

ENGINEERING UPDATE

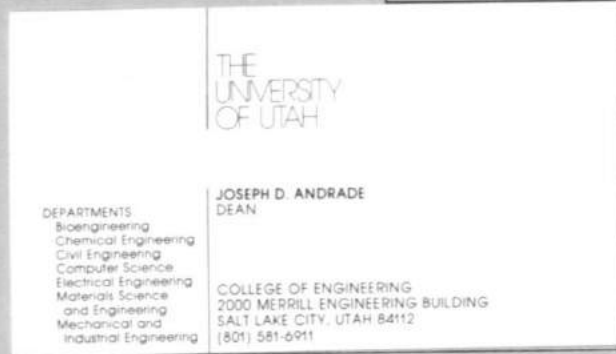
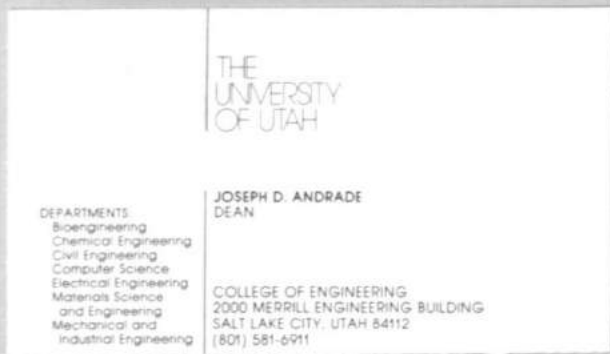
December 1984

Volume 1, Number 1

Published for alumni and friends
of the University of Utah College of Engineering

University of Utah
College of Engineering
2000 Merrill Engineering Building
Salt Lake City, Utah 84112

Nonprofit Organization
U.S. Postage Paid
Permit No. 1529
Salt Lake City, Utah



Letter from the President

Dear Alumni and Friends of the College of Engineering,

We live in a time when high quality education is essential to all of us — as individuals, as a state and as a nation. State of the art education gives us the chance to compete in our "global village" where the rewards for competence are great and the penalty for incompetence will affect not only this generation but generations to come.

The College of Engineering plays a vital role in the future of this university and this state. The College's capacity to train a professional work force, to do research and attract research funding, to link up with other disciplines on the campus, to provide consultation to industry, and to spin off products and even companies must be enhanced. The College of Engineering must advance nationally and internationally in the ranks of fine schools of engineering.

This advancement will require a new partnership for the support and enhancement of the College — a partnership between the state, the university and industry. We need



Keeping You Informed Is a Top Priority

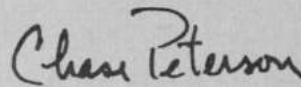
This year a number of new publications will be introduced by the College of Engineering to improve the lines of communication between the College, industry and the community. Dr. J.D. Andrade, Dean of the College of Engineering, has established "community information" as one of the College's outreach priorities for the year. During the '84-85 academic year, four newsletters, Technology Center brochures, program information brochures, the Bulletin for the College of Engineering and the Faculty Research Directory will be published.

"As the College continues to grow it becomes harder to keep our industry contacts and alumni informed on advances and accomplishments," says Dean Andrade, "and we must keep them

your help in getting about the business of forging such a partnership, or we shall surely fall behind states such as Arizona and Washington which already have developed this partnership in a way that guarantees high levels of support for engineering education.

I earnestly ask you to join with me, Vice President Altman, Dean Andrade and the faculty of the College of Engineering in meeting this challenge.

Sincerely,



Chase Peterson
President

Fostering an Unbeatable Partnership: College plus Industry

A primary goal of the College during the next year is to enhance its relationships with local and national industry. The Office of Industrial Relations was established in July of this year to implement that goal. This office seeks to nurture industrial interaction by instituting a number of programs that will provide industry with easier access to the College and its facilities.

Universities throughout the United States have tried a wide variety of programs to attract industrial support. For the most part, they have been only marginally successful — due, in part, to the lack of industrial involvement in planning programs. To avoid these problems, the Office of Industrial Relations contacted local industry leaders and employees to determine what would meet the needs of local industry and, on a large scale, national corporate priorities. With this input, the office will initiate a series of programs that should benefit both industry and the College.

The first program to get under way will be industry-sponsored continuing education, to bring on-site advanced courses directly to the sponsoring company. This makes it easier for employees to work on advanced degrees. For example, Industrial Relations is helping one company develop an individualized two-year course of study leading to the Master of Engineering

degree. In addition to meeting the company's projected educational needs, the College will now be able to serve 30 additional graduate candidates.

Other programs to be initiated this year include publications to provide industry with up-to-date information on current research and development at the College of Engineering, Technology Centers to centralize information on advanced areas of research and training and Industrial Affiliates to offer industry the opportunity to participate directly with ongoing and newly developed research projects.

Additional programs are being studied, and we are continuing to solicit ideas for new interactions and projects. If you or your company wishes to participate in a current program or to suggest a new one, contact the Industrial Relations Office.



Chevron U.S.A. Inc., generously donated \$67,500 to the University of Utah during 1984. A portion of that money was earmarked for College of Engineering use as well as for research and scholarship programs in Chemical Engineering and Mechanical Engineering. Present during the awards ceremony were Robert Boehm (Mechanical Engineering), Robert Osmundson (Chevron), David O'Reilly (Chevron), Dean Joseph Andrade, Lamont Tyler (Chemical Engineering) and M.E. Felkner (Chevron).

informed so there is continued enthusiasm and participation in all of our programs. The quality of our programs and research ranks the College among the top institutions in the United States but unfortunately, due to a lack of national media coverage, that's been a well kept secret." Through various brochures, bulletins and newsletters, Dr. Andrade hopes that industry will become interested in what the College has to offer.

Current Publications

**The Economics of Partnership
Research for Industry at the University
of Utah**

**A Thriving Partnership: The University
and High Tech Industry**

**Six (little known) ways the University
of Utah benefits the state**

**College of Engineering Faculty
Research Directory**

**Bulletin of the College of Engineering
Industrial Affiliates Program**

A Commitment to Innovation

**Center for Controlled Chemical Delivery
Center for Microelectronics**

Please contact the individual departments for information on graduate programs.

We will also be publishing an industrial affiliates newsletter and an alumni newsletter. We welcome article suggestions and other newsworthy information for either of these publications. Please send all suggestions, including the name, phone number and address of the appropriate contact, to Kathryn Barry, University of Utah, College of Engineering, 2000 MEB, Salt Lake City, Utah 84112.

College of Engineering
(801) 581-6911

General Information

Marvel Leader
Senior Administrative Officer

Industrial Interaction

Guil M. Funston III
Assistant Dean for Industrial Relations

Publications

Kathryn Barry
Editor

Bioengineering

J. Janata
Chairman

Chemical Engineering

A.L. Tyler
Chairman

Civil Engineering

E.S. Follis
Acting Chairman

Computer Science

R.F. Riesenfeld
Chairman

Electrical Engineering

C.K. Rushforth
Chairman

Materials Science and Engineering

G.B. Stringfellow
Chairman

Mechanical and Industrial Engineering

G.M. Sandquist
Acting Chairman

Dean

Joseph D. Andrade

Associate Dean

Robert Stephenson
Associate Dean for Research
K. L. Devries

Students To Conduct Alumni Phon-a-Thon

The student societies of the College of Engineering will be conducting an alumni Phon-a-Thon December 17 and 18 to raise money for a College computational devices facility. Mary Talmage, president of the Society of Women Engineers, feels that students should take an active role in developing the facilities needed by the College and suggested the Phon-a-Thon as an ideal way for students to participate. The students hope to raise \$100,000 from

alumni and friends of the College.

Alumni will be called in the evening, and it is hoped that their response will be generous. This is the first such event conducted by the College, and if successful, it may become an annual event. The College greatly appreciates all support, and alumni and friends who wish to participate but who will be unavailable on the above dates can mail their tax-deductible contributions to Student Phon-a-Thon, University of Utah, College of Engineering, 2000 Merrill Engineering Building, Salt Lake City, Utah 84112.

ME Degree Program Started at Sperry

The College of Engineering will implement a special continuing education program at the Sperry Defense Communications Division in Salt Lake City beginning Winter Quarter 1985. The program will consist of a "customized" 2½-year course of study in electrical engineering leading to an ME degree. When asked why such a program was instituted, Mark Yenchik, College Liaison Director at Sperry, said that "employees wanted a means to complete their degree without adversely impacting job performance, and the College of Engineering agreed to design a program."

Employees at Sperry will take two courses per quarter from a pre-determined series. The courses will be taught at the Sperry facility three days a week for one hour before and after work. This schedule will decrease the commuting time necessary for continuing education courses taught on campus and provide the Sperry students an easier transition between the class environment and the work place.

Yenchik explained that the company wants its employees to take advantage of the educational opportunities in the community, but in the past most class schedules did not mesh with working hours. "Some employees taking two classes a quarter on campus were so overloaded time wise that their job performance and ability to handle the course work suffered," he said.

When asked about the program, Dean Joseph Andrade responded, "Close relationships between the College and industry benefit both. We plan to expand these programs in order to provide continuing engineering education opportunities for Utah industry."

If the program meets Sperry's expect-

College Commits Support For Minority Students

The Dean's office wants to increase the number of underrepresented minorities in the College of Engineering. "This is a valuable resource that for a number of reasons has not been utilized advantageously," explains Guil Funston, Assistant Dean for Industrial Relations. "Primarily, the support structure at both the secondary and post-secondary education levels is not developed sufficiently to encourage minorities to enter and advance in mathematics, the sciences and engineering." To this end, Dean Andrade has appointed Dr. Edward M. Trujillo, Associate Professor of Chemical Engineering, to coordinate recruitment and support of minorities.

Dr. Trujillo is compiling statistical data on Black, Hispanic, American Indian and female students currently enrolled in the College. This information will be used to help initiate programs and solicit funds to encourage minority students to remain in school and graduate. Dr. Trujillo is also compiling a list of local and national organizations offering scholarships or fellowships to minority engineering students.

There are several national and state organizations that have initiated similar programs and have been extremely successful in increasing the number of minority students entering engineering and graduating. Dr. Trujillo has most recently been associated with the Colorado Minority Engineering Association, a pre-college engineering and science program patterned after the MESA program in California. With the help of Associate Vice President for Academic Affairs Afesa Adams, the University hopes to initiate a similar program in Utah.

Eventually, programs will be developed

Sperry: Partner in Semiconductor Studies

The HEDCO Laboratory and the departments of Electrical Engineering and Materials Science and Engineering have been developing new state-of-the-art semiconductor materials for the last four years. The technique used to produce the materials is organometallic vapor phase epitaxy (OMVPE) which is rapidly becoming the preferred technique for producing III/V semiconductor alloys. That is particularly true for the so-called "heterostructures," which will be the basis of the most advanced semiconductor devices. Perhaps the most important example of such a device is the high electron mobility transistor or HEMT, which will potentially be the fastest transistor available in three to five years.

Although there are several industries supporting this research, Sperry is the only Utah company involved with the University program. It funded a contract for an initial \$30,000 and subsequently donated \$80,000. This and future funding will allow further research and development of the HEMT device as well as supporting three of the 12 graduate students working in the III/V area. A Sperry employee will also act as an on-site co-researcher.

"This situation seems to be an excellent opportunity to strengthen our position in advanced semiconductor materials and devices and also to help an advanced semiconductor activity move into Utah industry," said Dr. G.B. Stringfellow, who supervises the III/V research in conjunction with Dr. R.J. Huber and Dr. R.M. Cohen. Currently, the semiconductor activities in Utah (National and Signetics) are concerned with design and production of conventional devices and circuits fabricated in silicon.

The University of Utah is a leader in advanced III/V semiconductor materials research. Since Sperry needs ultra-high-speed FETs for military systems, it is the perfect partner in this endeavor.

SWE Chapter: Advocate For Women Engineers

"We have an especially active group this year," commented Mary Talmage, president of the Society of Women Engineers, also known as SWE.

SWE is a professional, nonprofit, educational service organization of students, graduate engineers, and men and women with equivalent engineering experience. The international organization with membership numbering in the thousands is dedicated to the advancement of

tations during the first year, a second one will be started involving up to 60 students.

Students Win Prizes In Software Contest

Two College of Engineering students, Gary Bruner and Steven Swope, recently won a national portable computer software contest.

The contest, sponsored by NEC Home Electronics Inc. in an effort to expand its relationship with selected universities, was announced last spring at the University of Utah. Students submitted programs developed specifically for the NEC-8201A hand-held computer. Entries were judged on the basis of unique software application idea, ease of use, clear documentation and error handling.

The ten best entries from the University of Utah, judged by a faculty committee headed by Bill Salmon, went on to compete against others from MIT, UCLA, the University of Maryland and University of Illinois. "It's significant that we won half of the national prizes," commented Salmon.

Gary Bruner won second place for his program entitled "MATH.BA." He received an NEC-8201A computer and an additional

at the College level to help minority students secure financial aid, and to provide freshman orientation, summer employment, counseling and field trips. These programs will rely heavily on industrial support and will utilize the services of both the local community and industry.

\$2,000 prize. His program solves basic engineering math problems such as polynomial functions and determinants. "It's a nice computer," Bruner said, "and it was a great experience!" Steven Swope tied for third and won \$1,000 plus the 8201A computer for "XDIR," a program which shows a directory of all files in memory with information on each.

The other eight local winners from the University of Utah include Thomas Baer, D.R. Berrett, R.S. Berrett, R.J. Cooper, Conrad Felice, Paul Finlayson, John Hamilton, George Spencer and J. Mark Speicha. Each received an NEC-8201A computer. The faculty committee, consisting of J.D. Seader (ChE), David Schamber (CE), Bill Salmon (CS), Mark Smith (EE) and Gary Flandro (ME), also received home computers. Computers, cash prizes and other valuable equipment were donated to the University of Utah by NEC.

women in the engineering profession. The student section at the University of Utah has 50 members. There currently is no professional section in the state, however, and a committee of students nearing graduation is in the process of forming one.

The student section, advised by faculty member Sanford Baum, is fulfilling the objectives of the society — informing young women, their parents, counselors and the general public of the qualifications and achievements of women engineers as well as attaining high levels of educational and professional achievement. In addition, it serves as a center for information on women in engineering. To achieve these goals, SWE sponsors speakers and arranges company tours for students. This quarter the chapter had a very successful "Evening with Industry" program. Plans for winter quarter include a professional workshop and science demonstrations at several elementary schools to promote interest in engineering. The organization also keeps information files on industry and scholarship opportunities for women.

Ms. Talmage hopes to expand their services as an information center by working with Dr. Edward Trujillo, director of the minority engineering program.

For further information concerning the professional section of SWE, contact Charlie Hendrickson at 485-8960.



Laurie Schatz from NEC Home Electronics demonstrates the NEC-8201A portable home computer to U of U faculty D. Schamber (CE), G. Flandro (ME), B. Salmon (CS) and J.D. Seader (ChE).

Departmental Research

Continued from page 2

areas are robotics, turbulence and vibrations, fracture mechanics, composite materials, nuclear engineering and biomedical engineering.

Industrial engineering research interests include engineering economics, human factors, operation research, production, materials handling and robotics, and factory automation.

In the future, the College of Engineering will grow in these existing strength areas and will expand into new fields. By continuing its commitment to innovative, interdisciplinary research, the College can accomplish its goal of assisting the state of Utah in advancing its technology-based economy.

Past, Present and Future

Joseph D. Andrade
Dean, College of Engineering

The University of Utah College of Engineering is looking toward the future with a spirit of innovation, expectation and optimism. The College is committed to excellence in both education and research, and our success in these areas is largely due to a dedicated and resourceful faculty that has accomplished much with very limited resources.

One of the goals of the new University and College administration is to make the local and national community aware of this commitment. Through a series of College and University publications, we are informing alumni and other friends of the College of its activities and accomplishments as well as its problems and needs.

The College went through a particularly difficult period beginning in the fall of 1980. University budget cuts, low salaries, burgeoning enrollments and inadequate space led to a serious faculty morale problem. At a time when our peer Colleges nationally were expanding and improving their budget and salary situations, the University of Utah College of Engineering was suffering. In spite of these problems, our dedicated faculty provided excellent instruction to the rapidly growing number of students and continued to maintain their research competitiveness and productivity.

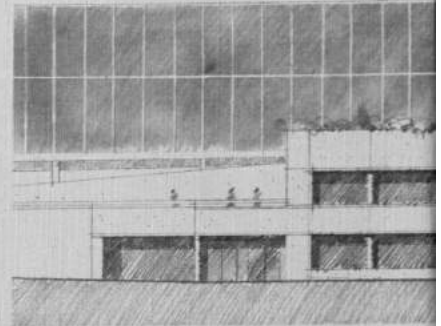
In the past 15 months a number of important developments have significantly improved the situation.

Enrollment limitations have been implemented throughout the College to control sophomore through senior enrollment. This will result in a decrease from the present level of 3,700 students to about 2,600 by Autumn Quarter 1985. Selection is based exclusively on academic performance in a student's freshman year. This plan immediately reduced excessive teaching loads and improved the general academic quality of engineering students.

In response to state and national concern over the quality of public and higher education, the Utah Legislature in February 1984 partially implemented an Education Initiative resulting in the first consequential increase in funding for higher education in many years. Salary funds made available through this action were allocated strictly on the basis of merit and market pressures resulting in engineering salary increases that ranged from two to more than 30 percent. The terrible faculty and staff salary situation was significantly improved for one-third of the faculty. The other two-thirds are still grossly underpaid. Clearly, competitive salaries remain our number one priority.

Engineering students generally agreed to imposition of higher course fees in order to help pay for computer and laboratory equipment access and maintenance.

The space situation also has been significantly improved. Thanks to the efforts of former Dean Larry Lattman (now President of the New Mexico Institute of Mining and Technology), we are now moving into a new research building, and a new instructional



laboratory building is under construction. In the Merrill Engineering Building has been renovated in several months to accommodate changing needs and

The College is perhaps the major engineering school in the West. The University of Utah ranks in approximately 10th in sponsored research. The College of Engineering on a per capita basis we rank 11th! This is a remarkable recognition of the excellence and productivity of the College.

The College's key resource and contribution to the state has individually benefited by the quality and quantity of graduates. Some of these alumni in future years will be: Sperry Corporation (Class of '51), Simon Ramo Science Advisor (Class of '33), William Gould, President of Sperry (Class of '42), and many others.

The College has a reputation for innovation. Some 20 companies have been formed by our graduates worth some \$500 million to the Utah economy!

The innovative and practical qualities of our graduates make a significant impact on Utah and the nation. The College has a major role in Utah's plans for rapid economic development and the rapidly growing state population.

The College is making a major effort to improve its reputation locally, nationally and internationally. A College Council has been established to coordinate, encourage and catalyze these efforts.

Industry Leaders Appointed to Board

Dean Andrade has announced the formation of the University of Utah College of Engineering State Advisory Board to assist him in improving the quality of industry / College interaction. The board will be composed of industry leaders throughout the State representing all of the educational areas of the College.

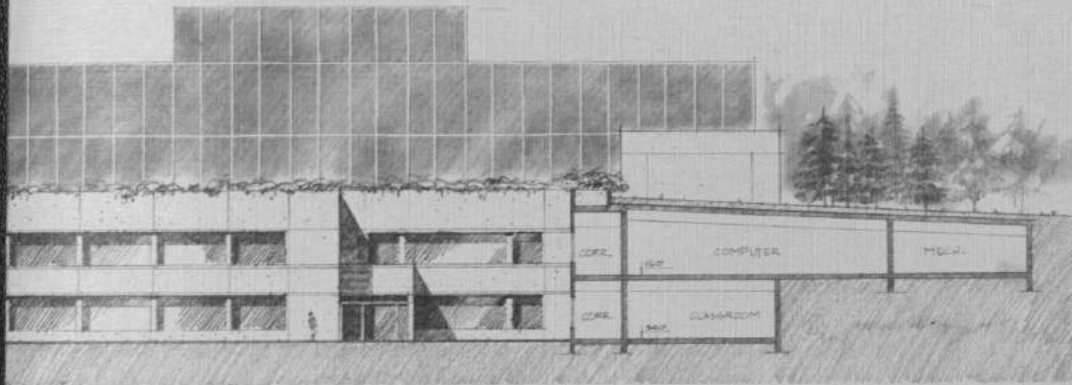
"The critical role the College plays in providing personnel, services and technology to local industry must be continuously updated to meet the ever changing needs of industry," Dr. Andrade noted in announcing the board's formation.

The dean explained that as the state's economic base expands, the role of the College must expand to provide the necessary services to enhance the industry.

External Perspective on Engineering Education

Laurence Lattman
Dean, College of Engineering (1978-1983)
President, New Mexico Institute of Mining and Technology
Socorro, New Mexico

A dean of engineering, in addition to defining objectives and long-range plans, is involved in the day-to-day operation of a College. In retrospect, the day-to-day details disappear and the College as an entity may be viewed. Just over a year after leaving the University of Utah's College of Engineering, I look back with respect and affection. I realize that the College is an extremely good college of engineering and, frankly, almost impervious to what a dean can do to it. The interactions among the departments are extremely strong and cooperative, even though at close range one hears a great deal of competition and noise. The College is responsive to new ideas, enthusiastic about maintaining quality and genuinely concerned about the education of engineers. Looking back, I realize that I was extremely fortunate to be associated with a first-rate school like the U of U's College of Engineering. Even at this distance, I see nothing that can prevent that College from achieving a higher and higher degree of excellence.



The 60,000-square-foot Instructional Laboratory Building (foreground) will be completed in approximately two years. Located south of Merrill Engineering Building, it will be used as the primary instruction facility for both the College of Engineering and the College of Mines and Mineral Industries. The building will have five lecture halls, six classrooms, design rooms, computer terminal rooms, and a microscopy laboratory and staging area. The addition of this new space will free up Merrill Engineering Building for its intended purposes — instructional laboratories, research facilities and administrative offices.

In addition, about 30 percent of the space in the building is modeled and/or reassigned in the last 15 years as priorities.

The College is a leading research institution in the Intermountain West, ranked nationally the top 30 nationally in terms of research funding, ranks in the top 20 or so — but on a per capita basis — achievement and is clear national leader in many areas of the College and its faculty.

The College's contribution to society is its 7,000 alumni, each of whom are a testament to the dedication of our faculty over the years. We face many issues. They include Gerald Probst, CEO of TRW and co-founder of TRW and a Presidential Fellow, and President of Southern California Edison (Class

of Entrepreneurship). Over the years, the College faculty, resulting in over 6,000 jobs and

our faculty and graduates are continuing to contribute to the national economy. The College will play a key role in growth — to provide the jobs to support

improve communication with industry — the Industrial Relations Office has been created to analyze communication and interaction with

industry. The College has set up a State Advisory Board and is establishing a National Advisory Committee. A number of joint University-Industry interdisciplinary centers are being established.

What are our priorities and goals? When Dr. Chase Peterson was appointed President of the University of Utah on August 1, 1983, he came with a vision. There are few truly great Universities, and it is his goal that the University of Utah become one of the extraordinary academic institutions world-wide. The College of Engineering shares that vision and goal.

We believe this is realistic and attainable. Utah is committed to excellence in education. The state's economy is developing rapidly — and the College of Engineering is vital to that development, just as California's Silicon Valley is largely due to Stanford and the Boston development is largely to the Massachusetts Institute of Technology. The state-University partnership coupled with the hard-working, resourceful nature of our faculty and students will guarantee major progress in the next few years.

Our programs and activities in biomedical engineering, computer science, computer-aided design and manufacturing, robotics, sensors, information processing, energy, chemical process engineering, polymers, ceramics, semiconductors, microelectronics, composites, transportation and others will all have dramatic positive impacts on the state, region and nation.

The development of a great University and College requires more than state support and hard, innovative work — it requires the commitment, dedication, and support of alumni and friends. We hope you will choose to share in our goals and vision — and help provide the support the College needs and deserves.

I look forward to working with each and every one of you.

College Research Funding and Support Continues Strong

K. L. DeVries
Associate Dean for Research

Research in the College of Engineering has increased steadily over the last four years. Funding for this research is distributed among all the College departments, but Computer Science and Electrical Engineering have by far the most research support. During 1983-84, the College

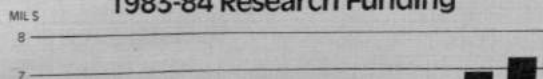
received over \$7 million for research support.

Such funding provides many advantages to the College. One of the most important is support for graduate students. Without this backing, our output of graduate students would be greatly diminished. Research contracts and grants currently provide support for more than 160 students, and largely as a result of such support, the College awarded more than 100 graduate degrees in the last academic year.

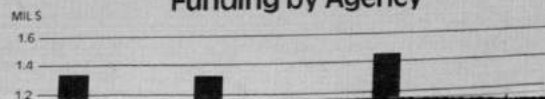
The diversity of sources from which the College's research support is derived is, in our opinion, a significant strength. It is particularly satisfying that 20 percent of this aid is from private companies. Nationally, only 7 percent of total research support comes from private corporate sources.

We would like the cooperation between private companies and the College to continue to grow and believe that both groups will benefit from such interaction.

1983-84 Research Funding



Funding by Agency



necessary services to enhance the industrial climate. "The role of the College in economic development is not a passive one," according to Andrade. "The industrial relationships and interactions the College maintains must be the result of a cooperative effort between the College, industry and the state. We should take note of the sizeable efforts being made by other states like Ohio, California, Texas and Arizona. For this state to be competitive, our industrial relationship must be on a par with those in other regions." Throughout the year, the board will meet to discuss and plan how the goals of the College and the economic needs of the state can be met.

The board consists of 16 members, half serving for one year and the other half serving for two years. This year the board members are:

- Mr. Kenneth J. Bentley**
President, Bonneville
Telecommunications Co.
- Mr. Garrison E. Bielen**
President, Sorenson Research Co.
- Mr. Clair F. Coleman**
President & CEO, Retired,
Mountain Fuel Resources Inc.
- Dr. David Evans**
President, Evans & Sutherland
Computer Corp.
- Dr. Sidney J. Green**
President, Terra Tek Inc.
- Mr. James Hart**
Vice President and General Manager
Defense Communications Division
Sperry Corp.
- Mr. David C. Johnston**
Partner, Arthur Andersen & Co.
- Mr. Ernest A. Mettenet**
President, Hercules Aerospace Division
Hercules Inc.
- Dr. Julius A. Mirabal**
President, Eaton-Kenway
- Mr. Ralph (Randy) Moon**
Utah State Science Adviser
- Mr. R. Gilbert Moore**
Special Projects Manager, Morton Thiokol
- Mr. John M. Nelson**
President, Norton Christensen
- Mr. David J. O'Reilly**
Refinery Manager, Chevron U.S.A Inc.
- Dr. Lawrence D. Reavely**
President, Reavely Engineers &
Associates Inc.
- Mr. Rod Savage**
President, J.R. Controls Inc.
- Mr. Lawrence M. Wennt**
Plant Manager, Rockwell-Collins
Telecommunications

Space Update

Robert E. Stephenson
Associate Dean for Academic Affairs

The space problem which the College of Engineering has faced for a number of years is improving on several fronts. We are now moving into the new Energy and Minerals Research Center, directly to the south of the Merrill Engineering Building. This 40,000-square-foot building is shared equally by the College of Engineering and the State College of Mines and Mineral Industries. It contains only research labs and conference rooms. Assigned occupants are moving into this new facility as quickly as arrangements can be made. The labs vary in size but each has a generous supply of storage cabinets, laboratory work benches and fume hoods.

Five buildings formerly owned by the U.S. Bureau of Mines are in the process of being renovated for use by both the College of Engineering and the State College of Mines and Mineral Industries.

Immediately in front of the Merrill Engineering Building, where the South Merrill parking lot used to be, an enormous hole exists. This hole is the beginning of a much needed and long overdue teaching facility. It will be called the Instructional Laboratory Building and will contain five large auditorium-type lecture halls, six smaller more conventional classrooms, three computer terminal rooms for computer-aided design, a conventional engineering design laboratory and a microscopy laboratory. When this building is completed in about two years, many of the substandard classrooms in the Merrill Engineering and the Browning Buildings will revert back to their originally intended purpose as laboratories.

Eleven new and badly needed offices are under construction in the south end of the fourth floor of the Merrill Engineering Building. Plans are also being completed for a rather complete renovation of the remainder of the fourth floor to provide additional offices and research space for the increasing research activities in the Computer Science Department.

More students would like to study engineering than we can accommodate. The pressures created by these potential students and a growing research program result in a chronic space problem. Plans are being formulated for another structure, perhaps to the west or north of Merrill Engineering. A significant fund-raising effort is planned in the near future to help pay for this new structure.

Microelectronics Center Begins Operation

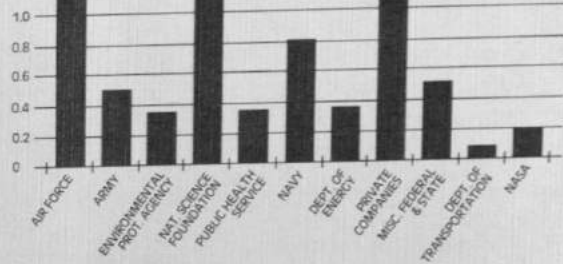
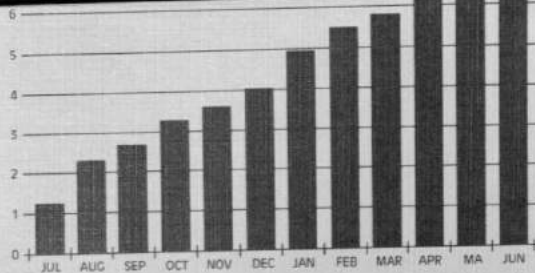
The Center for Microelectronics is the first center within the College of Engineering to be formally presented to industry for research support and participation. A new brochure has been created describing the research and training aspects of the center. The Office of Industrial Relations will mail the brochure to 350 top electronic firms nationally and internationally.

The center's program for microelectronics education provides the student with the knowledge needed to contribute directly to the development of the microelectronics industry. Student participants receive "hands on" experience in device fabrication and design. Students from most engineering and physical science disciplines may participate in the program. Currently two distinct specialty areas have developed — device physics and fabrication and VLSI design and modelling. The goal of the program is to train and educate future investigators, designers and engineers in the field of microelectronics and to fill current as well as projected needs for these highly specialized and creative individuals.

Industry involvement in the Center for Microelectronics is crucial to the development of this research and training resource for the microelectronics industry. Companies can participate in the center through research sponsorship or unrestricted center support. Industry benefits include recruiting assistance on campus, advance publications, on-campus meetings and seminars, research projects and, most importantly, a direct link between future innovators in the field and individual companies.

One of the major research interests of the center is III/V materials. The search for new semiconductor materials is an essential element of progress in microelectronics where device performance is clearly limited by the properties of existing materials. Several projects are advancing the state of the art of such III/V alloys as AlGaInP for short wavelength LEDs and injection lasers, GaInAs for ultra-high speed FETs, and GaAsSb for 1R detectors and solar cells. The research is all based on the rapidly evolving growth technique OMVPE.

As other centers come on line, similar programs will be initiated. The direct mail campaign for the Center for Microelectronics expects to generate \$1 million in research and industry support over the next two years.



Departmental Research: A Major Focus

Each of the seven academic departments in the College of Engineering is moving forward with great enthusiasm. All departments have major research efforts in progress and are continually updating their facilities. The majority of the faculty in these departments consult regularly with industry on both local and national levels.

The Department of **Bioengineering** emphasizes graduate education and research. The main research activities within the department are concentrated in the areas of bioinstrumentation, biomaterials, biomechanics and prostheses.

Other current programs include medical imaging, biomedical device design and testing the effects of microwaves on man, including development of a microwave hyperthermia system for use in cancer therapy. Also being studied is the biocompatibility of polymeric materials, including studies on physicochemical aspects of protein adsorption, cell adhesion and related interactions, and the development of modified or new polymers for specific implant applications. Nerve regeneration, vision research and information processing, mammalian cell culture, thin film electrodes for neurostimulation and analysis of expired air by ultra-sensitive spectroscopic methods are other ongoing activities.

The **Chemical Engineering** faculty is focusing their research activities in fluid mechanics, mass transfer, heat transfer, thermodynamics, process control and chemical-reaction kinetics.

Specific projects include ignition and burning of Western coals and coal chars, study of the connection between the structure of macromolecules and macro-

scopic properties of polymeric materials, and food production in relationship to energy and heat transfer. Air pollutant formation, controlled combustion, diffusional processes and computer-aided process synthesis are also current research areas.

Research interests of the Department of **Civil Engineering** faculty include mechanics — emphasizing composite materials, fracture mechanics and fatigue — computer-aided design of both dynamically and statically loaded structures, and earthquake engineering. Another area of interest is geotechnical engineering, including the response of soils to dynamic loading, the stability of slopes and the properties of soils, especially clays and weak-weathered rock. Water treatment and chemistry, hydrology, computational fluid mechanics, water resources, and system optimization and transportation are also current research areas.

Faculty in the Department of **Computer Science**, which was recently ranked 18th in the nation for graduate research, are conducting extensive research in computer-aided geometric design, particularly on a spline-based solid modelling system called Alpha 1, and on other aspects of computer graphics.

Artificial intelligence and symbolic computation are also being studied, including transportable LISP systems. There is a growing emphasis on computer and machine vision for smart robot applications as well as on full-text information processing. Other research areas include computer-aided VLSI design (NMOS, CMOS, and GaAs), logic programming languages, multiprocessor systems, parallel processing, distributive and

parallel computing, and programming language structures.

Currently, undergraduate as well as graduate students work with Department of **Electrical Engineering** faculty in a number of research areas. Among them is electromagnetic theory, emphasizing the biological effects and applications of electromagnetic radiation as well as electromagnetic techniques for energy and defense applications. Microwave tube research and design, semiconductors, applied optics, microelectronics, signal processing and opto-electronic systems are also areas of student-faculty interest.

Other projects involve signal restoration, adaptive filtering, modelling of the eye and ear, and design of communication systems for a variety of purposes.

Research investigations in the Department of **Materials Science and Engineering** are concerned with how solids can be utilized for man's benefit by modifying and optimizing their structure to further improve and custom design their properties.

Emphasis areas include ceramics — including processing, synthesis and characterization techniques — metals and physical metallurgy, solid state physics and VLSI. Biomaterials, polymers, semiconductors and surface science are also current research areas.

Research interests in the Department of **Mechanical Engineering** cover three basic areas: mechanics, systems and design, and the thermal-fluid-energy sciences. In conjunction with these, engineering materials, power generation, energy utilization, product safety, combustion, heat transfer and acoustics are also studied. Particular research thrust

Continued on back page

ENGINEERING UPDATE

UNIVERSITY OF UTAH COLLEGE OF ENGINEERING • VOLUME 3, NUMBER 1 • WINTER 1986

Marc Heritage, a senior IBM Engineer from Boulder, Colorado on loan to the College of Engineering for one year, is helping to assess and to consolidate efforts in Microengineering. Dean Joseph Andrade requested IBM's assistance in evaluating the College's programs in this area and in preparing large-scale proposals to government and industry to expand those efforts as rapidly as funding will permit. IBM is one of the first corporations to respond to higher education's needs for increased private sector funding in these times of federal and state budget reductions. In 1985, IBM provided American colleges and universities with \$71 million in direct grants and fellowships, and \$107 million in multi-year research contracts.

A Cambridge University graduate, Heritage came to the United States in 1968 specifically to join the R & D efforts of IBM. After spending his first year in the U.S. at the University of Florida at Gainesville, his first objective was met: he joined IBM at Yorktown Heights, N.Y., in 1969. After conducting research in micro-fabrication development, Heritage moved on to oversee some of the efforts of the Armonk, N.Y.-based IBM Science Advisory Committee. Following this experience, Marc assumed responsibilities for integrated circuit development for IBM in Boulder, Colorado.

New challenges have long been the hallmark of Heritage's career, and he began intensively to seek an IBM-sponsored technical sabbatical to come to Utah and to work in our academic environment. Since coming to Utah in June, Marc has had to put on

UTAH'S "IBM HERITAGE"



two hats, that of teacher and student. Marc says of his assignment, "I think it is an intriguing assignment. You set your own targets and objectives you can achieve. I now realize how customers see IBM, from the other side. I see the reason customers accept or reject IBM products and what it takes to make the products more attractive to customers". Since Marc's arrival, he has been working very closely with Assistant Dean Pete Gerity to develop a funding base for the integration of our micro-engineering program.

Micro-engineering is currently thought of as a field in which the U.S. could recapture world leadership in manufacturing technology, and is the integration at the micro level of mechanical, electrical, chemical and many other special functions. Medicine in particular has a great need for such miniaturization. Medical

instrumentation and neuroprosthetic devices represent significant areas of co-development for microengineering. "The possibilities are mind-boggling", Heritage says. "Building devices in microengineering that mimic functions of the human body, like synthesizing vision - that's fascinating!"

Dr. Andrade expects to reap the benefit of Heritage's one-year sojourn and says that, "Marc understands the basic technology involved in microengineering and has the business skill necessary to present funding proposals in terms that government and corporate officials can identify with."

So far, Marc has been enjoying his sabbatical. "Everyone is extremely friendly here and they have a good understanding of technology," he reports. IBM's investment in Marc and

Continued on page 2

"Magnificent Seven" Join Engineering Faculty

Seven appointments to the faculty of the College of Engineering have been announced, effective September, 1986.

Dr. Willard D. Bascom becomes Research Professor in Materials Science and Engineering. He has lived in Utah since 1981, when he joined Hercules Inc. at Magna as manager of composite research in the graphite fibers department. He received his B.S. in chemistry from Worcester Polytech, a master's from Georgetown and a Ph.D. from Catholic U. From 1956 to 1981 he was with the Naval Research Laboratory in Washington, D.C.

Dr. Terry A. Ring, Associate Professor of Materials Science and Engineering, comes to the College from the Massachusetts Institute of Technology where he has served on the faculty since 1980. He received a B.S. in Chemical Engineering and an M.S. in Physical Chemistry from Clarkson, an M.S. in Chemical Engineering from the U. of California at Berkeley, and a Ph.D. in Chemical Engineering from Cambridge University (England). He was a research engineer at Kaiser Aluminum from 1974 to 1976.

Dr. Kenneth W. Horch, who becomes Associate Professor of Bioengineering, has been on the faculty of the U of Utah in the Department of Physiology since 1973, most recently as the Director of Graduate Studies in the department. He received his B.S. in engineering from Lehigh and his M. Phil. and Ph.D. in biology from Yale. Earlier this year he was visiting professor at the University of Grenoble (France). He has been a member of the board of editors of the Journal of Electrophysiological Techniques since 1983.

Dr. Donald S. Boswick, Assistant Professor of Mechanical and Industrial

Engineering, has been a consulting engineer in occupational health and safety since 1980. From 1969 to 1979 he was a civilian engineer with the U.S. Army in Texas, New Jersey and West Germany. He is director of the safety and ergonomics program for the Rocky Mountain Center for Occupational and Environmental Health. He received a B.S. in mechanical engineering from Michigan State, an M.S. in industrial engineering from Texas A&M, an M.A. in human relations from Oklahoma and a Ph.D. in industrial and operations engineering from Michigan.

Dr. Yoichi Matsumoto, Assistant Professor of Industrial Engineering, comes to Utah from the U. of Oklahoma, where he was a faculty member since 1983. After receiving a B.S. in mechanical engineering from the Musashi Institute of Technology in Tokyo, he held an engineering position with Komatsu Manufacturing in Japan from 1970 to 1976. He received an M.S. from North Carolina State and a Ph.D. from Purdue, both in industrial engineering.

Dr. John A. Nairn, Assistant Professor of Materials Science and Engineering, joins the College faculty after five years as a staff scientist at duPont's experimental station in Wilmington, Del. He received his B.A. in chemistry from Dartmouth and a Ph.D. in that subject from the U. of California at Berkeley.

Dr. Neil E. Cotter, Assistant Professor of Bioengineering and Electrical Engineering, received his Ph.D. in electrical engineering in June, 1986, from Stanford. He had previously received M.S. degrees in that subject and in mathematics from Stanford, and a B.S. in electrical engineering from the California Institute of Technology.

...LATE NEWS...

TITLE VII-B FEDERAL GRANT FUNDED

Dr. Gerity announced that a Title VII-B Department of Education grant was just funded. Including matching funds, this grant will infuse nearly \$550,000 to the college. Dr.'s Gerity, Heritage and Huber jointly developed this grant proposal which will form "phase I" of the college's Microengineering initiative. It will provide for environmental safety compliance, technical support and equipment upgrade in the college's HEDCO facility.

HERITAGE con't

the College of Engineering has already paid dividends in the form of success. Shortly after Marc's arrival on campus, he teamed up with Assistant Dean Pete Gerity and they jointly developed a proposal to the Federal government to fund phase-one of an integrated micro-engineering program. This proposal was approved and will bring nearly \$500,000 into the College of Engineering for the development of the program.

It would appear that Marc has very successfully changed gears to readapt quickly to the academic environment and to introduce the team approach here which is so effectively utilized at IBM.

ADMINISTRATIVE CHANGES

GEHMLICH, BRYNER, DeVRIES APPOINTED
ASSOCIATE DEANS; GERITY NAMED
ASSISTANT DEAN; STEPHENSON LAUDED

Several administrative appointments in the College of Engineering have been announced by Dean Joseph D. Andrade, effective July 1, 1986.

Dr. Robert E. Stephenson, who has been Associate Dean for both Academic Affairs and for Facilities and Resources, resigned his administrative duties in order to return to full-time teaching as Professor of Electrical Engineering. Dr. Dietrich K. Gehmlich, Professor of Electrical Engineering, becomes Associate Dean for Academic Affairs. Clifford G. Bryner, Civil Engineering, becomes Associate Dean for Facilities. Dr. Kenneth L. (Larry) DeVries, Professor of Mechanical and Industrial Engineering, continues as Associate Dean for Research. Dr. Peter F. Gerity, formerly director of Development at Westminster College in Salt Lake City, becomes Assistant Dean for External and Community Relations.

Dean Andrade expressed congratulations to the new appointees and thanks for their past and future service to the College. Regarding Dr. Stephenson, he said: "We are all deeply grateful to Bob Stephenson for the extremely hard and effective work he has performed over 15 years as Associate Dean under Deans Max Williams, Wayne Brown, Larry Lattman and me. He has been very responsible and highly motivated and dedicated in managing a myriad of remodeling and building projects, while at the same time performing his academic duties in an outstanding manner. In this, his 40th anniversary year on the Utah campus, we all thank him and salute him."

Dr. Stephenson received his Ph.D. in Electrical Engineering from Purdue University in 1952. His recent research interests have included computer simulation and power systems analysis. Among his publications is a college-level text-book he co-authored with L.D. Harris, entitled Power System Analysis, which was translated and published in Indonesian in 1962.



Dr. Gehmlich has been a member of the College of Engineering faculty since 1952, and received his Ph.D. degree in Electrical Engineering here in 1956. His current areas of research are automatic control systems and medical instrumentation. He has been author and coauthor of six books in electrical engineering and electromechanical systems.



Professor Bryner has been on the University of Utah faculty since 1950 and received his M.S. degree in Civil Engineering here in 1957. His research areas have included measurements of the earth's crust, and photogrammetry and remote sensing in solving problems. He has been the author of numerous publications in these fields.



Dr. DeVries received his Ph.D. in Mechanical Engineering from the University of Utah in 1962 and has been on the College faculty since 1966. His research interests have covered: mechanical properties of polymers; adhesive analysis and testing; failure of materials; and materials usage in design. He has received University awards for distinguished research and teaching.



Dr. Gerity obtained a Ph.D. degree in Histochemistry in 1970 at Virginia Polytechnic Institute and has held academic and administrative appointments in the Schools of Medicine of Indiana University and the University of Utah. He also served in faculty and administrative posts at Purdue University. He has been president of AMS Inc., a technology transfer and market development company serving 63 countries.



UNIVERSITY NAMES TECHNOLOGY TRANSFER DIRECTOR

UTAH SPIN-OFF COMPANIES

According to the National Science Foundation, the University of Utah ranks 3rd nationally (behind MIT and CalTech) in creating small spin-off companies. Companies founded upon university technology are shown below. Through licensing procedures the U. holds equity in 22 of the 32 companies listed.

Adaptive Digital Systems
Anesta Corp.
Animate Systems, Inc.
Antim Group
Biomaterials International, Inc.
Bunnell, Inc.
Cardiac Systems, Inc.
Ceramatic, Inc.
Computer Geometry Systems, Inc.
Contexture, Inc.
Datascope
D C Software, Inc.
DMS systems, Inc.
Darbick Instructional Software Systems, Inc.
Deseret Medical, Inc.
Deseret Research, Inc.
Dimensional Technologies, Inc.
EDL Corp.
Evans and Sutherland
Excalibur Electronics
Fields Financial Corp.
Lee Scientific
Life Extenders Corp.
Metals Manufacturing Co.
Microfield Devices, Inc.
Motion Control, Inc.
Research Industries Corp.
Sarcos Group, Inc.
Soundstream Inc.
Southern Cross Ventures, Inc.
State-of-the-Art Co.
Symbion, Inc.
Techniscan, Inc.
Therapeutic Technologies
Vascular International, Inc.
WAK-Utah, Inc.
Zinetics Medical Technology Corp.



Dr. Norman Brown was appointed Director of Technology Transfer of the University of Utah in April, 1986. In this position, Dr. Brown will supervise the patenting and licensing of technological innovations arising under research at the University or by University employees.

Dr. Brown brings to Utah an impressive background in both the academic and industrial worlds. A Phi Beta Kappa graduate of Washington State University in 1969, he subsequently received a master's degree in international relations and a doctorate of business administration from George Washington University and a doctorate of law from Georgetown University. After holding planning and marketing positions with General Mills and Bethlehem Steel, he served as marketing director of Cutter Laboratories from 1976 to 1980, and as an international manager of Bayer A.G. in West Germany from 1980 to 1982. He was then board chairman of Innovation Dynamics Corporation in Oakland, CA, until 1983 when he joined the University of California's patent office in Berkeley as Licensing Officer.

Dr. Brown's experience has thus covered corporate marketing and planning, technology development and licensing, and start-up operations. At Utah, Dr. Brown is responsible for technology transfer of more than 1,000 inventions produced on the campus. He points out that, like private

corporations, the University claims title to inventions, discoveries and improvements originated by its employees. Unlike corporations, however, the University shares the economic benefits of the inventions with the individual inventor. Most companies require assignment of employee inventions without such sharing.

Dr. Brown explains that at Utah the inventor (or group of inventors) receives a fixed percentage of the net income received by the University. Net income is defined as gross income from royalties or fees, less the patenting and other direct costs incurred by the University in commercializing the invention. The percentages of net income are: 40% of the first \$20,000; 35% of the second \$20,000; and 30% of all net income over \$40,000.

The inventor's right to this royalty income is automatically and fully vested at the time the invention is officially disclosed to the Technology Transfer Office. This right will continue to exist as long as the University receives net income from the invention. The inventor may still receive payments after he or she has left the Department or the University. After the inventor's death, payments can be made to his or her heirs.

Besides providing economic benefits to inventors, the University policy shares net income from inventions with the Departments or Colleges where the inventions arise. However, Dr. Brown points out, the decision to allot such shares is made annually, because economic conditions in any given year may limit available funds. Such decisions are made each fall by the board of the University of Utah Research Foundation. To the extent possible, 15% of net income is distributed to Departments and 10% to Colleges.

RESEARCH FUNDING

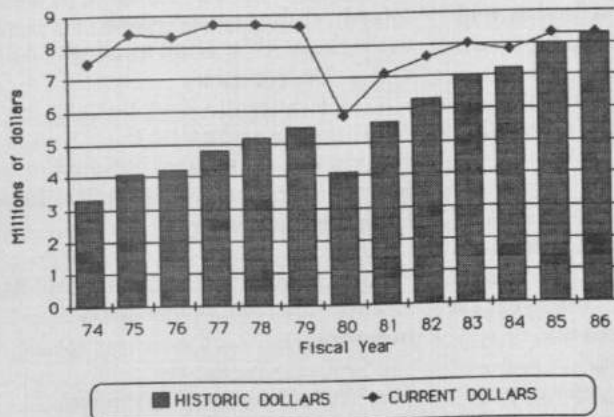
FEDERAL AND PRIVATE FUNDING OF COLLEGE'S RESEARCH REMAINS HIGH

By Dr. Kenneth L. DeVries
Associate Dean for Research
College of Engineering, University of Utah

Research awards totaling \$8,274,235 were made by Federal agencies, private companies and the state to the various Departments of the College of Engineering in the 1985-86 academic year. This continued the high level of such largely out-of-state financial support which the College has received for more than a decade. In fact, as the accompanying bar chart indicates, the annual totals have increased steadily in all but one year since 1974. Even when adjusted for inflation (which the "current dollars" line reports) the total of research contracts and grants has held up very well.

COLLEGE OF ENGINEERING RESEARCH FUNDING

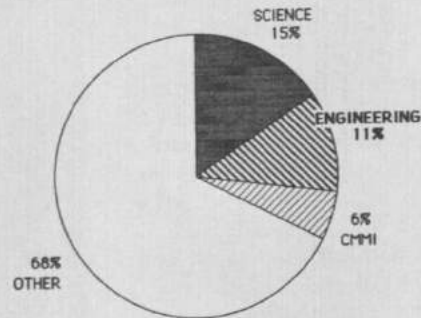
For fiscal years ended June 30, 1974 - 86



Other sources of research funding over the 1982-86 period were: Air Force, 12.9%; Public Health Service, 10.3%; Navy, 9.3%; D.A.R.P.A., 8.6%; miscellaneous Federal and State, 6.6%; Army, 5.5%; Dept. of Energy, 5.4%; Environmental Protection Agency, 3.7%; NASA, 1.1%; other private, 0.4%; and Dept. of Transportation, 0.4%.

Most of our research contracts and grants were generated through the efforts of our highly-motivated and very competent faculty. In the 1985-86 year, they submitted a total of 187 research proposals for funding, as compared with 145 proposals the previous year.

TOTAL RESEARCH FUNDING AWARDED TO THE U. of U.
For fiscal years ended June 30, 1982-86



5 YR. TOTAL
\$ 315.2 Million

Besides the impetus which such awards give to the advancement of engineering sciences, they have the additional benefit of providing support for the College's graduate students. The College thus was able to grant 100 graduate degrees in the last academic year --- 81 master's and 19 Ph.D.'s. Directly or indirectly, the research grants are assisting the education of some 500 students pursuing graduate degree programs.

Over the past five years, the largest single source of this funding has been the National Science Foundation, which accounted for 19 percent of the funds received. Business and industry supplied nearly 17 percent of funding during the period, or about twice the national average for such support of research. We hope that this cooperation between private companies and the College will continue to expand, especially through such mechanisms as the Centers of Excellence which accelerate the process of technology transfer very effectively.

N.S.F.	\$7,010,863	19.0%
BUSINESS/INDUSTRY	\$6,237,666	16.9%
AIR FORCE	\$4,769,592	12.9%
P.H.S.	\$3,816,522	10.3%
NAVY	\$3,442,704	9.3%
D.A.R.P.A.	\$3,169,800	8.6%
MISC. FED./STATE	\$2,444,588	6.6%
ARMY	\$2,016,544	5.5%
D.O.E.	\$1,999,007	5.4%
E.P.A.	\$1,361,047	3.7%
N.A.S.A.	\$395,337	1.1%
PRIVATE-OTHER	\$157,660	0.4%
D.O.T.	\$147,384	0.4%

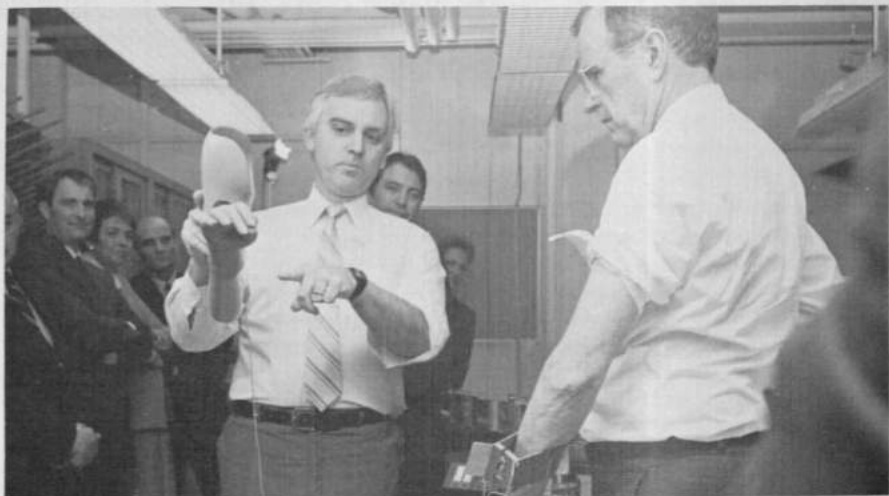
CENTERS OF

by
Dr. Lynn H. Blake, State Director
Centers of Excellence Program

Economic development is based upon new technologies and new technologies are developed through the process of innovation. This process begins with research and extends in a continuous spectrum of development, test and evaluation, demonstration, and finally, commercialization. Research and development, therefore, becomes the engine for strengthening the State's existing industrial base, the creation of new firms, and the attraction of expanding or relocating companies.

In Utah, our strategies for economic development are built upon these principles. These strategies are working. They are working because the colleges and universities within the State are leading centers for research and development. They are working because the innovation process has greatly strengthened the State's existing industrial base and fostered the creation of new firms. There has now been a new commitment from state government to enhance this process.

The colleges and universities within the State have been recognized as leading centers for research and development. They have played a significant role in economic development for many years by training technical workers and expanding the base of scientific knowledge. By transferring this talent and knowledge to the private sector, they have contributed to the diffusion of innovation and the creation of new firms and industries both within and without the state.



The growing economic importance of technological innovation has created new opportunities for cooperation between universities and industries. Recent studies indicate that strong leadership and stable, long-term funding for colleges and universities can significantly enhance technological innovation and regional economic development.

One example of this new commitment from the State has been the creation of the Centers of Excellence Program. This program teams the best resources of education, business, and government, into a partnership focused on the commercialization of the products of research.

The program was modeled after the National Science Foundation's (NSF) well-established, successful University-Industry Cooperative Research Centers Program. The Utah Centers of Excellence Program provides matching funds for interdisciplinary research and development programs which are supported by industry and based at Utah universities.

The goals of this new program are to:

- Accelerate the growth of targeted technologies by catalyzing interdisciplinary research activities within Utah's colleges and Universities;
- Stimulate and assist the translation of research product from University laboratories into Utah's economy; and
- Enhance the image of the state as a center for technology-based industry.

The Utah Centers of Excellence Program was created by the Legislature and initially funded with \$2.5 million. The program will:

- Identify and build upon research strengths of Utah's colleges and Universities;
- Establish centers where research excellence can attract industrial support and technology transfer;
- Facilitate cooperative associations among centers within

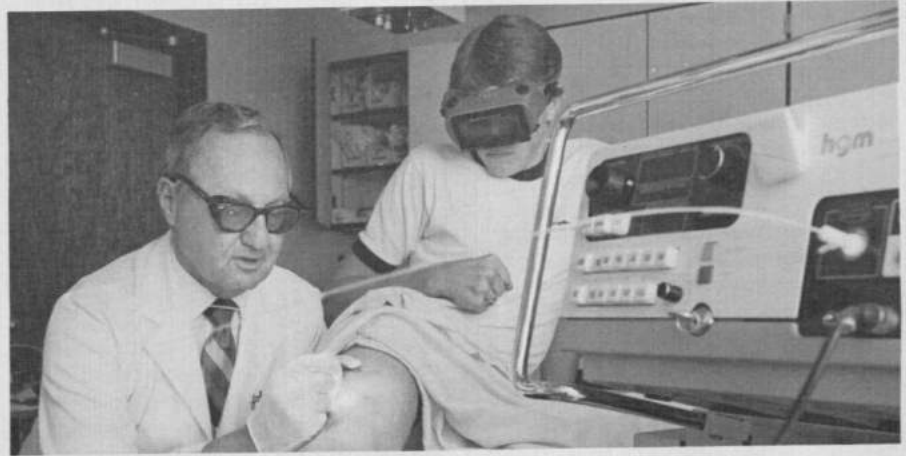
EXCELLENCE

targeted technologies; and

- Provide national visibility to Utah's focus on research and economic development.

The program has targeted seven areas of technology where current research and development can have a major economic impact upon the state. Thirteen centers, each focused on one of these seven targeted areas, received support from the program the first year. Nine other programs are being developed as potential centers. The seven main areas of focus are:

- **Space Engineering and Applications:** These centers are focused on space engineering research and aerospace technology. These centers have led the nation in academic research and development in space.
- **Biomedical Technologies:** These centers have an international reputation for their research on total artificial hearts and biomedical devices, biopolymers at interfaces, medical application of lasers, and sensor technology.
- **Manufacturing Technologies:** These centers are concentrating on computer-aided design and manufacturing. Indicative of Utah's prominence in this area, IBM recently selected these programs for two of 25 grants given nationally.
- **Natural Resources:** These centers have as their primary focus the optimal use of our State's natural resources. These include fossil fuel technologies and water. The Center for Advanced Combustion Engineering was selected by NSF from 106 applicants as a new NSF Center.



- **Communications and Information Technologies:** These centers are concentrating on signal processing systems, microelectronics, and communications research.
- **Engineering Technologies:** These centers have sponsored projects in many areas, which include artificial limbs, chemical and physiological monitors, robotics, and micro-electromechanical devices.
- **Biotechnology:** These centers include the production and transport of molecules. This area has been identified as an area for future growth and development with human, animal, and agricultural applications.

The response to this new program has been overwhelming. Prior to the initiation of the COEP, these research centers had already developed associations with a combine total of 67 private companies. As a result of this new program, an additional 46 companies have committed funding for new or expanded research at the centers. The COEP required at least a 2-to-1 match of all State support.

Instead of the \$5 million match required, the private support was more than \$16 million, or a factor of 6.6. Therefore, the \$2.5 million investment created \$18.5 million for research and development. Using the multiplier of 2.5 for research and development activities, the first round of support for the centers will produce more than \$46 million in direct and indirect benefits to the Utah economy.

While the short-term values of stimulating research and the economy directly are important, it is also anticipated that the research and development at these centers will strengthen existing companies and generate many new private companies. Over 35 spin-off companies have already been formed in Utah to commercialize the results of these research programs.

Now is the time to strengthen the research engine within the State and now is also the time to utilize more effectively the product of this research for further economic development within the State. The Centers of Excellence Program is committed to complement these efforts.

RESEARCH CENTERS

Governor Norman H. Bangerter of Utah in March, 1986, announced that Centers of Excellence at the University of Utah's College of Engineering would be among 13 such groups in the state to receive a total of \$2.5 million under the state's economic development initiative. The 13 research programs will be required to obtain at least \$4.7 million in matching funds from industry and federal agencies in order to qualify for the state monies.

The Governor announced that planning grants were also being awarded to nine additional research proposals, in order to prepare for a possible second round of financing.

The University's Centers that were awarded matching grants by the state are:

Center for Engineering Design, Director: Dr. Stephen C. Jacobsen --Founded in 1974, this Center involves faculty and students from the Colleges of Engineering, Medicine, Science, and Business, as well as associates and personnel from government, industry and other universities. Principal focus is the design process -- converting ideas into successful products. Current R & D activities include 48 sponsored projects in 7 principal areas: artificial limbs, drug delivery, physiological monitors, artificial kidneys, robotics, and micro-electromechanical devices. Eight commercial products developed at the Center are on the market, and six others will soon be introduced. The Utah Artificial Arm has become a widely used prosthetic device, and the Utah - MIT Hand is being developed as a robotic device. Two spinoff companies already exist and two others are being formed. Current operating budget is \$1.8 million per year. State funds will be used to expand capabilities (hire additional staff to administer projects and pursue additional research grants) and to relocate the Center (and its spinoffs) to the University Research Park.

Center for Biopolymers at Interfaces, Director: Dr. Karin Caldwell -- A joint activity of the Colleges of Science, Engineering, Pharmacy, and School of Medicine. The Center investigates problems and develops technologies relating to the adsorption or binding of



proteins and other biomolecules onto various surfaces. Two local spinoff companies have already been created in this field. Several proposed projects have major commercial significance, including protein-proof coatings for blood bags and medical devices; control of blood clotting, cell deposits, and inflammation related to use of devices like artificial kidney machines; diagnostic sensors and detectors; artificial red cells and blood; and several diagnostic, filtration, and catalytic techniques based on surface adsorption. Within 12 to 18 months, this research could produce transferable technology that would benefit industries including medical devices, biomedical diagnostics, pharmaceuticals, cosmetics, dairy, and food processing. State funds will be used to support graduate students, purchase research supplies and equipment, and recruit additional industrial sponsors.

Center for Sensor Technology, Director: Dr. Jiri Janata --The Center consolidates existing research activities in the Colleges of Engineering and Science and the School of Medicine. Research includes some 18 sensor-related projects with out-of-state funding of almost \$1.5 million a year. The Center provides a common information base, graduate and intensive courses in sensor research and development, colloquia, and a seed-money fund for speculative, high-risk projects. Industry participates through proprietary research contracts with individual faculty members and through sponsorship as full industrial

members. One of the Center's goals is to attract sensor research laboratories to locate in University Research Park and other areas of Salt Lake City.

Center for Microelectronics, Director: Dr. Robert J. Huber -- The Center is expanding at the HEDCO Microelectronics Laboratory, established in 1977. It has four objectives: developing new materials for semiconductors (compounds like gallium arsenide (GaAs) that increase speed and accuracy); processing these materials into integrated circuits and devices (techniques for producing GaAs and fabricating injection lasers, optical detectors, and ultra-high-speed transistors); developing new design tools (computer modeling and computer aided design techniques for VLSI circuits and computer graphics systems); and transferring this leading-edge technology to new and existing Utah companies for commercial exploitation. The lab has attracted 20 research projects and over \$1 million in annual funding during its first 4 years of operation.

Center for Communications Research, Directors: Dr. Craig Rushforth and Dr. Gerald Stringfellow --The Center conducts basic and applied research related to design and evaluation of communications systems, including computer networking, data compression, signal processing, and VLSI applications. It is a joint effort of U/U Electrical Engineering and Computer Science Departments with Sperry's Corporate Technology Center for Communications (CTC). Principal investigator is consultant to CTC and supervises four Ph.D. students supported by \$60,000/yr CTC grant. Sperry is preparing to increase CTC budget and staff and to expand University support enough to support two additional faculty members and ten graduate students. State funds will be used to acquire additional computer equipment needed to support proposed research.

Combustion Engineering Center, Director: Dr. George R. Hill -- Two major areas of research are underway: (a) Advanced Fossil Fuel Technology -- This coal research program, launched in 1952, attracted over \$18 million in

GAIN STATE SUPPORT

Federal and industry research funding between 1978 and 1985. It has special expertise in differential liquefaction and chemical characterization of solid and liquid fossil fuels. Current research focuses on six major areas: structure and reactivity of coal, oil shale, and tar sands; separation, beneficiation, and characterization techniques; mechanistic, kinetic, and modeling studies of conversion processes; separation, upgrading, and stability of synfuels; innovative procedures for characterization and analysis; and



environmental and health effects of fossil fuel technologies. State support is being used to upgrade instrumentation (replace obsolete equipment and complete the unique computerized spectroscopy network) and to provide first-year salary for business manager in charge of industrial liaison. (b) Coal Preparation --This program seeks to promote Utah's coal industry by stimulating research and development on the cleaning of Utah coals. It provides a focus for existing research and promote new activities in three areas: innovative techniques for characterizing and processing coal; production of "super-clean coal" (special low-sulfur, low ash product to be mixed with water to replace heating oil in utility boilers); and development of pipeline transport of Utah coal (reducing transport costs, thereby increasing competitiveness in remote markets). The Center provides seed money for research projects, selected by competitive proposals. It also provides access to equipment and facilities; coordinates research activities; and promotes publications and seminars. Current Federal and industrial support for related research is about \$200,000/yr.

Center for Non-Intrusive and Diagnostic

Imaging, Director: Dr. Steven A. Johnson-- The Center is devoted to stimulating the growth of an advanced imaging industry and infra structure in the State of Utah. Its focus will be the emerging medical, geoexploration, robotics and aerospace technologies which are becoming more dependent upon advanced imaging techniques. The Center provides consultation to existing aerospace firms on improved quality control and competitive bidding for contracts. It aids in establishing new industries in the fields of medical diagnosis, non-destructive testing and geophysical exploration. The Center draws upon the unique talents of a core of investigators and the specialties which they have developed during their research careers. Expertise in the areas of x-ray, ultrasound, NMR, medical imaging, seismic imaging, flow measurement, non-destructive testing, mathematical modeling of imaging processes and computer science comprise the center currently.

Center for Controlled Chemical Delivery,

Director: Dr. Sung Wan Kim--The Center Pursues research and development of controlled chemical delivery techniques for the pharmaceutical, medical device, biotechnology, and chemical process industries. Products already patented and commercialized include the nitroglycerine patch (one-a-day patch for cardiac patients that delivers the drug through the skin). Current projects include biodegradable narcotic antagonists (subcutaneous injection lasting 3 to 6 months to combat morphine addiction); remineralization of dental enamel (fluoride delivery system to combat dental caries); transdermal systems (movement of drugs through skin and effect of skin metabolism on drug bioavailability); prodrugs (drug derivatives that are activated by enzymes in skin during transit); cholesterol dissolution (improved agents for dissolving gallstones); and remote fiber optics biosensors. Future developments may include gastrointestinal delivery, self-regulating insulin delivery, and antitumor drug delivery systems. Three local firms are already developing commercial products based on this research, and one or more may establish manufacturing facilities in Utah within

5 years.

Center for Total Artificial Hearts and Biomedical Devices, Director: Dr.

Donald B. Olsen -- The Center supports and expands existing activities in the design, fabrication, implantation, and monitoring of artificial organs. U/U's leadership in this technology is exemplified by the JARVIK -7 pneumatic system, and it has created a number of spinoff companies and licensing agreements to develop and market products such as dialysis equipment, artificial ear and urinary tract, and cardiac assist system. Other projects include the artificial fallopian tube, urinary bladder, urethra, ureter, and sphincter. State funding will support salaries, supplies and equipment to expand and enhance research capabilities in four areas: fully implantable artificial hearts (two systems, electrohydraulic and magnetically suspended rotor, are under parallel development); Good Laboratory Practice Implementation (the highest level of experimental techniques and standards, intended to meet FDA regulations and enable the Center to attract additional R & D contracts); neurohormonal control (blood chemistry interactions with implants); and instrumentation (design and fabrication of computerized equipment to monitor, gather, analyze, and diagnose data on experimental animals). Industry support represents a 4 to 1 match for State funds.

The Centers of Excellence Program was created by the Utah State Legislature in the spring of 1985 to provide matching grants for the creation and support of university-based, industry-supported research and development centers. Funding was passed as part of an economic development appropriation in July, 1985. Nine colleges and universities submitted a total of 36 proposals, requesting a total of more than \$10 million. The proposals were evaluated by a panel of out-of-state reviewers based on their economic development potential, as well as their scientific merit. The Centers were also judged on the basis of the industrial support they could obtain. They are expected to become self-supporting within three to five years.

UTAH MUST GRADUATE MORE ENGINEERS

by
*Clair F. Coleman, Retired President and
Chief Executive Officer of Mountain Fuel
Resources, Inc.; Chairman, Industrial
Advisory Board, College of Engineering*

Utah's current economic problems have been partly caused by external factors over which the state has little control. The declines in agriculture and mining have resulted from world-scale trends which Utah can do little to change. In the manufacturing sector, however, Utah can take actions to improve its position both nationally and internationally. The most cost-effective step, in my view, would be to expand the state's capacity to educate engineers and to stimulate the creation of new technologies.

The University of Utah's College of Engineering currently graduates some 400 engineers a year. An additional 300 are graduated by the state's two other engineering schools at Brigham Young University and Utah State University. In recent years, approximately 70 percent of these graduates took jobs within the state while 30 percent went to work in other parts of the country. This is a vast improvement over the situation of 10 years ago, when the percentages were almost reversed. But it is still not good enough.

The hard fact is that too many corporate executives who consider Utah as a possible site for manufacturing operations are discouraged from selecting this state because of the lack of sufficient numbers of trained engineers. The same shortage has also deterred some of our existing plants from expanding production. Manufacturing employment has actually declined in the past year in Utah.

Yet the state possesses a valuable instrument for expanding its

industrial base--its College of Engineering. Study after study has shown that a first-class engineering school can be the creator of the technology and the producer of the skilled people that together generate economic development--new products, new plants and new jobs. The most dramatic examples have been in New England, where the Massachusetts Institute of Technology has spawned hundreds of companies, and in California, where Stanford University's engineering school has done similarly in Silicon Valley. On a smaller scale, our College of Engineering accomplished a similar result by inventing the technology that established more than 30 companies in Utah over the past 15 years. More than 8,000 jobs were created here in the process, as well as some \$20 million annually in local and state tax payments. In contrast, the state's annual appropriation for the College is only about \$6 million.

After considering all of these facts, the College's Industrial Advisory Board has recommended that plans be made to double the output of engineering graduates with bachelor's degrees from 300 to 600 by 1994. This would entail increasing the base budget of the College by approximately \$2 million a year for five years.

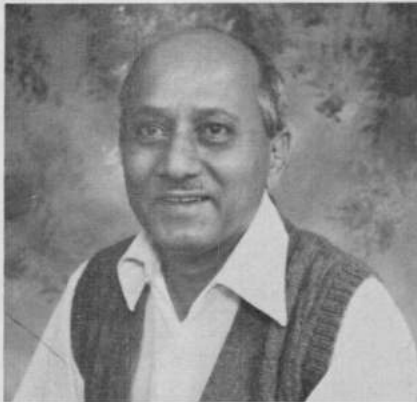
In addition, the Board studied other areas of the College's operations. It found serious underfunding in several respects. Faculty salaries are some 25 percent below those of peer institutions, as is the state appropriation on a per-student basis. Library acquisitions are funded at less

than half those of peer colleges.

The College today has a faculty of extremely high quality, attested to by the more than \$8 million in research contracts which are placed with them by Federal agencies and by corporations each year. They have the potential for creating exciting new technologies that can help the economy of Utah and of the nation. But such faculty cannot be expected to be retained indefinitely if their salary levels remain so far below the average. Therefore, the Board also proposes: --The state appropriation to the College of Engineering and allied areas be increased by at least \$4 or 5 million a year, to be spent on faculty and staff salaries, laboratory equipment, engineering-related studies (mathematics, chemistry, physics and writing), library services and materials. These sums would be in addition to the \$2 million-a-year increase in base budget for expanded enrollment. -- Plans be made for construction of a new microengineering and biotechnology laboratory building. The cost might be in the \$12 million to \$15 million range. -- An additional engineering building be constructed to accommodate the increased faculty, students and staff that program expansions would produce. This could cost \$15 million to \$20 million.

The Advisory Board believes that the College of Engineering can help move the state into economic prosperity for many generations to come. Strengthening that resource may involve difficult financial decisions, but such funding will be an effective investment in the economic future of Utah.

SCHOLARSHIP ESTABLISHED IN MEMORY OF DR. RAVINDRA VYAS



On Thursday, November 13, 1986, Professor Ravindra Vyas passed away suddenly in his Salt Lake home. The students, faculty, and staff of the Department of Civil Engineering at the University of Utah are deeply grieved at his passing. In his memory the Department along with family and friends, will be establishing a RAVINDRA K. VYAS MEMORIAL SCHOLARSHIP FUND.

Dr. Vyas came to the University of Utah in July of 1968. Since that time, he has been actively involved in teaching and research in the Department. He introduced 11 courses, and taught 27 different courses at graduate and undergraduate levels. He supervised about a dozen doctoral and master's theses, and served on 80 doctoral and master's supervisory committees. He published extensively in the areas of shells, singularities, and elastomeric seals, in the form of refereed publications and reports. He also presented papers at numerous symposia and conferences.

During the last several years, he developed a keen interest in Emergency Management, and during the summers of 1985 and 1986 he was invited by the Federal Emergency Management Agency to participate in their Summer Institute. From his experiences there, he was able to introduce valuable topics of earthquake, high wind, and flood

emergency management into his courses.

Despite his failing health in the last few years, he participated in all his responsibilities and shared his load with a smile. His love and affection towards the staff, students, and colleagues were exemplary. He was a man of high integrity and had a deep sense of compassion and commitment to his friends and colleagues. His dedication to the University was of the highest order. We have suffered a great loss at his untimely death. In his honor, the faculty voted unanimously to establish this scholarship. Those whose lives were touched by Dr. Vyas, and wish to make contributions, may contact either the Department of Civil Engineering, 3220 Merrill Engineering Building, or the University Development Office at 306 Park Building.

College of Engineering Administration

Dean
J.D. Andrade 581-6911

Assistant to the Dean
Marvel Leader 581-6911

Assoc. Dean for Academic Affairs
D.K. Gehmlich 581-6911

Assoc. Dean for Facilities
C.G. Bryner 581-8363

Associate Dean for Research
K.L. DeVries 581-7101

Assist. Dean for External
and Community Relations
Peter F. Gerity 581-8346

Bioengineering
D. Christensen
Chairman 581-7859

Chemical Engineering
A.L. Tyler
Chairman 581-6920

Civil Engineering
S. Ghosh
Chairman 581-6931

Computer Science
R. Riesenfeld
Chairman 581-7026

Electrical Engineering
T.G. Stockham
Chairman 581-8541

Materials Science and Engineering
J. DuBow
Chairman 581-8388

Mechanical and Industrial
Engineering
David W. Hoepfner
Chairman 581-3851

GUIDA MEMORIAL SCHOLARSHIP ESTABLISHED

The Julie Penrod Guida Memorial Scholarship fund has been established in the Department of Mechanical and Industrial Engineering at the request of her family.

Recipients of the scholarship must meet most of the following requirements:

- Female
- Minority
- Economically disadvantaged
- Undergraduate or Graduate student in Mechanical Engineering

Ms. Guida graduated with a B.S. in Mechanical Engineering in 1984, and was a Test Engineer at Hercules at the time of her death.

Hercules officials plan to match any contributions to this Memorial Fund made by Ms. Guida's co-workers. Contributions from family, friends and co-workers have already reached the \$1000 level. To make a contribution, contact Ms. Sylvia Morris, Administrative Manager, Department of Mechanical Engineering.

Make A Gift Before December 31

If you make a charitable contribution to the College of Engineering before midnight Dec. 31, 1986, you will enjoy considerable tax advantages under the Tax Reform Act of 1986. Please send contributions, along with designation of use to: Dean's Office, College of Engineering, 2000 Merrill Engineering Building, University of Utah, Salt Lake City, UT 84112

Reasons:

- Because top individual tax rates will drop from 50% in 1986 to 38.5% in 1987 and to 28% in 1988, you will have greater tax savings if you contribute in 1986.
- Because gifts of stock, bonds or property are likely to produce greater tax savings in 1986 than in years hereafter. This is so for taxpayers subject to alternative minimum tax. Any increase in the property's value over the donor's cost basis will -- from 1987 on -- be considered as a tax preference item; that means it will be included in his AMT income. For a donor in the top tax bracket, this could mean that a donation in 1986 will produce as much as 10 times the tax saving that it would in 1987.
- Because donors who do not itemize deductions on their tax returns gain a special incentive. Their donations for 1986 are for the first and only time treated exactly like the deductions of itemizers. After 1986, non-itemizers will be unable to take their charitable contributions as deductions.

HAPPY HOLIDAYS
from
THE STAFF AND FACULTY
of the
COLLEGE OF ENGINEERING

ENGINEERING UPDATE

Dean's Office
College of Engineering
2001 Merrill Engineering Building
University of Utah
Salt Lake City, UT 84112

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Salt Lake City, Utah

Engineering News

University of Utah College of Engineering

Vol. 4 No. 2 January 5, 1987

Message from the Dean

The faculty and staff join me in wishing all of our students a happy and productive New Year.

The current year has been a difficult one for the College--and indeed for the entire University of Utah--and the State. It has been a year of declining tax revenues and budget cuts. The 1987 Utah Legislature will convene soon to consider the Governor's budget for the 1987-88 fiscal year. Due to the declining tax revenues, the Governor has had to propose a significant increase in taxes to provide a near zero increase budget. It is critical--it is vital--that the Governor's plan be enacted in order to provide the revenues required for the University in general and for the College of Engineering in particular. I am confident that the University will provide adequate budgets for Engineering--if the University receives a reasonable budget.

An investment in higher education and especially in Engineering is the best

Continued on page 2

Fifth Straight year!

The American Institute of Chemical Engineers has presented its national Student Chapter Award of Excellence to the University of Utah Chemical Engineering Department for the fifth consecutive year.

Cliff Keeler, chapter vice president, accepted the 1985-86 award at AIChE's annual meeting in Miami Beach, Fla. Other University students who attended the ceremonies are Robert Carter, Chris

Ferguson, and Chad McCleary.

Dr. A. LaMont Tyler, professor and department chairman, says the University has won the award eight times in the past nine years. The award recognizes programs and activities that enhance the professional development of chemical engineering students.

Student chapters are judged on program quality, professionalism, and the

level of their participation in chapter, university, and community activities, says Tyler.

"The award pays tribute to the excellent and consistent program maintained by chemical engineering students at the University," says Tyler. Leslie O'Rourke and Russell Rainey served consecutively as president of the student chapter during the past academic year.

Graduating Seniors: Are You Creative?

Prove it!--and get a full three-year fellowship for graduate school. The National Science Foundation has just announced the "Creativity Awards in Graduate Engineering"...a program of awards to individuals for creative research to be done in colleges and schools of engineering as a part of the applicant's graduate study. The purpose is to make creative undergraduates more aware of research activities and so increase the number of creative persons in the engineering profession in

Continued on page 3

Early Risers: Make a Date with the Dean.

If you've been feeling like a collegiate wallflower, the Dean of the College of Engineering is offering you a chance to remedy the situation.

Starting Winter Quarter, Dean Joseph D. Andrade is inviting any interested engineering student to sign up to attend a once-a-month breakfast with the Dean (Dutch treat). The breakfast will give students a chance to get to know Dean Andrade and each other and to talk

informally about issues that concern them.

The breakfasts scheduled so far will be held on the following Wednesdays: January 28th, February 25th, and April 1st. The morning meetings will take place from 7:15 to 8:15 in the Union Cafeteria. See Marvel Leader in the Dean's office for details and to sign up.

Attendance will be restricted to 6-12 people each month so sign up early.

Message from Dean cont. investment the State can make to guarantee economic vitality and stability in the future. Please contact your legislators and urge them to support the Governor's budget. Convince your parents, employers, friends, and colleagues to do likewise. I urge you to write letters to the editors of local papers to express your views.

Documents further explaining the budget and tax situation are available in the Dean's Office. Please do your part to guarantee a secure future for the State.

Yea Randall!

We would like to congratulate Randall Mills on his second place finish in the IEEE student paper competition at WESCON this Fall. He continues a long tradition of success by U of U at this national competition.

The American Association for the Advancement of Science has announced a 1987 Mass Media Science and Engineering Fellows Program. This program expects to support 15-20 advanced students in the natural and social sciences and engineering to work for 10 weeks as reporters, researchers and production assistants in the mass media for the summer. It is the goal of this program to strengthen the relationship between science and technology and the media and to enhance coverage of science and technology issues in the media in order to improve public understanding of science and technology.

Priority will be given to graduate students in the natural and social sciences and engineering, but applications will be considered from

Attention Writers!

outstanding undergraduate and postdoctoral students. Applicants must be committed to conveying to the public a better understanding and appreciation of science and technology. Media hosts who serve as sponsors expect to benefit from the different perspectives of students with scientific and technical expertise. Therefore, the program is limited to students demonstrating proficiency in their programs of study.

Individuals whose backgrounds include some mass media experience or other activities that demonstrate such a commitment are more likely to be accepted. Minorities and persons with disabilities are especially encouraged to apply. Each chosen fellow will attend an orientation in Washington D.C. in early

June; begin the fellowship in mid June, working at a specific radio station, television station, newspaper or magazine to which the fellow has been assigned; have travel expenses paid and receive a weekly stipend of \$300.00.

To receive an application for the Mass Media Science and Engineering Fellows Program write:

Mass Media Science and Engineering
Fellows Program
AAAS 1133 H Street
Northwest
Washington, D.C. 20005

The deadline for receipt of applications is February 2nd, 1987. Candidates will receive initial notification of the status of their applications by April 15th, 1987.

F.E. Review Seminars Scheduled

As in the past, the faculty of the College of Engineering will present a series of review lectures for students taking the Fundamentals of Engineering Exam in April. The review sessions will be given every Friday during Winter Quarter from 3:10 until 5 P.M. in MEB 3140 (old number 3176).

Review topics will include

Electrical Engineering, Statics, Strength of Materials, Thermodynamics, Fluid Mechanics, Dynamics, Engineering Economics, Systems and Computer Science and Chemistry and Structure of Matter. In each session typical problems from a recent FE examination will be presented and worked, and questions will

be answered in the specific review area.

Applications for the FE exam will also be made available. The deadline for filing applications for the April 11th examination is February 11th, 1987. The fall examination is scheduled for October 31st, 1987 with the deadline for

applications being August 31st, 1987.

The review course is sponsored by the College of Engineering at no cost to students. All faculty and students who wish to take the Fundamentals of Engineering Examination are invited and encouraged to attend these review sessions.

Cooperative Education Update

National Science Foundation Creativity Awards cont.

the United States. This is a competition for undergraduates currently nearing completion of requirements for a bachelor's degree in engineering, and for recent graduates who have not previously been graduate students in engineering. Awards are conditional on the applicant being accepted into a full-time engineering graduate program in 1987. The awards are portable; successful applicants may study in a degree program at any U.S. university or college. That institution will receive the funds from the National Science Foundation.

"The institutions, to which the successful applicants are admitted to graduate school, will receive grants of up to \$30,000 per year. From these grants the applicants will receive an award in the form of a stipend (normally \$11,000 per year) plus tuition and fees. Funds are also

available for research costs". (Further details may be obtained in the Dean's Office.)

"Applications will be received from prospective graduate students in engineering, whether they are currently undergraduates or are recently graduated, based on the creativity and originality of the ideas proposed. The program is not open to students who are or have been enrolled in graduate study in engineering. Further, the program is open only to U.S. citizens and applicants who are permanent residents on February 1, 1987.

Applicants who have already graduated may apply only if the degree was received within three years of the closing date of the program."

Contact your department office or the Dean's Office for more information. Go for it!

The College of Engineering is pleased to announce that the Placement and Career Information Center has been awarded a federal grant to develop a Cooperative Education program at the University of Utah. The College of Engineering is one of four Colleges on campus in which programs will be developed this year. Other Colleges in the program include Business, Health, and Mining and Mineral Resources. Dr. Dietrich Gehmlich will be the Engineering Faculty Advisor for Coop Education. An Engineering College Coordinator is also being chosen. Karen Landward, the Associate Director of the Placement Center, is the overall program director. Watch the bulletin boards and future issues of this newsletter for information about orientation seminars and getting started on your way to a Co-op job.

Cooperative Education is a unique program designed to integrate students' college studies with professional work experience in business, industry, or government agencies. Students participating in Co-op Education alternate periods of

academic study with periods of full-time paid employment. While in school, students carry regular course schedules; while on Co-op assignment, they work with professionals in their field who supervise their training and work.

Co-op positions will become increasingly more available throughout the coming year. Examples of companies who hire Co-op students include: IBM, Jet Propulsion Laboratory, Naval Undersea Warfare Engineering Station, Kimberly Clark, and the CIA.

Information on Co-op in general and on specific Co-op positions is available in the Student Employment Office of the Placement and Career Information Center, Room 382 SSB. If you have questions talk to Karen Landward in that office or call her at 581-6186.

**Co-op Education:
Earn a future
while you earn a
degree!**

----- Rural Utahns--We need your Help! -----

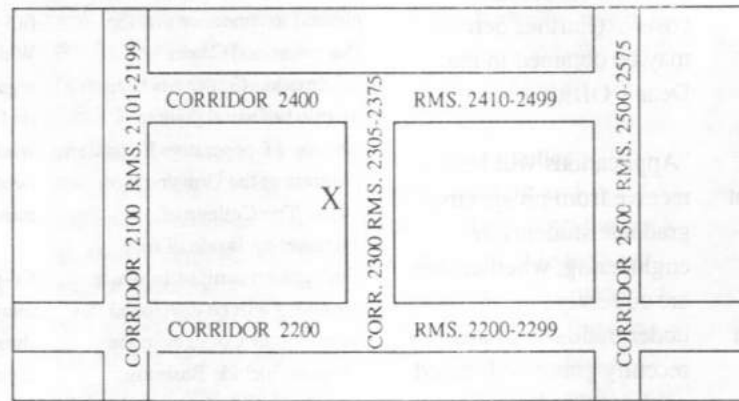
Some influential people in the State still feel that the University of Utah is not relevant to citizens residing outside of the Salt Lake Valley. The University of Utah and the College of Engineering serve the

entire State. We would like to get information about our successful, productive students (and their faculty) to newspapers and groups throughout the State. If you are elected or

appointed to an interesting position--if you win an award or prize--if you have some significant technical accomplishment--let the Dean's Office know. We'd like to arrange a brief press release for your

hometown (and maybe even your high school) paper. It not only makes you and your family feel good, but helps out the College and University as well. So--don't be shy!

Merrill Engineering Building Room Numbering System



SECOND FLOOR (TYPICAL LAYOUT)

The new (brass) room numbers have been installed and are to be utilized at the beginning of Winter Quarter 1987.

CONCEPT

The corridors numbering pattern provides an address system similar to the Salt Lake City Street System which has avenues running East and West, and Streets running North and South. In MEB the East-West corridors are even numbered; example 2200 and 2400; while the North-South corridors are odd numbered; example 2100, 2300, 2500.

EXAMPLE

For a typical room number such as 2350 (see X on drawing)

2 The first digit represents the floor number (1,2,3,4).

3 The second digit represents the corridor designation (23).

5 The third and fourth digits represent the room designation and in this case 50 is midway along the corridor, thus providing an approximate location for the room.

ROOM DIRECTORIES

Wall mounted drawings showing room numbers will be placed at the corridor intersections throughout the building.

Get Ready for Engineering Week!

Engineering Week is coming up: February 22nd thru 28th. Get involved in one of the contests.

Great Egg Drop
Paper Airplane
Pinewood Derby
Precision Car
Concrete Frisby
Truss Bridge
Computer Programming
Rubber Band Car
Poor Engineer (Fashion)

Prizes, some worth hundreds of dollars, will be awarded for the winners of each contest. Contest rules are available in the Society Room (Rm 3230).

Watch the bulletin boards for more information about the prizes to be awarded and the date and time of each contest.

For more information, contact Stuart Harris @ 322-4195, or bug the Dean's Office.

---- News Briefs ----

SPECTRUM, the IEEE magazine, is sponsoring summer internships for undergraduate IEEE members interested in writing. Contact Robert Rainey @486-1486/266-3535 for details.

This newsletter is looking for two reporters and an editor. If you are interested in the NSF or Spectrum internships, working on this publication would give you some experience to draw on. Leave a note in the Dean's Office if you are interested.

ENGINEERING NEWS

UNIVERSITY OF UTAH COLLEGE OF ENGINEERING

VOL. 5 NO. 1 September, 1987

MESSAGE FROM THE "NEW" DEAN



DEAN DAVID W. PERSHING

It is my pleasure to welcome you to the College of Engineering for the Autumn, 1987 term. We are proud to have you as part of the college and we are committed to offering you the best education we can. We look forward to renewed interactions with those of you who are returning to continue your engineering studies and particularly welcome those of you who are here for the first time. We recognize that a large university campus can sometimes be a cold and unfriendly place, but we hope that you will come to feel that the college is your home and that the faculty and staff sincerely care about your well-being.

As the new Dean of Engineering, effective October 1, 1987, I would like to assure you of my commitment to excellence in undergraduate and graduate education. In addition to being nationally recognized for its research activities in a wide variety of fields, the College of Engineering has a long tradition of commitment to teaching and students which I intend to actively support.

I would like to strongly encourage you to become involved with the faculty in activities outside the classroom, because in a true university environment there exist excellent educational opportunities beyond the formal course work. Because of our strong research programs, many of you can have the opportunity of becoming involved with exciting pioneering work long before it reaches the textbook stage. During the year the college hosts a large number of specialty seminars, visiting professors, visiting scholars and other activities which you can use to enrich your engineering education. Take advantage of them! Do not be afraid to sit in on a seminar where the subject interests you. You will always gain some insight and perspective and you may be exposed to some new ideas which could lead to a change in career or direction. Do not be afraid to talk to the faculty individually. Most of us are here because we enjoy interacting with students directly. The students are the core of the university experience, and for most of the faculty they are the best part.

The Dean's office and the departments are sincerely interested in your input. We are working closely with the undergraduate and graduate SAC's and the ASOCE (Associated Students Organizations of the College of Engineering) to insure that student needs are properly voiced and represented. Dr. Dietrich Gehmlich, Associate Dean for Academic Affairs and I will be meeting regularly with the leaders of these organizations to discuss policy issues that have a major impact on student life and to listen to student concerns.

Do not hesitate to ask advisors, chairmen, professors, instructors, and deans for help when you need it. They will take the time to answer your questions.

BEST WISHES FOR A SUCCESSFUL AND REWARDING ACADEMIC YEAR!

David W. Pershing

A MESSAGE FROM THE "OLD" DEAN

Dean Joseph D. Andrade

Welcome to the 1987-88 academic year! You will surely experience many intellectual adventures this year as a result of your courses in the college and elsewhere in the University. Many of your classes will be in new rooms and surroundings. The Engineering Classroom Building is now a reality, providing excellent lecture and computer lab facilities. It is a testimonial to the State's continuing commitment and emphasis to engineering. Major remodeling projects will soon (again!) be underway in the Merrill Engineering Building. We have continued to hold enrollment at manageable levels in order to continue to provide you with an outstanding, hands-on engineering education. Our research volume is up, providing enhanced opportunities for undergraduate, as well as graduate, research experience and opportunities.

I leave the Dean's Office on September 30 to return to full time duties as Professor of Bioengineering and of Materials Science and Engineering. These past four years as Dean have been challenging, exciting, and personally very rewarding. I have particularly enjoyed the opportunities to work with student leaders and student organizations.

I urge you to be involved in the various student organizations, particularly professional engineering society student chapters. I urge you to work closely with other students, your faculty, and the Dean's Office in activities relating to enhanced support for engineering and recognition of its vital role in the future of the State and region. Please find and take the time to be involved--to be active in these important societal and professional issues.

You are preparing for a most challenging, rewarding, and important profession. You are becoming educated to look at problems and issues as a whole, and to solve these problems. Engineering is the problem-solving profession. Society needs more well-educated engineers to tackle --and solve-- the increasingly complex array of problems. Your education here provides excellent preparation for those challenges. Please take advantage of the educational opportunities before you. I know you will. In the words of Chuck Mangione and the theme of the 1980 Winter Olympics -- "Give it all you've got!"

Good Luck!

For a while

JOIN AN ENGINEERING SOCIETY !

Society	President	Phone
Am. Instit. of Chem. Engineers	R. Deversaux	292-4679
Chi Epsilon (Civ. Honorary)	David Marosok	292-3412
Am. Soc. of Civil Engineers	Davud Cline	359-7846
Eta Kappa Nu (Elect. Honorary)	Ramin Baseri	unavailable
Inst. of Elect. & Electronic Eng.	David Foote	968-3078
Am. Soc. of Mech. Engineers	Kirk Marshall	466-8752
Am. Inst. of Indust. Engineers	Don Tropp	965-9082
Alpha Pi Mu (Indus. Honorary)	Cindy Huang	364-2408
Am. Nuclear Society	Melinda Tolle	943-5447
Am. Inst. of Aeronautics	John Crepeau	595-1741
Am. Soc. of Heating, Refrig., and Air Conditioning Eng.	Karl Williams	278-5409
Pi Tau Sigma	Michelle Matsuda	unavailable
Minority Engineering Students	Alfonso Rico	571-5929
Society of Women Engineers	Cynthia Sheya	484-6936
National Soc. of Profess. Engrs.	John Burns	583-2297
Tau Beta Pi	Jenny Troutman	272-9103
Association for Computing Mach.	Eric Ivancich	942-6970
Assoc. Student Organizations of the College of Engineering	Odean Bowler	583-1215

ASME ACTIVITIES

The Student Chapter of the American Society of Mechanical Engineers has an interesting schedule of events planned for the coming year. The Chapter is once again selling a review book for the FE Exam (Fundamentals of Engineering). These books were popular with students preparing for the FE Exam last year. The major design contest for the year is a mouse-trap-powered helicopter. That should prove to be a challenging problem with some innovative solutions. Chapter meetings will be held twice each quarter in lieu of seminars. At these meetings everyone will have a chance to get acquainted, participate in mini design contests and learn more about special events planned by ASME. The first meeting is scheduled for Tuesday, October 20, at 11:00 a.m.

For more information about ASME or any of these activities see Kirk Marshall, the chapter President, or Dr. Hansen (MEB 3106), the faculty advisor.

AIAA ACTIVITIES

The student branch of the American Institute of Aeronautics and Astronautics helps familiarize the student with real world engineering. Each month, speakers from around the country come to Utah to explain their particular research topics. Occasionally we take field trips to Morton Thiokol or Hill Air Force Base. In order to promote AIAA student membership, the group is selling "Utah Engineering" T-shirts for \$8.00. Contact: John Crepeau at MEB 2140.

THE MINORITY ENGINEERING PROGRAM

The minority engineering program (MEP) is a comprehensive recruitment and retention program here at the University of Utah. The program seeks to assist members to succeed throughout the rigorous engineering (or Computer Science) curriculum, the ultimate goal of the program being the graduation of all MEP students.

The program offers participants academic support as needed through advising, study groups, tutoring and/or supplemental instruction. In addition to academic support, MEP offers information or referrals with respect to part-time, full-time or summer employment, scholarships and financial aid, career development, graduate study, etc.

MEP is comprised of persons of American Indian, Black or Hispanic Ethnic background and women, that is, those groups currently under-represented in all areas of Engineering and Computer Science as compared to their numbers in the general population of the United States.

Support for the MEP comes from various sources:

- The University of Utah
- The National Action Council for Minorities in Engineer (NACME)
- The MESA/MEP Board of Directors
- (Contributions from industry, including funds, services equipment and participation).

For more information call:

Christine Reyes, Director
Minority Engineering Program
Merrill Engineering Building, 2236
(801) 581-8954

MATH/SCIENCE NETWORK ORIENTATION

The Math/Science Network will hold an orientation for women students, faculty and staff on Thursday, October 22, Room 102, Engineering and Mines Classroom Building, from 7:00 to 9:00 p.m. There is no charge, and refreshments will be served.

The Math/Science Network, a nation wide organization originating out of Mills College in California, consists of professional women in math/science related fields. The organization is dedicated to: promoting math/science education of Utah women; helping women take full advantage of opportunities in math and science related fields; providing opportunities to form contacts with women working in math and science; providing a forum for the interchange of ideas, experiences, problem solving techniques, job opportunities and communication skills; making the Math/Science Network unnecessary by the integration and acceptance of women in all areas of the professional world.

You are cordially invited to meet members and learn about the Math/Science Network on October 22.

Jo Rieber ... 359-9855

STUDENT GUIDELINES ON CHEATING AND PLAGIARISM

Cheating and plagiarism are forbidden. A student who is caught cheating or plagiarizing will be given an E in the class. The class may be taken over and a passing grade obtained, but the E for cheating remains on the transcript forever. Depending on the severity or repetition of the offense, students may be remanded to the Student Behavior Committee for further disciplinary action. Students may also appeal failing grades given for cheating by applying to the Student Behavior Committee. Student rights, responsibilities, and obligations are detailed in the University of Utah Student Code, which every student should read.

Cheating means giving or receiving unpermitted aid on an examination. Note that the one who gives aid is punished as severely as the one who receives aid. If an instructor requires that homework be the unaided work of the individual student (which is uncommon), then giving or receiving aid on homework is also cheating.

Plagiarism means presenting other people's work as your own, in reports, papers, etc. If you copy from some book, article, report, etc. you are perfectly safe, if you enclose the entire copied material in quotes (and preferably use narrower margins), and at the end of the copied part give a clear bibliographic reference.

"Plagiarize...tr 1. To steal and use (the ideals or writings of another) as one's own. 2. To appropriate passages or ideas from (another) and use them as one's own: "I did hate to be accused of plagiarizing Bret Harte". (Mark Twain) - intr. To take and uses as one's own the writings or ideas of another (From Plagiary)" (1)
(1) The American Heritage Dictionary of the English Language, Wm. Morris, Ed, New York, Houghton Mifflin, 1973, p 1001

Make your quotes from other sources as clearly annotated as the above quote is, and no one will ever accuse you of plagiarism!

COOPERATIVE EDUCATION ARTICLE

WANTED: Bright, energetic junior or senior engineering student to work for three months at \$11.00/hr. Will be working with state-of-the-art equipment on a \$230 million design competition contract. Contract involves simulation of aircraft mechanisms in a laboratory environment. Will pay travel and relocation expenses.

This is an actual listing for a cooperative education job opportunity. Outstanding co-op jobs are available for all engineering disciplines and provide the student with invaluable work experience. If you need more information about the co-op program, want to be registered in it, receive help in resume writing, interviewing, and job development ... please contact Diane Ward at 581-6186...380 SSB.

Computer Science News

The Computer Science Department welcomes a new chairman this year. Professor Robert Johnson continues to build on a distinguished career in fields of computer science and electrical engineering. A former Vice President of Research at Burroughs and the founder of advanced electronic companies called Ovanic Display Systems and Mosaic Systems, Professor Johnson comes to the University as a leading expert in computer architecture and system design. His research interests center around user-friendly interfaces, and in particular, graphical programming as a tool for quantitative performance measures for computing systems.

We are also pleased to announce that two new Assistant Professors have joined our regular faculty ranks. Dr. Gary Ridsdale is from Simon-Fraser University. His principal research interests are computer-assisted figure animation and knowledge-based systems. Most software tools for animation currently function only at the geometric level, having commands for moving objects through a path in space. In the future, to specify a complex animated scene with several characters, animators will require software tools having much greater "intelligence" (understanding of scene and character constraints) than current computer animation systems. Other interests include figure rendering, interface design, hypertext, planning and constraint satisfaction.

Dr. Joseph Zachary joins us from MIT. He is interested in those aspects of software engineering that address the issues that arise when constructing large programs. These areas include programming and specification languages, programming paradigms, and software tools. Recently he investigated the problem of incorporating abstraction mechanisms into an equational logic programming language. Professor Zachary also participated in the concurrent design of an algebraic specification language and its syntax-directed editor. His current plan is to investigate the possibility of exploiting parallelism to obtain fault-tolerant software.

Congratulations go to Jun Gu, a graduate student in Computer Science, who was awarded the prestigious ACM-IEE fellowship for the 1987-1988 academic year.

ENGINEERING NEWS ADMINISTRATION

Odean BowlerEditor

Paul JonesManaging Editor

Associated Student Organizations of the College of Engineering/ Dean's Office - 2202 MEB

F.E. REVIEW SEMINARS SCHEDULED

As in the past, the faculty of the College of Engineering will present a series of review lectures for students taking the Fundamentals of Engineering Exam. The review sessions will be given every Monday and Friday during Fall Quarter from 3:10 until 5:00 pm. in EMCB 102.

Review topics will include: Electrical Engineering, Statics, Strength of Materials, Thermodynamics, Fluid Mechanics, Dynamics, Engineering Economics, Systems and Computer Science and Chemistry and Structure of Matter. In each session typical problems from a recent FE examination will be presented and worked, and questions will be answered in the specific review area.

The fall examination is scheduled for October 31st, 1987, the deadline for applications was August 31st, 1987. The next examination will be April 12th, 1988. The review course is sponsored by the College of Engineering at no cost to students. All faculty and students who wish to take the Fundamentals of Engineering are invited and encouraged to attend these review sessions.

National AIChE Student Membership Available to Chemical Engineering Students

All students of Chemical Engineering are eligible, with the opening of school this Autumn, to become national members of the American Institute of Chemical Engineers. Previously students could belong only to their student chapter of AIChE.

The new national student membership in AIChE includes several new services for student members. A new journal, entitled Chapter One, is being published by AIChE for student members. The Fall, 1987, issue (Vol. 1 No.1) is now out and is being distributed to all chemical engineering students this quarter; subsequent issues will be mailed directly to student members. Between issues of "Chapter One," student members will receive a national student newsletter to keep them abreast of student activities in the Institute.

Other features of the new student membership program include:

A national Student Contest Design Problem--student members may compete for prizes awarded at the Annual Meeting of the Institute.

AIChE \$500 Scholarship Awards-- two awards will be given annually in each of the ten student regions nationwide.

Availability of all AIChE Employment Services to student members.

Member Rates for Technical Publications and Low Student Registration Fees at all National and Regional Meetings.

Other member services such as group insurance, etc.

PREPROPOSAL

TO:

SUBMITTED BY: College of Engineering, University of Utah, Salt Lake City.

SUBJECT: Laying the Basic Groundwork for the Sixth Generation: Cellular and Neural Computation.

BACKGROUND:

The United States and Japan are spending incredible sums of money on the development of "Fifth Generation" computers which will lead to an enhancement in speed and computational capabilities of perhaps a factor of a thousand. Current estimates are that this will be accomplished by going to sub-micron fabrication (the order of 0.5 micron), significant enhancements in software and software systems, and perhaps by parallel processing. The Japanese projections, and most of the projections of the experts in the United States, do not indicate any insurmountable problems in this development. In fact, most people are betting that this will indeed come to pass within ten years and possibly as early as 1990.

The Fifth Generation project is an immense developmental effort--admittedly with a considerable amount of applied science in the process--perhaps analogous to our earlier objective of landing a man on the moon. If it is clear that Fifth Generation technology and perhaps even Fifth Generation computers will be available in the early 1990's, it immediately raises the question: What will be available after that? What should we be projecting and studying now in terms of basic and applied science to lay the groundwork for the developments of the 1990's, the year 2000, and beyond? Clearly, there is a Sixth Generation beyond the Fifth.

SUGGESTION:

The limits of sub-micron fabrication are roughly in the size range of a single bacterium and other single-celled micro-organisms. These organisms have processing systems--sensing systems--of incredible sophistication within a very small volume. They do not function with silicon, gallium arsenide, or CMOS technologies. The human mind and animal brain and spinal system also do not function with such technologies. They function with circuits and interconnections with the neuron as the basic unit. Clearly there are problems with neuronal processors: they are sometimes slow; their memories are often volatile. But they also have advantages over conventional computer technology, including the Fifth Generation development. Neuron circuits provide opportunities for parallel and integrated processing and even re-circuiting and re-design of the processor to suit the problems at hand. Clearly, there is a place in computer and information processing technology for biologically-based hybrid systems--not to replace Fifth Generation computers, but perhaps to work in parallel with them, performing those functions which biological systems are best able to perform, and allowing the Fifth Generation machines to perform those functions which they are best able to perform. Such hybrid systems could well be the beginnings of the Sixth Generation.

PROPOSAL :

Considerable development has occurred in recent years in the growth and culture of nerve cells in two-dimensional monolayers on solid supports. There has also been major progress in applied mathematics and computer science in the study of neural networks. Most of the latter has been purely in the modelling arena with little or no practical experimentation, other than that based on conventional inorganic integrated circuit technology. Only recently have the biological model systems, that is two-dimensional layers of nerve cells, become available to truly test the models and theories produced by the neural network people. The nerve cell culture technology, coupled with the tremendous advances being made in growth factors and neuro-chemistry, permit us to begin to seriously consider practical experiments on neural networks. Such studies could provide much of the basic foundation required for the consideration of true biological and cellular computation systems.

The University of Utah has put together a Neural Network Study Group composed of applied mathematicians, computer scientists interested in parallel processing and artificial vision, biomaterial scientists interested in cell-substrates and cell-material interaction, neurophysiologists, and neural cell culture individuals. This team is beginning to assemble and talk with one another and to host a series of seminars and colloquia. We all realize that experiments and discussions in this area are considered a bit "off the wall". Off-the-wall projects are not foreign to the University of Utah environment. This is the University that has made great strides in the development of the artificial kidney, has been largely responsible for the development of the artificial heart, and has developed one of the most advanced artificial arms anywhere in the world. This same group has developed a clinical artificial ear, has well-developed programs in the area of chemical and biochemical sensors, and has pioneered computer applications in medicine. Hybrid, interdisciplinary, off-the-wall, scientific development efforts are not only tolerated, they are encouraged! It is a very unique academic environment, and one that is well suited for beginning to probe the possibilities of cellular and biological computation.

BUDGET:

A total budget of perhaps \$300,000 for the first year would be adequate to catalyze and launch the research activities. Depending on interest and progress, the budget could be expanded in subsequent years to about \$500,000-600,000 per year. Given the several billion-dollar research efforts that this country is putting into the Fifth Generation activity over the next decade or so, it is not unreasonable to devote 0.1% (of the order of several million) to laying the groundwork for the generation beyond.

ADMINISTRATION:

The P.I. should probably be J. D. Andrade, Dean of the College of Engineering, who has catalyzed the establishment of the Neural Networks Study Group, the Center for Molecular Graphics, and is generally trying to encourage the Computer Science and Electrical Engineering Departments to work much more closely with Bioengineering, Mathematics, and Physiology to develop these hybrid areas. The Executive Committee will be composed of the key disciplinary participants: Frank Hoppensteadt, Chairman of the Department of

Mathematics, who is finishing a book on Neural Networks; Kathryn Rappaport, Research Professor, Department of Bioengineering, who is an expert on nerve cell culture; and Tom Stockham, Professor, Department of Electrical Engineering, who is involved in parallel processing, signal processing, and computer science.

The best use of the funds would probably be as catalytic seed money to launch pilot, interdisciplinary projects. The primary use of the funds would be for graduate student and postdoctoral support to carry out these projects over the next several years, for visiting scientist positions, and for technical staff. Limited funds would also be used for travel and for an extensive colloquium series to bring in relevant experts. Basically the funds would be managed as seed money to encourage research and study in the general area with the hope and expectation that the seed money projects would become worthy of spinning off as independently-funded research projects in their own right.

TIMING:

The activity could begin as early as late summer 1984--possibly effective September 1, 1984, depending on the availability of funds.

INFORMATION:

For further information, contact Dr. J. D. Andrade, Dean, College of Engineering, 2000 Merrill Engineering Building, University of Utah, Salt Lake City, Utah 84112, 801-581-6911.

SOURCE OF SUPPORT

Expenditures	\$9,683,205
Grants	76,171
Donations	756
Other	223,372
	<u>302</u>
Total	\$9,731,841

STATE RESEARCH EXPENDITURES

No. of Projects	Expenditures (\$)
	\$ 489,733
	450,417
	92,172
	117,438
	6,013,779
	1,999,047
	569,255
Total	9,731,841

MANAGED LABORATORIES

University Laboratory \$1,174,030.

STATE OF UTAH

2(a). NUMBER OF FACULTY

The combined total of full-time engineering teaching and research faculty in the three professorial ranks is 115. The combined total of full-time, part-time and other faculty is 176.

2(b). NUMBER OF UNDERGRADUATE STUDENTS

The total undergraduate student enrollment is 3,074.

3. GRADUATE DEGREE REQUIREMENTS

Master's: Forty-five credit hours of approved upper graduate study; average of at least B and no grade below C; at least 36 hours of work completed in residence; no foreign language required; thesis plus oral defense.

Doctorate: Three years or more of approved graduate study are required to complete the Ph.D. degree. One of the last two years in residence; high scholarship and ability in independent research; departments offering work toward the Ph.D. degree determine whether foreign language proficiency shall be required of candidates; qualifying preliminary examination; dissertation and oral defense.

Other: (Master of Engineering, Master of Engineering Administration) No thesis or oral defense.

4. EXTENSION CENTERS FOR GRADUATE STUDY LOCATED OFF-CAMPUS

Special courses are conducted at Hill Air Force Base, Utah.

5. FACULTY, ENROLLMENT, AND DEGREES GRANTED

Degree Program	Enrollment, Fall 1982				Degrees Granted, 1981-82			
	Faculty	Master's	Pro-fessional	Doc-torate	Under-graduate	Master's	Pro-fessional	Doc-torate
Bioengineering	4	33	-	17	-	9	-	4
Chemical Engineering	13	35	-	14	32	11	-	6
Civil Engineering	15	32	-	12	54	14	-	1
Computer Science	16	62	-	33	52	15	-	6
Electrical Engineering	13	64	-	17	65	11	-	2
Materials Science and Engineering	11	35	-	36	13	2	-	3
Mechanical and Industrial Engineering	20	82	-	7	67	17	-	2
Total	343	-	136	283	283	79	-	24

*Total part-time is 56.

6. APPOINTMENTS MADE TO GRADUATE STUDENTS

Title of Appointee	Appointments Made (8/81-7/82)	Academic Load Allowed, in Credit Hours	Stipend for Academic Year (\$)
Research Assistant	123	Quarter	Varies-to 15 3,500-9,000 ¹
Teaching Assistant	99	Varies-to 15	2,400-6,758 ²

¹Income tax waived if work is partial fulfillment of requirements for advanced degree.

²Tuition and fees waived.

7. RESEARCH AREAS OF ACCEPTED DOCTORAL THESES

Bioengineering: field effect transistors (2), microprocessors, skeletal interface. **Chemical Engineering:** NO formation (2), polymer science (2), fluid mechanics, combustion. **Civil Engineering:** applied mechanics, design automation for speed independent circuits, storage management in applicative multi-processing systems (2), synthesis of synchronizers, demand driven data flow. **Electrical Engineering:** image restoration, integrated circuit design. **Materials Science and Engineering:** biomaterials, polymers, ceramics. **Mechanical and Industrial Engineering:** heat transfer, mechanical properties of polymers.

8. PERSONNEL ENGAGED IN SEPARATELY BUDGETED RESEARCH

Professorial faculty	58
Other faculty	10
Postdoctoral fellows	12
Graduate students	149
Undergraduate students	38
Nonteaching research personnel	12
Total	279

7/1/81-6/30/82

FACULTY

Total of full-time engineering teaching and research faculty in three professorial ranks is 115. The combined total of full-time and other faculty is 176.

UNDERGRADUATE STUDENTS

Undergraduate student enrollment is 3,074.

DEGREE REQUIREMENTS

Master's: 45 credit hours of approved upper graduate study; average of at least B and no grade below C; at least 36 hours of work completed in residence; no foreign language required; thesis plus oral defense.

Doctorate: 3 years or more of approved graduate study are required to complete the Ph.D. degree. One of the last two years in residence; high scholarship and ability in independent research; departments offering work toward the Ph.D. degree determine whether foreign language proficiency shall be required of candidates; qualifying preliminary examination; dissertation and oral defense.

Other: (Master of Engineering, Master of Engineering Administration) No thesis or oral defense.

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7/1/81-6/30/82

9(a). RESEARCH EXPENDITURES BY SOURCE OF SUPPORT

Federal government	4,367,887
State & local government	-0-
Private, non-profit organizations	133,660
Business & industry	1,212,459

TOTAL 5,714,006

9(b). SEPARATELY BUDGETED RESEARCH EXPENDITURES

Engineering College Unit	No. of Projects	Expenditures (\$)
Bioengineering	22	752,675
Biomaterials		
Instrumentation		
Ultrasound		
Chemical Engineering	11	404,211
Energy Conservation		
Environmental protection		
Fuel resource dev. & fuel ref.		
Properties of materials		
Civil Engineering	7	174,142
Fluid mechanics		
Geotechnical		
Mechanics		
Transportation		
Computer Science	19	1,154,531
Integrated circuits		
Concurrent systems		
Graphics		
Programming languages		
Symbolic computation		
Waveform processing		
Portable operating systems		
Networking		
Electrical Engineering	23	1,342,550
Biological thermometry		
Electronic instrumentation		
Guidance systems		
Image processing		
Microwave biological measurements		
Microwave radiation effects		
Satellite data evaluation		
Software reliability		
Materials Science & Engineering	21	1,229,132
Energy		
Implant		
Polymer		
Metallurgy		
Ceramics		
Mechanical behavior		
Molecular behavior		
Mechanical & Industrial Engineering	17	656,765
Artificial organs		
Energy		
Composite studies		
Conservation		
Fracture/viscoelastic		
Geothermal		
Nuclear		
Solar		
Oil Shale		
Innovation		
Undergraduate research		
Polymers/fracture		
Design		
Total	120	5,714,006

10. SEPARATELY FUNDED AND MANAGED LABORATORIES

Utah Engineering Experiment Station 274,056

—192—

VANDERBILT UNIVERSITY

SCHOOL OF ENGINEERING
Nashville, Tennessee 37235
(615) 322-2762

1. OFFICERS

Chancellor: Joe B. Wyatt
Dean of Eng.: Paul Harrawood
Chairmen of engineering departments: Chemical Eng., Karl B. Schnelle; Civil & Environmental Eng., Edward L. Thackston; Computer Science, Patrick C. Fischer; Electrical & Biomedical Eng., Gerald Cook; Mechanical & Materials Eng., Alvin M. Strauss.
Head of research administrative unit: Arthur J. Brodersen, Associate Dean.
ASEE Eng. Research Council representative: Paul Harrawood, Dean.
Address admission inquiries to: Robert W. House, Dean, Graduate School (M.S. and Ph.D.); M. Roger Webb, Assistant Dean and Registrar, School of Engineering (M.Eng.).
Admission information: GRE required in some departments, optional in others; semester system; continuing education offerings through Continuing Engineering Education Office.

2(a). NUMBER OF FACULTY

The combined total of full-time engineering teaching and research faculty in the three professorial ranks is 68. The combined total of full-time, part-time and other faculty is 99.

2(b). NUMBER OF UNDERGRADUATE STUDENTS

The total undergraduate student enrollment is 1,103.

3. GRADUATE DEGREE REQUIREMENTS

Master's: 24 semester hours plus thesis (in Environmental Eng., thesis or additional course work optional); tuition \$6100/yr. or \$254/sem. hr. \$200 minimum, residence 9 months; no foreign language; B average in all courses.
Doctorate: 72 semester hours plus dissertation; tuition same as above; residence 1 year; foreign language variable requirements; B average in all courses.
Other: (M.Eng.) 30 semester hours; thesis not required; tuition same as above; residence requirement flexible, and off-campus work can be arranged; no foreign language; B average in all courses.
Thesis may be written in absentia.

5. FACULTY, ENROLLMENT, AND DEGREES GRANTED

Degree Program	Enrollment, Fall 1982				Degrees Granted, 1981-82			
	Faculty	Master's	Professional	Doctorate	Undergraduate	Master's	Professional	Doctorate
Biomedical Eng.	7	8	-	8	9	2	-	0
Chemical Eng.	9	11	-	2	42	2	-	1
Civil Eng.	12	9	1	3	36	4	0	0
Computer Science	9	11	2	18	11	4	2	1
Electrical Eng.	18	18	-	12	62	3	-	1
Eng. Management	1	2	-	-	-	11	-	-
Eng. Science	3	-	-	-	30	-	-	-
Environmental & Water Resources Eng.	9	23	0	16	9	5	0	4
Materials Science & Eng.	6	6	-	7	8	1	-	0
Mechanical Eng.	8	8	0	3	35	1	0	1
Total	96	3	69	242	33	2	8	

*Total part-time is 0.