three to four hours. Usually half of the period was used for a general lecture, the other half devoted to the projects.

The instructor acted as consultant to the teams. The students had to learn what they needed for their project on their own. This sometimes meant finding "experts" inside and/or outside the university, including faculty and industrial people. The ultimate goal of *project completeness* was a set of specifications and drawings from which the design could be made readily. The goal of the *course* was to give students an experience of the design process in a controlled environment with guidance and benevolent feedback, something they could not much expect in an actual industrial environment.

Classroom Activities

A large variety of activities took place over the several times the course was taught, not all of them during the same term, the same activities often differing in presentation or format. For the same activity, differences in the collective response of each class was noticeable. Activities successful in one class left another class indifferent or even negative. Activities and techniques were introduced and conducted in class almost on impulse, based on the instructor's estimation of how the class felt in any one week of instruction. I found that feedback from the class and individual students, as well as my own sense of mood, very often dominated my deciding on a particular activity.

Classroom activities could be grouped into four categories. The first category contained activities aimed at the generation of an atmosphere of *acceptance.* We wanted to see the students accept each other, the instructors, and the goals of the course, in a personal way and not as an accidental result of university scheduling (that being most often the case for required courses). The second category contained activities that dealt with the *exploration* of the self and its relation to others. Creativity techniques, conditioning, stereotyping, and leadership skills were included in this group. The third category contained activities for the development of *communication* skills. Oral presentations of the project and written reports were part of this group, together with specific exercises aiming at interpersonal communication. Finally, the fourth category dealt with an explicit understanding and interpretation of *learning* techniques. Problem-solving and decision-making were examined through exercises and interpreted through the current theories in the psychology of learning and organizational psychology.

A complete description of the individual activities and the motivation behind them can be found in the report cited. Here I would like to limit the discussion to a few observations:

1) It was extremely important to maintain a feeling of underlying discipline and structure in the free atmosphere of the course; otherwise an impression of chaos and of "nothing happening" might easily develop. A rigid set of project deadlines and a fast pace of events during class meetings are highly recommended. The autonomous learner must recognize the difference between freedom and irresponsibility.

2) An unconventional grading scheme was used and worked very well. Grading criteria were established early in the term by the class. After the final report, a joint conference of each team with the instructors took place. Each member discussed his/her own contribution and that of the others, and proposed grades. Final grades were arrived at by consensus, with some finetuning from the instructors. This scheme forces the students to take more responsibility about their learning and gives them also a first taste of the unpleasant task of evaluating others, perhaps good friends.

3) The apparent prestige of the communicator/instructor was an important contributor to the amount of attitudinal change observed in individual students. For the more rigid-minded students, prestige confers legitimacy to the unconventional.

4) The formation of the design teams was a complex process, but it was not difficult to achieve. The non-negotiable deadline for specific team proposals was very effective. The three-member size team is optimal.

5) It is important in many ways to let the students express something very personal without the fear of criticism or ridicule. A technique to achieve this is through a "game." For example, we asked the students to compose and present a script about their educational experience and characterize it as a motion picture or a television show. Fear of criticism is a well-known inhibitor of creativity and it stifles the interpersonal communication needed for autonomous learning.

6) The role of leadership is very important in group dynamics. In the design teams, a leader with wide responsibilities was elected on a rotating basis. When these responsibilities were stressed by the instructor, the leader turned out to be the hardest-working person in the group! This experience enhances the capability of the students to work effectively together and appreciate the role of a leader in any organizational structure.

7) The class feedback to the speakers after the oral presentations included criticism on style and nonverbal communication. Students universally agreed that presentations and feedback were one of the most important experiences in the course. This feedback is particularly useful in autonomous learning, not only because of learning more about one's self but also because of recognizing how others see one.

8) This senior course was particularly suitable for trying out ideas. For most other courses, introducing a very few ideas in

autonomous learning would be easy, but structuring a "regular" course in the setting I described is indeed a major undertaking.

Looking Back

I made the case that *experiences in* personal growth and group processes are very important in our engineering curriculum, particularly for the coming decades. I described how these ideas can be put in a learning context and be applied to the conduct of a senior design course. Although I claim success, this by no means signifies that there were no problems or that all students were satisfied. Patience helps though: two of my most unsatisfied students wrote me two years after graduation that they now realized what they had learned and how it helped them. I should confess that I often felt as if I were performing a balancing act and I can remember one or two near crashes. Yet all of the observations I described are useful in their own right and I would recommend trying them out where appropriate.

Caveat

As a parting remark, I should insist that no attempt was made to settle any issues, but rather to stimulate ideas and indeed to provoke some argument. For myself, I do like to "enjoy the problem for a while" and that (I suspect) is why I happen to be still at school.

Mathematical Modeling:
Applying the Principles of the Art Studio*

S. M. POLLOCK
Professor and Chairman of
Industrial and Operations Engineering

Most practitioners seem to agree that engineering problem solving is (or should be) an art. This position is particularly true when the approach is through the use of a mathematical model. Although my remarks here were originally directed towards how one might teach the art of mathematical modeling, they seem to hold equally well for more general engineering attacks on problems. All engineering disciplines share an underlying need for the structuring of a formal model in order to develop prescriptive or descriptive statements about states of affairs, both natural and man-made. They also share much time, effort and typescript devoted to bringing home the point that the 'art of modeling' is difficult, if not impossible, to teach. If we are truly in such an unfortunate position, those of us who teach seem to be relegated to the position of merely teaching *techniques,* in the hope that the brighter students will appreciate the application of these techniques to the solution of real problems.

On the other hand, professional 'creative' artists seem to have no problem teaching the skills of their art to students. Their teaching, however, is rarely done in a formal classroom setting, but rather in an artist's studio: a painting studio for painters, a music studio for budding pianists and violinists, and so on. How might we design a similar studio in which to teach the art of problem solving? Can we learn anything from the other creative artists?

The pedagogical principles applied by musicians, painters and sculptors can in fact carry over practically unaltered, and have been used to design a full-semester course that has been offered since 1969.

It is assumed that basic mathematical skills have been learned by the students. We are faced with the task of making artists out of what would otherwise be journeyman technicians. The question of model validation (of ultimate importance to a potential user) is not addressed here: We are more concerned with teaching a student how to approach a problem, an awesome task to some who have never tried it.

A set of necessary (but probably not sufficient) conditions for a successful studio environment are listed below, not necessarily in order of importance.

Principles of the Studio

1) **Encourage excess.** To avoid a certain staleness of composition and form, it is a recognized procedure in the visual arts to encourage excess. Whether in the amount of paint used, the size of canvas, the fineness of an etched line, or the speed at which a musical passage is played, a pushing of resources is essentially the only way a student can discover both personal limitations and those of the medium. If there is the suggestion that a certain process is constant over time, we try to see what would happen if it varied. A hypothesized cost appears to be well represented by a linear function of inputs. What are the implications of using a non-linear function? What happens at very high pressures? At zero pressure?

Excess can also lie in the extreme of simplicity, even in striving for elegance. (It must be made clear, however, that excess is *not* recommended in the modeling of situations: it is rather emphasized in *learning how* to model.)

2) **Philosophy comes last.** One of the most frustrating experiences to be wished on anyone is to teach the first lecture of a survey course in operations research or systems engineering. This is where one attempts to teach the "philosophy" of mathematical modeling. To one who has never suffered the exquisite pains of trying to map reality into a set of equations, the esoteric trade-offs involved in balancing strengths and weaknesses of portions of the models, the constant tension between completeness and usefulness, formality and informality, the costs and benefits of parametrization compared to unique solution, must seem like mystical incantation. I strongly recommend that the philosophy of modeling be discussed at the very *end* of a course on modeling, rather than the beginning. A dialogue concerning the "form" and "image" of a piece of music is much more satisfying between mature and successful musicians than one between tyros.

3) **Use real data.** The artist desires the real world to be the inspiration for his artistic creations or recreations. The problem solver of course *requires* the real world to be the object of his attention. This argues then for the inclusion of real data, dirty as it

*A slightly abridged version of an article by Professor Pollock which appeared in *Engineering Education*, November 1976, pp. 167-71.

may be, in the studio. Not only real data, but real decision makers, complete with fuzzy and unclear objectives, real but arbitrary constraints, and (most important) real institutional structures within which the system being modeled operates.

It is important to note that the 'case study' flavor achieved by the usual introduction of data carries with it some unfortunate baggage, most notably that many students will presume the problem has already been solved or modeled by others. Therefore they will look for *the* model rather than *a* model. Too much data can prove to be a bad thing, just as a photograph of a scene may not capture the essence of a situation as well as an abstract version.

4) **Use no data.** Every successful realistic artist has also practiced his skills abstractly in the use of colors, the design of patterns, the arbitrary usage and contramixing of techniques. The similar ability to create *without* the outside world is extremely important in the education of an engineer. (The extreme version of this principle — solving the wrong problem by means of modeling a pleasant abstraction — is, of course, to be avoided.)

The student must be exposed in the studio to situations in which data is not explicitly made available, but where the underlying relationships among variables is all important. It is great sport to invent situations in which the inclusion of data would perhaps lead an unwary student to unwarranted conclusions or generalities.

5) **Have available experts who do not know everything.** Here is an opportunity for the true impact of reality to be felt. Often a practicing violinist is interrupted by the master who, attempting to criticize his technique, finds that in fact the student has discovered something new: a new way, for example, of running over an arpeggio. If we can introduce into the studio an "expert" in the field, this has a number of salutary effects: students discover that experts do not know everything: some valuable insights about the environment within which problems must be solved are gained: and exposure to the confrontation situation in which a student will find himself, once he becomes a professional, is afforded.

6) **Encourage mutual skepticism.** There is nothing more fun or rewarding than to watch someone who feels he has a complete grasp of a problem to be subject to the criticism of another (perhaps equally new at the game) who thinks that *he* has the "right" approach. A number of interchanges between these two students will do more for their development of new structures and approaches than any amount of learned discussion by a supervising faculty member. One practical difficulty influencing the size of the class involves the time needed for a successful critique. Since works of visual art (painting, sculpture) are, in a McLuhanesque sense, "non-linear," the process of critiqueing them can be quick and all-encompassing. For "linear" art (modeling, music performance) the process is slow and drawn-out, and an accordingly large number of contact hours must be scheduled.

An additional difficulty in these sessions arises when the supervising faculty member cannot break down the academic distance between himself and the students. The result, to be avoided at all costs, is that the students busily take notes on what they perceive to be the faculty member's "correct" approach. The problem may be ameliorated, somewhat, by using a studio assistant who is also a learner (perhaps more advanced), as the critic and goad. Myron Tribus has found an analogy from athletics:

> . . . The modern approach to the development of a skill is to coach the player as he learns the game. *Coaching* is not the same as *lecturing*. Some of the abilities and skills which cannot be taught but which can be learned with the help of a coach are: . . . Ability to recognize a problem and decide what needs to be done. Without this ability, even bright men panic . . . Skill at generating, finding, and organizing data. A man learns best when he needs to know. Data one has personally organized will remain a lifetime; to be forced to learn another man's pattern is depressing.

7) **Require self-criticism.** The simple process of requiring a student to point out explicitly the weak points of his analysis and model has an amazing effect on subsequent versions. It also helps to develop in a potential analyst what R. A. Howard calls, "a strong sense of self — that provides the security necessary if he is to question conventional procedures." A well-planned studio will allow time for the instructor to leave, in order for the students to feel more comfortable in self-criticism.

8) **Lay a foundation (but not pilings) of techniques.** A foundation is something solid and broad upon which to build a further structure. Mathematical techniques and tools and formal theories should certainly be elements of the foundation for an engineering problem solver.

What is to be *avoided* is the creation of 'pilings.' Those are long, strong, deeply imbedded, but extremely narrow structures that may lead to inflexible approaches. We all have our favorite anecdotes about the professional who forces every problem he encounters into a pet framework. We must be concerned with not producing more of these.

The foregoing discussion may seem to be somewhat abstract, and perhaps even supportive of the opinion that mathematical modeling and engineering problem solving *are* arts and therefore cannot be taught in a classroom. However, a "modeling studio" course has been taught along these lines since 1969 (when it was created by Seth Bonder and me). Details of the administration, and examples of problems investigated can be found elsewhere (particularly in my article in *Engineering Education*, November 1976, pages 167-171, from which this discussion has been taken).

Summary

The one definite conclusion reached after over ten years is that the problem solving *process* encouraged by the studio approach is what the student gains in the long run. Content is either forgotten, becomes obsolete, or is irrelevant to new situations. Although those of us who have been associated with the modeling studio will argue for its virtues, both practical and theoretical, it would be patently wrong for us to insist that is is the *only* way to teach modeling. Letters from some colleagues insist that the studio is too difficult to handle, too time consuming, and only attractive to the top 20% of their students. Success must be measured relatively: student reaction at Michigan has been favorable to the point that the studio is consistently oversubscribed. A number of papers which had their seeds in a particular studio problem have been published in professional journals. A number of organizations have actually based decisions on the results of some specific analyses. Finally, the pleasure of helping students to teach themselves, a skill that will help them in their inevitable battle with technological obsolescence, is matched only by the pleasure of knowing that I also have been forced to learn something new.

Outstanding Teaching Award Recipients for 1982-83

ZIYA AKCASU

While a faculty member at The University of Michigan, Professor Ziya Akcasu has achieved a truly distinguished reputation as both a scholar and a teacher. He has demonstrated a rare ability to master a wide range of subjects in engineering and physics, develop research programs of exceptional creativity and quality in these subjects, and then synthesize the deep understanding gained from his original research into a form suitable for classroom presentation. His courses in subjects ranging from statistical mechanics, polymer physics, control theory, plasma physics, and applied mathematics have always been among the most popular in his department. Beyond that, his reputation for presenting difficult material at the forefront of scientific research has attracted both advanced graduate students, postdoctoral scholars, and faculty to his lectures. Professor Akcasu is most deserving of his reputation as one of the truly outstanding scholars and teachers in the College of Engineering.

JACK LOHMANN

It is rare, indeed, that a young faculty member gains such rapid recognition as one of the outstanding teachers in the College. However, since arriving at Michigan in 1980 Professor Jack Lohmann gained an exceptional reputation for excellence in teaching. He was twice recognized by the Alpha Pi Mu as Outstanding Teacher, establishing a precedent by being the first professor to ever receive this award two years in succession. The subject matter of his courses on Engineering Economics is extremely ponderous, and without an unusual amount of creativity and finesse, could easily become onerous. It is a tribute to his reputation as an excellent teacher that his courses have become several of the most popular in his department.

ROBERT M. CADDELL

Professor Robert Caddell has been a respected member of the faculty of the College for the past 30 years. During that time he has developed a strong reputation for excellence in both teaching and research. Students have consistently rated his courses among the most outstanding in his department. Professor Caddell has recently co-authored two textbooks in the field of mechanical behavior and forming of materials that promise to become classics in this important field. His writing, as well as his classroom presentation, are noted for clarity of exposition. A hallmark of Professor Caddell's approach to his professional activities has been the total integration of his research, teaching and writing activities. His students and colleagues have benefited greatly from this approach, as they have from his sincerity, personal interest, and selfless sharing of time, knowledge, and experience.

ALAN B. MACNEE

It would be virtually impossible to list in this brief moment the contributions that Professor Alan Macnee has made to the department, the College, the University, and to his profession over the years. During the thirty-two years he has been a distinguished and respected member of the faculty he has made a lasting impression on his colleagues for his competence and initiative in his scholarship and for the students through his effective course development and presentation of material in an interesting and comprehensive way. He has gained a well-deserved reputation as one of the finest teachers in the College of Engineering, who excels not only in a lecture mode, but in the important area of laboratory instruction. His reputation as an outstanding researcher and teacher extends into the profession through his very significant contributions to the Institute for Electronics and Electrical Engineering. But to his students and former students he will always represent a model of excellent teacher and mentor — an individual who takes true joy in his profession of teaching.

Senior Research Fellowship Recipients for 1983-84

While virtually every University awards scholarships at the undergraduate level based on need and/or grade point average, the College of Engineering has initiated a program that awards scholarships based on the students' creativity. Each year research fellowships covering a full year's instate tuition during the senior year are awarded.

The objective of these fellowships is to enhance students' open-ended problem solving capabilities and self learning and to promote scholarly research activity at the undergraduate level which may encourage students to continue on to graduate school. The fellowships are awarded to students submitting the best research proposals of a project they would like to carry out. Students receiving these awards are expected to devote 10 to 12 hours per week toward their projects for two terms during their senior year. Seminars are arranged at the end of the winter term to allow each student to present the results of his or her research.

The suggested format of the proposal is that it not be more than *ten typed pages in length* and should contain the following sections:

1. Problem definition
2. Significance of the Problem
3. Literature Survey
4. Proposed research
5. Required resources
6. Resume
7. Time schedule
8. Faculty endorsement
9. Instate or Out-of-State Tuition Status

The panel selecting the most promising research proposals is chaired by a College faculty member and consists primarily of the graduate students receiving the Outstanding Graduate Student Awards at Honors Convocation. There were nine fellowships awarded in 1982 and thirteen in 1983. The recipients were honored at a luncheon on April 20 and are as follows:

PHILIP L. BERRY,
Engineering Science,
"A Proposal for Prosthetic Research: Graphical Display of Stump-Socket Interface Pressure Profile"

JULIE BOEKER,
Chemical Engineering,
"The Adsorption of the Surfactant SDBS onto Germanium Oxide"

DAVID BRIEF,
Electrical Engineering,
"Analysis of a Spiral Local Area Computer Network"

THOMAS B. BRUST,
Chemical Engineering,
"Infrared Studies of Radiation Induced Crosslinking in Polyethylene Chain Folds"

JAMES D. CARLSON,
Chemical Engineering,
"Proteinase Activity in Escherichia coli Cells"

ROBERT R. HERSHEY,
Electrical Engineering,
Comparison of Lenses and Diffraction Gratings as Single Frequency Imaging Devices"

RONALD A. KRASNOW,
Materials and Metallurgical Engineering,
"The Thermodynamic Equilibrium Properties in Fe-A1-B-N"

JEFFREY LEITNER,
Aerospace Engineering,
"Reduction of Aerodynamic Drag of Large Tractor-Trailer Trucks"

JAMES R. MEYER,
Naval Architecture and Marine Engineering,
"Request to Conduct Engineering Research in the Field of Aquaculture"

ROBERT C. SKUPINSKI,
Mechanical Engineering and Applied Mechanics,
"Generating Electricity Using Lean Fuel/Air Mixtures"

MICHAEL STOLOFF,
Electrical and Computer Engineering,
"The Effect of a Small Wind Turbine Generator on the Reception of an Antenna Mounted on the Same Support"

ROBERT T. TAEPKE II,
Electrical and Computer Engineering,
"Detection, Analysis, and Formatting of Multiple Neural Spikes for Prosthesis Control"

NANCY WINFREE,
Industrial and Operations Engineering,
"The Effects of Mental Distraction on Postural Sway"

FROM THE ALUMNI

No one can accuse Michigan engineers of leading dull lives! Whether conducting design research on low temperature isotopic distillation or writing a child's story about elves, whether studying conflict management through peaceful means or developing surgical implant biomaterials, Michigan grads are making unique impacts across the country and throughout the world. Please read below what other alumni are up to, and then sit down and let them know what's important in your life.

JAY M. BABICH (EE 71) was appointed National Account Manager by Allen-Bradley in Sept. 1982, and opened a sales office in Poughkeepsie, NY, in Nov. 1982. **MARSH F. BEALL** (CE, EE 32), who retired from the U.S. Corps of Engineers in 1967, writes that he travels every year to Washington, DC, where one daughter, a UCLA Ph.D., is a librarian at the Library of Congress. "I go by train, usually thru Canada to Montreal and to Washington, DC. I don't think these flying machines that disintegrate in mid-air are here to stay." His other daugher is an M.D., specializing in pediatrics-neonatology at the Bess Kaiser Hospital in Portland, OR, where Marsh also lives. **MICHAEL A. BRODER** (NA&ME 67) is Manager, Assembly Planning at General Electric's Gas Turbine Division in Greenville, SC. Michael received an M.S. degree in Industrial Administration from Union University in 1972. He was recently Manufacturing Coordinator for the 105 MW MS 9000 gas turbine. He comments, "even though we're living in the den of the Clemson tiger, Michigan will always be #1." **LARRY COATES** (I&OE 78) has been appointed Manager in the Management Information Consulting practice of Arthur Andersen & Co.'s Detroit office. Larry also received an M.B.A. degree from Northwestern University's Kellogg Graduate School of Management. He lives in Plymouth, MI. **LARRY COLE** (EM 62, OCEANO 64) is a self-employed consulting engineer specializing in vibration analysis and equipment troubleshooting. His office is in Wayne, ME. Larry writes, "my Michigan education and lots of part time job experience in the campus labs has allowed me to finish many interesting projects. I hope students can still work on the research contracts on campus. The experience is valuable." **JOHN DE LISI** (AERO 82) took a job with the flight test department of McDonnell-Douglas after graduation in May of 1982. Following a field assignment to the Patuxent River Naval Air Test Center in Maryland, John and his wife recently moved to St. Louis, MO. "I am currently working on the F-18 program and enjoying my job very much." **EDWARD C. DRIESE** (EE 56, MATH 56, EE 59) has been with SCOPE, INC. of Reston, VA for 24 years. He started as a senior engineer, later worked as laboratory manager, director of engineering, vice president of engineering, president of a subsidiary, then in 1982 became president of the corporation. The company specializes in signal processing, special purpose computer development, laser scanners, and computer terminals. Edward has been a member of IEEE since he was a student at Michigan. **DAVID O. EAMES** (AERO 77) is a U.S.M.C. officer and CH-53 pilot. Recent accomplishments include promotion to captain and completion of his second West Pacific tour in July 1983. David is attached to the HMM-265, 1st Marine Brigade, Kaneohe Bay, Hawaii. David notes, "I am an Alumni Cheerleader looking forward to attending future homecoming games!" [We hope you made the Iowa game on October 22, David — it was not to be missed.] **RALPH E. EDWARDS** (MATH 35) writes that he is "mostly retired," but still does some consulting. "The standard formula for certain mortality studies uses the Balducci Assumption. My 1943 origination of an alternate was recently located and entitled the Edwards Uniform Distribution Assumption. This led me to solve a difficulty in its use, published in the 1983.1 issue of ARCH (Actuarial Research Clearing House). It uses the 'Edwards Approximation.' " Ralph lives in Baltimore, MD. **MAX L. EIDSWICK** (I&OE 78) and his family have recently returned to the United States after several years. They now live in Sterling, VA. Max comments, "my engineering education has provided me with the necessary tools to excel in my profession . . . I consider the engineering program at the University of Michigan to be one of the finest in the country — if not the world. I wish you all possible success." **MARC AARON FELDMAN** (CHEM 79) has graduated from the Medical School at Wayne State University. On July 1, 1983, he began a three-year residency in Internal Medicine at Washington Hospital Center in Washington, D.C. "Medical school has taught me much, but engine school taught me to *think*!" **JOHN FRISK, III** (CIVIL 80) was hired by the Baltimore County, MD, Bureau of Sanitation in February 1981 as an Engineer 1. In November 1982 he was tranferred to the Bureau of Engineering of Baltimore County and was promoted to Engineer 2. **DARRYL L. GIANNETTI** (IE 71) is Vice President of Design Components, Inc. in Medfield, MA, which is involved in sales and marketing of linear motion products for the automation field. **JOHN C. HAGMAN** (BSE ENV. SCI. 74, MS PEPS 76) sends this update: "My wife Brenda (UM SNR 75) and I both work at the Wisconsin DNR in Madison. We have a son, Jake (3-30-83), and have visited Germany and Alaska on forestry tours in the last two years. GO BLUE!" **THOMAS HAMRICK** (AERO 48) retired from Airesearch Manufacturing Co. of Arizona in January 1979. Thomas resides in Sun City West, AZ and is "proud to call myself a graduate of U of M." **GERALD F. HAUSE** (EE 50) retired in 1982 from the General Motors Corporation Chevrolet Division after 32 years. Gerald's son Roy and daughter Linda are also U of M graduates. Gerald lives in Birmingham, MI. **KENNETH A. HOEDEMAN** (CIVIL 63) in the General Manager, Projects Department of NUTECH Engineers in San Jose, CA. He is currently working on analysis of modifications to nuclear power plants in the United States. Kenneth notes that he "was disappointed in outcome of 1983 Rosebowl but had a good trip to Pasadena — weather was perfect." **THURMAN JESSUP** (NA&ME 66) is a Design Engineer for Western Gear Corp. in Lynwood, CA. Thurman writes, "I like to fly gliders and read about astronomy (not at the same time)." **MARVIN JUNG** (A&OS 73) has started his own consulting firm in Sacramento, CA after having worked the past ten years as a consultant for various private firms and organizations. The firm specializes in designing aquatic toxicological studies, water pollution assessment and monitoring, environmental fate studies of toxic chemicals, and liaison work with government and private industry. Currently Marvin is consulting to the California State Water Resources Control Board's Toxic Substances Control Program and to the U.S. Bureau of Reclamation on a proposed major agricultural drain to discharge into the San Francisco Estuary. **STEPHEN H. KALE** (MECH 58) is the Westinghouse Project Manager for the South Texas 2600 MW nuclear plant near Houston, TX. Stephen notes, "based in Pittsburgh, PA, I had to learn tolerance toward those noxious Buckeyes to the west. Nevertheless I am gratified to see that high quality people come to Westinghouse from U of M." **PHILIP A. KALSON** (CHEM PhD 81) has moved from the Technion-Israel Institute of Technology to the Casali Institute of Applied Chemistry of the Hebrew University in Jerusalem. There he is carrying out research in liquid fuels from oil shale and coal. **LINDA G. (ROOME) KENT** (CHEM 78) obtained a MS ChE degree in August 1982 from the University of Dayton, OH, and subsequently obtained her Professional Engineer's license in the state of Ohio in the spring of 1983. She is currently a Development Engineer for the Monsanto Research Corp. in Miamisburg, OH, presently working on two main design projects: (1) low temperature isotopic distillation and (2) tritium containment system. Linda married Brian M. Kent (BSEE '79 MSU, MSEE OSU) on September 18, 1982. **GARY W. KLANN** (EE 73) is an Applications Engineering Manager for the Westinghouse Electric Corp. He reports, "I have held four positions in nine years with Westinghouse in Roanoke, VA, Chattanooga, TN and now in Fayetteville, NC — one Yankee gone South and likes it. My education at U of M helped me be prepared for my new job challenges. Thanks. I have been married for seven years and have two children, a very wonderful family. Hobbies are golf, wood work, and dog training." **ARTHUR F. KOHN** (CHEM 34) since 1978 has been President of A. F. Kohn Assoc. Inc., Metallurgical Consultants. Expertise in non-ferrous metals, air pollution control and foundry practices. Arthur writes that he enjoys playing "lots of tennis," travelling (including China), writing chapters for American Foundryman Society publication. He has presented papers over the years to AIME meetings. **MARK A. KRAMER** (CHEM 79) received a Ph.D. in Chemical Engineering in January 1983 from Princeton and has joined the faculty at MIT as an Assistant Professor. He states, "I look forward to U of M graduates attending graduate school here!" **JEFF LEBOW** (I&OE 80, 81) recently joined Robot Systems, Inc. in Atlanta, GA where he is an Applications Engineer and is engaged in setting up a quality program. Jeff formerly was with Weyerhaeuser Co. in Tacoma and Aberdeen, WA, and Columbus, MS. Jeff writes, "Last March, I lectured my old statistical quality control class (IOE 465) which was a great learning experience and lots of fun." **J. ANDREW LINNELL** (MATH 72, CICE 73) was recently (4/83) promoted to management of performance analysis for Wang's computer and office automation products in Lowell, MA. Andrew is organizing conferences on "Computers and Human Values" and has written an article on "Computers and the Image of Man" for *Anthropology in New England.* He has also written a child's story on elves. Married with two boys, Andrew lives in Wilton, NH. **DAVID C. LUKE** (AERO 68) is a colonel in the U.S. Air Force. In October 1982 he became Vice Commander of the Rome Air Development Center. RADC is the largest electronics laboratory in the Air Force and specializes in command, control, communications and intelligence (C^3I) research and development. **DOUGLAS D. MAC LEOD** (EE 48) retired after 34 years of service with the Michigan Bell Telephone Company as District Manager, Transmission Equipment Engineering in August 1982. Douglas writes, "as a former U of M bandsman, I've renewed my interests in music and occasionally perform with the Detroit Concert Band as well as other musical organizations." Douglas lives in Dearborn, MI. **CHRISTOPHER J. MARZONIE** (ESC 76) earned a D.D.S. degree in 1981. He is now in his own private practice of dentistry in Ann Arbor. Christopher reports that he is "joyfully married for 1½ years with a new son." His hobbies include playing the Carillon at the Burton Memorial Tower. **J. FREDERIC NEMENSKI** (CICE 78) divides his time between his position as Project Engineering at the Milford Proving Grounds of the General Motors Corporation and working on an M.B.A. at the U of M School of Business Administration. Frederic lives in Detroit. **DAVID NEWTON** (I&OE 80) is an Operations Analyst in the Advanced Systems Analysis Group of Hartman Material Handling Systems, Inc. He lives in Pittsford, NY. **KERRY L. NYE** (EE 78) is a U.S. Naval Flight Officer, S-3A Viking Tactical Coordinator. He writes, "the demands and responsibilities of studying at Michigan prepared me for a successful career as a naval officer." Kerry is now in the midst of completing his second squadron deployment, aboard the Navy's newest carrier, the USS Carl Vinson (CVN-70). His specialty is carrier-based anti-submarine warfare. Kerry will be visiting many exciting ports around the world before returning to the States. **WILLIAM ROGERS OLIVER** (MECH 72) is Senior Engineer with Systems Applications, Inc. William writes, "it's been more than rewarding to be in a position to help protect the environment" through his current consulting position and past activities at the EPA. He recently obtained a master's degree in environmental planning from San Francisco State University. William writes that he is "concerned over the qualities and activities of the U of M being pulled down by a state dependent on an industry seemingly mired in the Dark Ages." **R. J. RADFORD** (EE 52) is employed by Aramco Overseas Company in The Hague, Netherlands. Robert was married on August 21, 1982 to the former Wilma A. Shortridge of Witham, Essex, England. The wedding took place in Braintree, Essex, England. **G. KEITH RICHEY** (AERO PhD 75) has served since 1977 as U.S. Coordinator of NATO AGARD Fluid Dynamics Panel. Keith is Chief Scientist at the Air Force Flight Dynamics Laboratory, Wright Patterson AFB, OH. In 1982 he supported the Office of Science and Technology Policy (White House) study on U.S. aeronautics policy and Air Force Project 2000. He is "happy to see the Aero Dept. growing again" and sends "best wishes to the new Chairman, Tom Adamson, who was my thesis advisor." **ROBERT E. SANDER** (CHEM 69) is the Technical Superintendent of Polypropylene for the Soltex Polymer Corp. in Deer Park, TX. Robert writes, "I've been in plastics manufacture ever since I left Michigan. First polystyrene, then acrylics, then polyethylene, now polypropylene in Houston. The industry has changed a lot since 'The Graduate' was made and 'plastics' was the word." **FREDERICK J. SCHOEN** (CHEM & MET 66) went on to receive a Ph.D. in Materials Science and an M.D. He is now Director of the Cardiac Pathology Laboratory at the Brigham and Women's Hospital in Boston and on the faculty of the Harvard Medical School. His research relates to development of the surgical implant biomaterials and the pathology of artificial body parts. **DAVID E. SMITH** (MECH 52) recently retired as Deputy Director of Support Equipment Logistic Programs, Naval Airsystems Command, Washington, DC. He is currently spending time studying world future problems of population, food production, industrial production, the information society, natural resource depletion, and is taking a course in "conflict management" through peaceful means. David reports, "attendance at Michigan was a rewarding and productive experience for me." He lives in Falls Church, VA. **DENTON L. SMITH** (MET 47) retired as Senior Vice President of the J. M. Ney Co. in Bloomfield, CT after 25 years. Denton lives in Salem, SC. **HAROLD M. STRAUBE** (EE 39) is President of Straube Tele Consulting. He sent us this communiqué: "BELL TELEPHONE LABS/RCA/DATACQ/CHESTEL/STRAUBE TELE CONSULTING/IEEE & SIGMA XI/27 COUNTRIES/25 PAPERS/11 PATENTS/1 WIFE/5 CHILDREN/VISIT US IN CHESTER, CT!" **MICHAEL L. SURMANIAN** (CHEM 72, 76) was named to Manager, International Operations for ITT Cannon. He is responsible for worldwide strategic and product planning of Cannon's five European and one Far East Divisions. He is based in Fountain Valley, CA. **JAMES C. SWEAT** (NAVAL ARCH 74) is a self-employed consultant, "on my own going on two years, working harder than 8 to 5, but enjoying it more!" James lives in Neptune Beach, FL. **ROGER M. TRIPLETT** (I&OE 76) and **PAMELA M. (HARRISON) TRIPLETT** (CHEM 76) wrote us in March 1983 that Pam had recently traded her position as Environmental Engineer for Diamond Shamrock's Chemical Unit for a new challenge and that they are expecting their first child this Fall. "We're looking forward to raising a little 'Wolverine' in Buckeye Country!" Roger is Senior Industrial Engineer, Corporate Manufacturing Services, Eaton Corporation, Cleveland, OH. **PETE URBISCI** (MECH 77, 78) is Senior Associate Engineer for IBM in San Jose, CA. He works in Product Development and is involved in testing disk surface quality on new disk drives. Pete writes that he is "happy to hear that the Mechanical Engineering Dept. is renovating their laboratories and continuing its pursuit in Computer Aided Engineering. I am also pleased to know that the College of Engineering has opened its new computing laboratories. With the rapidly advancing technology in these areas, it is important that the College lead the way for high tech industries." **DOUGLAS G. VANDER MOLEN** (CHEM 75) relocated to Murray, KY in November 1983 after joining Vanderbilt Chemical Corporation in April 1983 as their Process Engineer. Douglas has also advanced to Member Grade, AICLE. **PAUL WAITE** (A&OS 66) is the State Climatologist with the Iowa Department of Agriculture. He authored "Weather and Climate," Chapter 5 in *Iowa's Natural Heritage* (1982), published by the Iowa Natural Heritage Foundation and the Iowa Academy of Science. Paul lives in Des Moines. **CLIFFORD R. WARG** (MECH 48) is now retired after a broad career in aviation engineering. Clifford was the test engineer responsible for design of jet engine test facilities and related operational publications for both jet engines and facilities. He was a quality control engineer for the Department of Defense office located at Bell Aerospace Co., where he was involved in procurement of aerospace equipment for most aerospace programs of the 60's and 70's. Clifford wrote and published USAF Tech. Orders 02B-1-4 and 4A for testing of overhauled jet engines. He travelled to Japan and the Philippine Islands during the Korean War to instruct USAF personnel in the use of jet engine test equipment. He resides in New Boston, NH. **GILBERT WAY** (MECH 26) has been an automotive consultant since his retirement from Ethyl Corporation in 1968. He was elected to Fellow Grade of membership, Society of Automotive Engineers in March of 1983. Gilbert reports that he "still enjoys sailing and racing, cycling, cross country skiing and jogging. Fond memories of life in Ann Arbor." **RUSSEL C. WELLS** (EE 57) was named 138th Grand Master of Masons in Michigan in May 1983. During his 35 years as a Mason, Wells has held many elected positions and been involved in many associations, including the Scottish Rite, York Rite Masonry and the Shrine. He is a clown in the Shrine, an organization most recognized for its founding of the 21 Shriners Hospitals for Crippled Children and Burns Institutes throughout the United States, where medical care is free of charge. Russel earned an LL.B. degree from the Detroit College of Law in 1964. Four years later he received his Juris Doctor of Law from DCL. He is currently the Northern Regional Patent Counsel for the Bendix Corporation. **GORDON G. WEPFER** (CHEM 56, NUCLEAR 57, 66) was recently appointed Associate Dean of Hiram College, Hiram, OH, in addition to his duties as Chairman of the Department of Physics. **LEONARD W. WILLIAMS** (CIV 56) is a self-employed CPA in Sunnyvale, CA. He is a member, Tax Determination Subcommittee, American Institute of CPA's; Chairman ("as long as anyone can remember"), Tax Committee, Peninsula Chapter, California CPA Society. He was a tax speaker at the 1982 convention of the California Association of Realtors, held in San Francisco and is Regional Vice President, International Fire Buff Associates.

FENN M. HOLDEN CELEBRATES 100TH BIRTHDAY

Mr. Fenn M. Holden was born on a farm in Erie County, in northwestern Pennsylvania, on November 1, 1883. He graduated from the College of Engineering in 1908 with a degree in mechanical engineering. He began work for General Motors Corp. that same year.

Mr. Holden was involved in the testing of the first V-8 engine to power an American-made automobile, the 1915 Cadillac. He was working with Henry Leland when he brought over a British engineer who was familiar with the V-8 developed in France by De Dean Benton & Co. It was kept under lock and key and the testing was carried out in secret in 1912 and 1913. Mr. Holden, as a dynamometer authority, was one privy to the secrets.

He was with Cadillac when Charles F. Kettering came to test his idea for the improved ignition system and the electric starter. Mr. Holden had a special interest and skill in mathematics and worked out a formula for calculating the degree of vibration in engines, utilizing the weight of reciprocating parts and thus he could advise where to cut down on weight to reduce vibration.

One of his greatest contributions to General Motors Corp. was an improved design for the proving ground in Milford, Michigan; part of which was named for him. His idea was a straight mile track which made it possible to calculate acceleration with the elimination of wind resistance.

Mr. Holden has been an avid bird watcher and an authority at recognizing birds by their songs and calls. Also, he wrote a monograph entitled "How Came the Mountain," in which he set forth his own theory of the origin of the change in mountain ranges of the earth.

Mr. Holden has been a resident of Wesley Manor in Jacksonville, Florida, since 1966. He is still interested in world events and scientific advancements.

All of us at the College of Engineering send our warmest regards to this longtime friend and loyal alumnus as he celebrates his 100th birthday.

IF you didn't find your entry this time, it arrived past the cut-off date and will appear in the next issue.

IF you failed to submit an entry, sit right down and do!

IF you'd like the current address of a classmate, let us know. If we've got it, you'll get it!

IN MEMORIAM

NORMAN R. BAILEY '24E, NASA ENGINEER

Structural stress analysis for NASA's spacecrafts Mercury, Gemini, and Apollo (1959 to 1970) highlighted the aeronautical engineering career of the late Norman R. Bailey. Mr. Bailey died October 4, 1983, at the age of 84 in Wyoming, Michigan, where he lived following his retirement from NASA in 1970.

Before joining the National Aeronautics and Space Administration, Manned Spacecraft Center in 1959 at Langley Field, Virginia (moved to Houston, Texas in 1962), Mr. Bailey worked for more than 30 years on Airplane Structural Analysis and Design for aircraft companies in Bristol, Pennsylvania; Farmingdale and Buffalo, New York; Baltimore, Maryland; St. Louis, Missouri; Wichita, Kansas; Dallas, Texas; and Columbus, Ohio. Most of his work centered on military type airplanes, but some on passenger carrying airplanes.

After graduating from the University in June 1924, Mr. Bailey worked as draftsman on a Navy airplane at the Glenn L. Martin factory in Cleveland, Ohio. From there he went to Dayton, Ohio where he worked for four years for the Army Air Corps, Engineering Division at McCook and Wright Fields, on Civil Service, doing airplane structural stress analysis, design and research. In July of 1929 he left the Army Air Corps to work for Vervill Aircraft Company in Detroit as chief structures engineer. After the stock market crash in 1930 he worked for various aircraft companies in various states.

Mr. Bailey's wife, Ruby Talbott Bailey, died in 1980. He is survived by a son, Marvin Bailey of South Lake Tahoe, California; two brothers, George of Cincinnati, Ohio and Carl of Birch Run, Michigan; a sister, Mrs. Harold Bolton of Great Neck, New York, and a nephew, Robert Bailey of Mt. Clemens, Michigan.

MATTHEW FORREST '27E, NAVAL ARCHITECT

Matthew G. Forrest, a naval architect who participated in the design of many Navy vessels and the liner "United States," died in March 1983 in Flemington, New Jersey. He was 77.

Forrest received his degree in Naval Architecture and Marine Engineering from the College in 1927. He joined Gibbs & Cox Inc., naval architects and marine engineers, in 1928, retiring in 1971 as executive vice president. He was awarded a certificate of commendation by the Navy's Bureau of Ships in 1947 for his service in World War II.

He was born in Johnstone, Scotland, and came to the United States as a child. He served as U.S. representative at the International Conference for Safety of Life at Sea in London in 1960. He was a past president of the Society of Naval Architects and Marine Engineers.

Forrest is survived by his wife, Elizabeth; two sons, Matthew D., of Tokyo, and Jonathan L., of Short Hills, N.J., and seven grandchildren.

JOSEPH J. MARTIN

Professor Joe Martin provided over thirty-five years of varied contributions to the College, the University, and his profession. This included an appointment as Associate Director of the Institute for Science and Technology for seventeen years, President of the American Society for Engineering Education, and President of the American Society for Engineering Education, and President of the American Institute of Chemical Engineers. Yet his first love and passion always remained teaching. Courses he initiated and designed have become models for complementary courses in undergraduate education in Chemical Engineering. His pioneering role in the development of courses in thermodynamics has established a methodology for chemical engineering education. His vigor and enthusiasm for his subject matter inspired other teachers of the subject, as well as undergraduate and graduate students who had the advantage of his unique and effective teaching skills.

The entire University community deeply regrets the loss of Professor Martin on December 13, 1982.

CLIFFORD E. PAINE '11E, DESIGNER OF GOLDEN GATE BRIDGE

Clifford E. Paine, who received his bachelor's degree in civil engineering from the College in 1911, passed away at his home in Fennville, Michigan on July 12, 1983. He was 95. Paine was a partner of Joseph B. Strauss in their engineering firm, Strauss and Paine, Inc., which was responsible for the design and construction of San Francisco's famed Golden Gate Bridge.

Paine had done additional work on the bridge since it was completed in May 1937. In 1951, his theory on bridge construction that makes long spans safe in all weather conditions was applied to the Golden Gate.

In addition to the Golden Gate, Paine contributed another historic bridge. In 1941, he received an award from the American Institute of Steel Construction for designing the Thunder Bay Bridge, a unique movable bridge located near Alpena.

Paine was born September 11, 1887, in Fennville. He spent most of his life near his boyhood farm home which he had developed as one of the largest fruit farms in the area.

Paine is survived by two sons, Clifford Jr. and Robert; four grandchildren; and four great-grandchildren.

RECENT ALUMNI DEATHS

'17 Roger Birdsell, d. August 1983
'17 Clarence Turner Fishleigh, d. Sept. 2, 1983 in Deerfield, IL
'19 Oscar Christian Klager, d. July 17, 1983 in Boca Raton, FL
'19 Edgar Warren Meranda, d. Oct. 20, 1983 in Ann Arbor, MI
'21 McKim Carpenter, d. August 2, 1983 in Chelsea, MI
'21 Raymond Smith DeMott, d. June 13, 1983
'21 Louis Joseph Schindler, d. Oct. 13, 1983 in Toledo, OH
'24 Bert Edward Uebele, Jr., d. June 10, 1983 in Boca Raton, FL
'25 Millard John Bamber, d. August 3, 1983
'28 Marion Smith Hodgson, d. July 5, 1983 in Lewisburg, WV
'28 Harry Carl Walker, Sr., d. August 14, 1983
'30 John Firth Middleton, d. June 15, 1983
'30 Joseph Saxe Schermack, d. June 29, 1983 in Sarasota, FL
'31 Gordon Rinkel Fritch, d. August 24, 1983
'32 Louis Zanoff, d. March 27, 1983
'34 Rollin Wellington Clark, Jr., d. June 5, 1983 in St. Petersburg, FL
'34 Wesley Warren McMullen, d. Oct. 7, 1983
'35 George Hoyt Servis, d. Oct. 13, 1983
'38 Russell Oscar Erickson, d. May 9, 1983
'38 Frederick Minard Kempton, d. August 30, 1983
'43 Richard David Gauthier, d. July 26, 1983 in Seattle, WA
'47 Harold William Stelzle, d. July 31, 1983
'49 John Alden Main, d. July 3, 1983
'52 Karl Ernst H. Moltrecht, d. July 31, 1983
'78 Michael Patrick McCarthy, d. August 14, 1983 in California

FROM THE ALUMNI

NAME ______________________________

DEPARTMENT & CLASS YEAR ______________________________

EMPLOYER & POSITION ______________________________

ACTIVITIES/ACHIEVEMENTS (job changes, professional projects, travel, society memberships, articles, you name it . . .)

____

____

____

____

____

____

____

Non-Profit Organization
US Postage
PAID
Ann Arbor, Mich.
Permit No. 144

College of Engineering
The University of Michigan
Chrysler Center/North Campus
Ann Arbor, Michigan 48109-2092