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COVER: The end of the semester brings reading week and final examinations. See “Final Stretch,” a photo essay by Herb Weitman, beginning on page six.

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Photo credits: pages 18-23, National Aeronautics and Space Agency; page 25, Richard N. Levine; all others by Herb Weitman.
SONAR HAS BEEN used as another way of “seeing” for countless millions of years by bats and porpoises, who employ it to navigate, find food, and avoid predators. The first known use of ultrasound by humans was the attempt to locate the sunken Titanic by bouncing ultrasonic waves off the ocean floor in the general area where the ship went down, hoping to pick up echoes from the submerged hull. In World War I, ultrasound was first employed as an anti-submarine weapon. In the second world war, sonar and its electromagnetic cousin, radar, played crucial roles.

Both sonar and radar use the basic technique of broadcasting pulsed bursts of energy and then measuring the time it takes them to get back from any objects they encounter, the angle of reflection on the return trip, and the amount of reflection or absorption by the encountered object. Radar employs radio microwaves; sonar uses ultrasound waves, which can be defined as mechanical pressure waves propagated through gases, liquids, or solids at frequencies above the range of human hearing.

It was shortly after World War II that industry began to use ultrasound to detect flaws in metals and other materials. In recent years, ultrasound has found widespread application in medicine, for unlike x-rays and other forms of ionizing radiation, it has been impossible to demonstrate any harmful effects from ultrasound scanning. It can yield rich diagnostic results rapidly and without pain, discomfort, or danger to the patient. In more than twenty years, no damaging side effects have been reported in the use of diagnostic ultrasonic scanning of human patients, despite intensive investigations to determine if any exist. Intense ultrasonic waves can produce appreciable amounts of heat, but it has not yet been possible to demonstrate any heat changes with diagnostic ultrasound scanning equipment.

Diagnostic ultrasound scanning can be used throughout the body. Its areas of use at the Washington University Medical Center include cardiology, gastroenterology, neurology, ophthalmology, and obstetrics and gynecology. The technique is especially valuable in obstetrics because of the limitations imposed on x-ray examinations by the vulnerability of the fetus to ionizing radiation.

The use of diagnostic ultrasound in Washington University's Department of Obstetrics and Gynecology began in 1972. In November of that year, Dr. Jacques Sauvage, associate professor of obstetrics and gynecology, working with research associate Mazie Kopta, set up the first ultrasound equipment in the OB-GYN Department and began to put ultrasound’s unique diagnostic abilities to work.

“At first,” recalls Ms. Kopta, now a registered diagnostic medical sonographer, “few physicians were aware of the diagnostic capabilities of sonography in obstetrics and gynecology. The question most frequently asked was ‘What’s an ultrasound?’ In the early months, we did free ultrasonic examinations to demonstrate the value of the technique to the physicians.”

Today, OB-GYN’s Perinatal Laboratory has three ultrasound machines. There are three technologists and two perinatal fellows working in sonographic diagnosis. Dr. Sauvage estimates that this year the number of patients examined by ultrasound will exceed 3500. Except for emergency cases, there is a three-week waiting period for time on the machine. “To keep up with the patient load,” Dr. Sauvage points out, “we need at least one more machine, an additional technologist, and another perinatal fellow in ultrasonic diagnosis.”

The idea of applying ultrasound to medical diagnosis began with Dr. Douglas Howry of the University of Colorado. In the late 1940’s, he and engineer Roger Bliss constructed a pulse-echo sys-
system based on surplus Navy sonar equipment. By the early 1950’s, they were making the first cross-sectional ultrasound images of soft tissue in humans. To provide an adequate propagation medium for the primitive equipment of that day, their first patients were submerged in water-filled laundry tubs or cattle troughs.

By 1954, Howry and Bliss had developed a much more sophisticated device, the “Somascope,” which employed a revolving gun turret from a B-29 bomber. While the patient sat in a tank of water and held on to lead weights to stay on the bottom, the modified gun turret, housing a transducer, revolved around the tank, bouncing bursts of ultrasound off the patient.

Another pioneer in the field was Dr. John J. Wild of Minneapolis. He and his colleagues developed the first two-dimensional ultrasound scanning system and produced the first ultrasonographic cross-section of the breast. In the mid-1950’s, after scanning seventy-seven patients with suspected breast abnormalities, the Wild team reported a 90 percent accuracy in the diagnosis of benign versus malignant lesions.

Dr. Ian Donald of Glasgow pioneered the application of ultrasound scanning to obstetrics and gynecology. Dr. Donald met Dr. Wild in London and took his ideas back to Scotland. In his first experiments, he used an industrial metal flaw detector and a huge rubber bucket to contain the patient. During the next few years, however, working in collaboration with engineer Tom Brown, he developed the prototype of the hand-operated, two-dimensional contact scanning machine—the model on which today’s sophisticated equipment is based.

With the contact scanner, the patient does not have to be submerged in a water tank. The transducer, on a pivoted arm, is placed in direct contact with the patient’s skin and moved smoothly over the surface, riding on a thin film of mineral oil. The transducer converts the electric signals into acoustic pulses, which are coupled to the patient’s skin. Reflected back through the transducer, the pulses are converted into echo signals which can be broadcast audibly, recorded on charts, film, or video tape, or displayed on an oscilloscope screen.

At the University’s Perinatal Laboratory, all of these capabilities are used. Fetal heartbeats are monitored as a continuous function, visibly and audibly displayed and permanently recorded. Polaroid prints of the ultrasound scanning image are made for study in detail and at length by physicians and stored for future use, and “real-time” images are displayed on a cathode screen. With the real-time capability of modern equipment, the beating of the fetal heart and the movement of fetal limbs can be observed on the screen.

The benefits of all of this technology are manifold. With ultrasonography, intrauterine pregnancy can be confirmed as early as five weeks after the patient’s last menstrual period. At that stage, the gestation sac can usually be clearly discerned. By noting the shape of the sac, the implantation site within the uterus, and the presence of moving fetal echoes, it is possible to report an encouraging prognosis of the pregnancy.

As gestation proceeds, it is possible, by ultrasound scanning, to determine the fetal age with considerable accuracy. Measurements are taken of the biparietal diameter of the fetal head and plotted against charts of normal development. The same capabilities permit early detection of such abnormalities as hydrocephalus, where the head is grossly enlarged by fluid, and anencephalus, where cerebral hemispheres are lacking or rudimentary.

Organs such as the fetal heart, liver, kidneys, and bladder can also be examined by ultrasound scanning, as a check on possible abnormalities. The gestational age can be determined with great accuracy and, by taking serial readings, it can be ascertained whether the growth increment is normal. Fetal death can also be determined with precision from early stages of gestation by the absence of a fetal heartbeat.

In addition, sonography can discover quickly if a pregnancy is inside the uterus or outside, as in tubal pregnancy. It can also give a clear picture of the placenta and alert attending physicians to any abnormalities in the placental position. Because of the ability of ultrasound to locate and measure the placenta so accurately, physicians are able to draw off samples of the amniotic fluid with little risk of perforation of the placenta or injury to the fetus.

Ultrasoundography has many important uses in cases of spontaneous abortion. It can determine if the abortion is genuine or if the fetus is still alive, and it can detect "missed" abortions by the lack of fetal heartbeat. After abortion, ultra-
sound can determine if the uterus is empty, and if so, avoid curettage.

Perinatal care follows the progress of pregnancy from its first detection until after delivery. Diagnostic ultrasonography can be of great value every step of the way. All of the patients who come to the Perinatal Laboratory are referred by their private physicians or by the staff of the Washington University Clinics. Many are considered high-risk cases for various reasons, including diabetes, hypertension, pelvic abnormalities, Rh complications, a history of difficult deliveries, or suspected genetic defects.

"Ideally," says Ms. Kopta, "all pregnant women should have an ultrasound scanning at twenty-four weeks into gestation but, unfortunately, equipment and trained personnel don't exist to do the scanning on that massive a scale."

Where a mother with Rh-negative blood is making antibodies to attack the Rh factor in the fetal blood, ultrasound scanning is used to pinpoint the location for taps of the amniotic fluid which are taken regularly after the twenty-fourth week of gestation. If the taps show signs that the bilirubin level is rising, which is an indication that the mother's antibodies are damaging the fetal blood cells, the fetus can be given transfusions while still in the uterus. Ultrasound is used to mark the precise pathway for the transfusion needle.

Taps of the amniotic fluid are also taken in certain high-risk cases for analysis by the Cytogenetic Laboratory at St. Louis Children's Hospital, a member institution of the Washington University Medical Center. The laboratory examines the fluid for evidence of abnormal chromosomes, such as those that indicate Down's Syndrome, or mongolism, a risk that increases with the age of the mother, especially after age forty. The laboratory can also detect the sex of the fetus by chromosome analysis in order to determine if certain sex-linked chromosome abnormalities are present. Ultrasound scanning is used to minimize the possibility of injury to the placenta or fetus when the tap is performed.

Ultrasound scanning has many important uses in gynecology as well as in obstetrics. It can be determined whether a mass is within the uterus or outside, and because of the difference in the echo pattern, whether the mass is a fluid-filled cyst or a solid tumor. While sonography cannot determine with certainty whether a tumor is malignant or not, it can cast the suspicion that indicates that further tests are necessary. It can detect fibroids, which are muscular tumors of the uterus, and hydatidiform moles, which result from the deterioration of the villous circulation in a pathologic ovum.

When radiation therapy is indicated in cases of malignant tumors of the uterus or other pelvic organs, ultrasound is used to check the unloaded radiation probes to be sure they are in exactly the right location. An unusual, but not uncommon use for sonography is the location of lost I.U.D.'s—intrauterine contraceptive devices that have become lodged in the uterus or have migrated to other pelvic regions. If the I.U.D. is within the uterus, the object can be located with ultrasound without subjecting the patient to x-ray irradiation.

Four years ago this fall, the first diagnostic ultrasonic scans were made on patients in the Perinatal Laboratory. Today, the technique is an established and important part of the work of the Obstetrics and Gynecology Department. At present, there are three scanning machines, including real-time equipment. In addition to sonographers Mazie Kopta and Claire Curtin, Dr. Marta Pineda is learning the technique to take back to her native Honduras. Her husband, Dr. Jorge Pineda, is one of the current perinatal fellows; the other is Dr. George Andronopolous. In addition, other physicians in the Department use the facilities and they are important teaching tools for residents, interns, and students.

"One of the many achievements of ultrasonography," Dr. Sauvage emphasizes, "is the substantial improvement it has brought about in prenatal and gynecologic diagnosis. Further technological refinement will no doubt advance these already spectacular results."

Looking to the future of ultrasonography in his field, Dr. Sauvage comments, "New investigative efforts concentrate now on the demonstration and evaluation of fetal function. Rather than the static description of anatomical structures, the goal is to study fetal dynamics in health, under stress and disease."

"Information will be provided," he adds, "that will modify our present modes of prevention and therapeutics. At present, research is concentrated on fetal cardiohemodynamics, fetal respiration, fetal urinary function, etc. Diagnostic ultrasound is indeed a rapidly growing, ever-changing, exciting field.
FROM THE beginning of time, it seems, the fall college semester began at the end of September and ended in late January, with a winter vacation around Christmas for the students to be with their families, enjoy the Holiday season, and worry about the finals they would have to take when they got back. In recent years at most institutions, school starts at the end of August and the whole semester, including finals, is over before the winter break, which is a great improvement for everyone concerned: students, faculty, and families.

On these pages, Herb Weitman has attempted to catch on film something of what went on this past winter during reading week and final examinations at Washington University.
READING WEEK, which immediately precedes final examinations, is a time of constant and sometimes frantic concentration on the part of most students. It is a time to review the work of the semester at leisure for some—a time to try to cram in at the last minute a lot of work that should have been done earlier for others. It's a time to take stock of how much you've learned and how much you know or a time to realize how little you've learned and how short a time you have to know a great deal more than you do.
Reading Week is not restricted to reading. As the semester draws to a close, many students use the pre-finals period to practice their skills and put the finishing touches to their creations. These are the art students, the music, dance, and theatre majors. They prepare for different kinds of final examinations: recitals, exhibits, performances, submission of projects and portfolios. Perhaps reading week should really be called review week or better still, preparation week.
Finally come the finals. To some temperaments, finals are nothing to worry about; even fun; to others, they are agony. But somehow, finals do come to an end and often the anxious and worried student does as well or better than the nonchalant. Best of all, when finals are over, there's the long winter holiday ahead—with no need to cram or grind. The semester is all over and you can look forward to the next one—knowing that next time you will do better.
LEON GOTTFRIED: TEACHER, SCHOLAR, DEAN

By Dorothy Brockhoff

A member of the Washington University faculty for over twenty years, Leon Gottfried was recently named Dean of the Faculty of Arts and Sciences. At the time of his appointment last November, one observer of the campus scene described him as the "quintessence of an ideal college administrator—superb teacher, skillful scholar, and proven statesman."

That's the famous branch of the family," Leon Gottfried, recently named Dean of the Faculty of Arts and Sciences, quipped facetiously. His ready response came in answer to the tongue-in-cheek question, "Are you, by any chance, related to Gottfried von Strassburg, the thirteenth century minnesinger, whose Tristan und Isolde became the major source for Wagner's opera?"

It would make a more dramatic story if the two were kin, but, unfortunately, there seems to be no connection between them except their name. Translated, it means "God's Peace." Undoubtedly, the dozens of scholars who have studied the medieval Gottfried over the centuries have determined if the appellation is appropriate. Certainly, understood in its broadest context, the surname suits Washington University's Gottfried. For he is, as David Hadas, associate professor of English and one of Gottfried's many friends, observed, "Someone who makes peace and reconciles people to each other." Hadas views this quality as one of Gottfried's great strengths. Others who know him well concur. They describe him variously as mediator and conciliator. Perhaps William G. Madsen, chairman of the English Department, expressed it most picturesquely when he said, "Leon is very effective in defusing explosive situations."

Gottfried's skill as an imperturbable negotiator, with the wisdom to perceive and understand people of diverse points of view, has made him an ideal choice for membership on numerous and important University and departmental committees during the past two decades. On these committees, he earned an enviable reputation as an able organizer and problem solver with the result that he was selected to chair two important groups—the Faculty Council and the Senate Council. These are the executive bodies which represent, respectively, the Faculty of Arts and Sciences and the faculty of the entire University. Through such dedicated service, he has become one of the best known figures on both campuses—the Hilltop and the School of Medicine.

Thus, it was natural that when an exhaustive search was instituted last year for a successor to Merle Kling, then Dean of the Faculty of Arts and Sciences who had been appointed Provost, Gottfried was among thirty-seven faculty members nominated. He remained among the candidates when the list was pared down to some six or seven—all of them Washington University faculty—because it had been agreed that outsiders would not be considered.

Screening was done by the six-member Faculty Council designated by Chancellor William H. Danforth as the Search Committee empowered to assist him in finding a successor to Kling. The Council consists of two representatives from the natural sciences: David Gutsche, professor of chemistry, and Edward L. Spitznagel, Jr., associate professor of mathematics; two from the social sciences: James W. Davis, professor of political science, and Michael Weinberg, associate professor of history; and two from the humanities: Daniel Shea, professor of English, and Richard S. Rudner, professor of philosophy, who serves as chairman. Chancellor Danforth made it a point to attend their frequent meetings.

Reminiscing about the experience a few weeks ago, Rudner explained: "What we were faced with was really an embarrassment of riches. The people who were nominated were able, relatively well-known to the community, sensitive to the need for excellence in the faculty and the problems confronting the University. In the end," he continued, "what we were doing was looking very carefully at marginal differences among people. I think any one of the final four contenders would have done ably, even though I think we are extremely lucky to have gotten Leon." As
one knowledgeable of the University expressed it: "He is the quintessence of an ideal college administrator—superb teacher, skillful scholar, and proven statesman."

At the end of the long search, Rudner continued, "I think the Council felt unanimously that Gottfried should be the choice, and, thus, when the decision was reached in early November, we made only a single recommendation to the Chancellor. It's my impression that he took it very happily." The Chancellor lost no time in announcing the appointment. At the time, he credited Gottfried with "both a vision of what a university should be and a comprehensive understanding of its parts." More recently, he commented, "One is immediately impressed by his balanced judgment, his good will, and his dedication to academic excellence."

Gottfried officially assumed his new duties as Dean on November 9, after what he calls "a weekend of crash preparation for deanship," directed by his predecessor Kling. Life now in his sunny, spacious office in North Brookings is, of course, very different from that in the classroom. But the transition has been made a bit easier because, for the past four years, Gottfried has had on-the-job administrative experience as chairman of the Art and Archaeology Department.

Gottfried's appointment to that position came as a complete surprise to many because he had been a full-time member of the English Department since 1954, when he joined the Washington University faculty as a fledgling instructor. At first glance, he seemed to some a Philistine in Steinberg Hall when he assumed his new responsibilities. It quickly became apparent, however, that he was no stranger in a strange land as many had mistakenly assumed. Although not formally trained as a specialist in art history and archaeology, he had long been interested in the relationship between literature and the visual arts. To bone up on the subject, Gottfried spent part of his 1966 sabbatical in Italy, doing research on Walter Pater, a leader in the nineteenth century revival of interest in Renaissance art and humanism.

In accepting the chairmanship, however, Gottfried did not completely abandon teaching in the English Department. He continued to devote half of his time to this vocation, and the rest to the problems inherent in managing any department. "I tried," he explained not long ago, "to compartmentalize my time. I knew from experience that if you sit at a desk eight hours a day for forty hours a week, somehow your work load will expand to fill all of that time. On the other hand, if you allot three afternoons a week to administrative tasks, you can, with the help of an able secretary, accomplish just about as much in far less time." There were periods, he admitted, when the pressures of departmental requirements made it necessary for him to devote extra hours to his Art and Archaeology assignment, but on the whole he was able to juggle his disparate responsibilities successfully.

In striking this balance, Gottfried's first allegiance has been to his students—those in his English classes as well as those whom he met in his capacity as chairman of a major department. "I've always thought it was important to be available to students," he emphasized. Gottfried's "open door" policy has encouraged young people to share their problems (both educational and personal) with him. "When they go out of his office," Adelyn Kettner, his former administrative secretary in Steinberg
Leon Gottfried:
Teacher, Scholar, Dean

Hall, observed, "they feel good." Perhaps, she suggested, that is because "he always seems to have time wherever time is needed."

Naomi Lebowitz, a colleague in the English Department, agreed. "Leon," she confided some months ago, "listens and is sensitive to students. At the same time, he always knows his subject." Tim Brennan, who is expected to complete work on his master's degree in English this semester, concurred. "With Mr. Gottfried," he said, "you can just sit down and talk. He's sort of avuncular."

Graduate student Raymond Hall provided additional insight. "In some ways," he said, "Gottfried's a low key teacher in the sense that he is not heavily pedagogical. He is erudite without being esoteric; instructive without being pedantic."

For these and many other reasons, Gottfried received a Washington University Alumni Association Award for excellence in teaching in 1968.

A career as an educator was not his objective, however, when he entered the University of Illinois in 1942. Because he was good in science and mathematics, he elected to major in chemical engineering. Midway during his college career, on D Day, June 6, 1944, Gottfried left the Illini campus to join the Navy. While in service, he was trained in naval electronics and radar. He was stationed in San Diego, preparing to take part in the projected invasion of Japan, when the dropping of the atomic bombs ended World War II. Soon after, he was shipped to the Philippines to while away his days until his tour of duty was completed.

"That was the beginning of my real education," Gottfried related. "In the Navy I met a lot of bright fellows," he recalled, "and I began to hear about T. S. Eliot and e. e. cummings." About that time, Gottfried's commander thought it would be a good idea to set up schools not only for servicemen but for native children as well. Because there was a surplus of volunteer teachers trained in chemistry and biology, Gottfried decided to teach English. With Porter G. Perrin's The Writer's Guide and Index to English as the text, Gottfried proceeded to teach freshman composition to sailors, basic high school English to the youngsters, and Shakespeare to the officers.

"It was all really a fluke," he explained with a chuckle. With the help of the ever ingenious Seabees, Gottfried somehow, located a copy of Shakespeare's plays, complete with footnotes and introductions. "I managed to keep up with the class," he recalled, "because I read a little faster than they did. This experience convinced me that I wanted to get some kind of humanistic education."

Accordingly, after leaving the service, Gottfried returned to the University of Illinois and sampled a potpourri of courses, including history, English, philosophy, and languages. He graduated with honors and a major in English in 1948, still undecided about what he really wanted to do. When he discovered that graduate assistantships were then relatively easy to get, Gottfried opted for further study at Illinois.

While waiting to be accepted in graduate school, he put his electronics training to use in the Illinois physics department, wiring circuits and doing other odd jobs. (His training and experience in science and technology, as well as the humanities, was later deemed particularly important when he was being considered for his present position.) Meanwhile, he earned some more extra money by working part time as a radio announcer.

A few years later, a brash, young freshman actor, Stanley Elkin, joined the campus radio station staff while Gottfried was still having difficulty making up his mind whether to concentrate on English or philosophy in graduate school. Elkin, of course, is now a well known novelist, professor of English at the University, and a close friend of Gottfried's. But, the two never met until both were on the Washington University faculty. Gottfried remembers hearing quite a bit about young Elkin at Illinois, however, from another graduate student, Jerry Beaty, who taught him in class. "Beaty, now a professor of English at Emory University, used to describe him as 'that wild, crazy, talented kid,' " Gottfried recalled with a laugh.

These days, Elkin uses Gottfried as a sounding board. "He'll pull a sheet out of his typewriter, hot and steaming, and corner me," Gottfried said. "Got a minute?" he'll inquire, and then proceed to try out his prose on me. In every book he writes," Gottfried added, "he seems to need a word, an image, or a phrase, and then he'll run down the hall and grab me. I guess I have left one little, teeny toeprint in just about every one of his books."

While studying for his doctorate, which he finally decided would be in English, Gottfried also worked on Accent, one of the so-called little magazines. It was started in the forties by two young Illini English professors, the late Kerker Quinn and Charles Shattuck, who still teaches at Illinois and is one of Gottfried's closest friends. In time, Quinn abandoned his own ambitions to become a creative writer in order to concentrate all of his energies on this embryonic periodical. "After carving out a career as one of the most brilliant and successful editors of Accent, he dropped dead in the classroom just a few years ago," Gottfried said sadly.

"Stanley and I went to Champaign for the funeral, which was a sort of star-studded event with generations of writers whom Kerker had encouraged present for the ceremony. Bill Gass [William Gass, widely acclaimed writer and now a professor of philosophy at the University], was, so to speak, an Accent discovery," Gottfried continued. "He submitted a package of his manuscripts while I was still on the Accent staff. A great sheaf of material, it included several critical essays, a short story, and a variety of other works. A teacher at Purdue, Gass had published little or nothing up to that time. This assortment of Gass's manuscripts found its way to Chuck Shattuck's desk. After reading through it, Chuck became very excited and shouted elatedly, 'we've just found a genius.' In honor of the event, Accent devoted several entire issues to Gass's work."

When asked what he had done for Accent, Gottfried said matter-of-factly, "I never did anything that was good enough to be published." Perhaps that was true at the time, but since then Gottfried has published a book, Matthew Arnold and the Romantics, which was well received, and numerous scholarly articles. One of the latter, an essay on Katherine Anne Porter's short story, Flowering Judas, was runnerup in 1969 for the William Riley Parker Prize, awarded by the Publications of the Modern Language Association.

Nonetheless, Gottfried does not regard himself as a truly dedicated scholar. Ruminating about this matter recently,
he said: “A real scholar is a person whose principal relationship is to his subject. If he or she is a scientist, such an individual never really feels comfortable outside a laboratory; if a humanist, the library study is the favorite retreat. Consider Stanley Elkin. As a creative artist, he’s tied to his typewriter. If he doesn’t spend a few hours every day doing a certain amount of work, he’s very restless and doesn’t even feel good physically. Although I have done some scholarship and publishing, which I flatter myself is of pretty good quality, I think my basic relationship is really more to people. Consequently, over the years I have involved myself with teaching and students, and, as I began to mature in the organization here—to the University.”

Gottfried’s dedication to the latter cause prompted Chancellor Danforth to describe him recently “as one of the outstanding University citizens.” Those who know him best agree that the reason he is able to function so efficiently and effectively is because he is so well informed about the University. His experience as a perennial committee member has served him and Washington University well.

Perhaps Naomi Lebowitz expressed it best when she observed, “Leon’s greatest contribution to the University, I think, is his sane, responsible commitment to it and its objectives. He inspires trust precisely because he has no manipulative tendencies. That’s very unusual in the academic world.”

Gottfried’s enormous creative energy and lively imagination have won him respect as an administrative innovator. He was instrumental in developing the Forsyth Houses program during the late fifties and early sixties and served as one of its first Fellows. The idea resulted from a discussion he had with two students, Bruce Walz (now a brilliant radiologist at the School of Medicine) and Bob Gould (now a physicist with the Aerochem Co., Princeton, N.J.), who were dissatisfied with the quality of life in the residence halls. They persuaded Gottfried that Forsyth Boulevard divided the campus into two different worlds. North of this street, there was lively and stimulating intellectual activity; south of it, in the residence area, they perceived an atmosphere of sterile isolation.

In response to their complaint, Gottfried, with a group of other faculty members, established a program which sought to make the residential area an integral part of the educational complex. Unfortunately, it disappeared during the late sixties, a victim of the turmoil which enveloped most university campuses during those times.

As chairman of the Faculty Council during this period of campus unrest (from 1968 through 1970), Gottfried played an important role in trying to mitigate the schism which had developed between the students and the University. He was instrumental in enabling each side to understand the other’s point of view, helping to control the turbulence which seethed on the campus.

Gottfried is credited with the leadership of an effort which led to the establishment of the bilateral, or as it is also called, the bicameral system, of the College of Arts and Sciences. Under the terms of this arrangement, provision was made for students and faculty to share responsibility in certain specific areas, including the University calendar, grading procedures, and college-wide requirements—virtually everything that pertains to students themselves. This cooperation is made possible by the creation of a group called the Council of Students of Arts and Sciences. It is roughly comparable to the over-all faculty organization in the College. Each body considers these issues separately. When there is disagreement, the students’ organization, through its executive committee, meets jointly with the Faculty Council to resolve the issues in dispute.

Students were also granted representation on selected college committees. Alarmists at the time predicted anarchy would ensue, but, on the whole, Gottfried believes these arrangements, negotiated under trying conditions, have worked well. With these tasks completed, Gottfried left the campus for the 1970-71 academic year to serve as a Fulbright Professor at the University of Malaya.

Some time after Gottfried returned to the University, Merle Kling, then Dean of the Faculty of Arts and Sciences, appointed him chairman of the Humanities Committee, established to investigate ways of improving the funding of humanistic studies. After considering various alternatives, the committee decided to ask the National Endowment for the Humanities for a planning grant.

Knowing that Steven Zwicker, associate professor of English, had already proposed the establishment of a joint program in literature and history, the Humanities Committee elected to move in that direction. Richard Davis, chairman of the Department of History and a member of the committee, credits Gottfried with writing the initial, successful proposal; building, it is true, on the work of Zwicker and the entire committee. What Gottfried did, Davis explained, “was to shape the proposal into a broader University context and to formulate the persuasive arguments which carried the day.” The result was an 18-month, $30,000 grant from the NEH, which became effective January 1, 1976. It was used to set up a new undergraduate degree program in English and American literature and history which leads to a bachelor’s degree in these subjects. Zwicker directs the program.

Meanwhile, Dean Gottfried has turned his attention to what he regards as two monumental problems facing the University today. The first is concerned with the necessity of developing new methods which will enable the University to continue to attract a highly selective student body in the face of an ever-shrinking number of college-age people. The other involves devising methods for making the wisest possible use of the tight budget allocated to the Faculty of Arts and Sciences. Such a task, Gottfried knows only too well, is tough because it “requires saying no more often than yes to many ideas and proposals. It is very difficult to be an administrator during a period of constraints.” But Gottfried proposes to try.

Why? He answered this question most eloquently some years ago in the Washington University Magazine when he wrote: “The University’s purpose is as challenging as any ever taken up by a human institution, and as simple as a few words: it is to preserve and to further man’s most hard-won gains of civilization against the darkness that howls without—and within.”

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THE EXPLORATION OF MARS

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Mars, the red planet, has been an object of interest ever since man first examined the heavens. The Babylonians called Mars, because of its reddish color, Nigal, master of battles and judge of the dead. Galileo, in the early 1600's, was one of the first to look at Mars through the telescope. Although Galileo had considerable success in delineating surface features on the moon, when he turned to Mars, very little detail could be seen. That is because the moon, in orbit around the earth, is only about 238,000 miles away, while Mars, the next planet out from the sun, is about 35 million miles from the earth, even at its closest approach.

Such large distances preclude resolving details of the Martian surface, even with the best telescopes. These earth-bound observations, in general, provide valuable information on such large-scale phenomena as the formation and movement of clouds and the growth and dissipation of the polar caps. Further, modern observations are done with photovoltaic detectors attached to telescopes, adding another dimension of being able to characterize Mars spectrally, thereby putting first-order constraints on the nature and composition of the atmosphere and surface. However, for geoscientists who are interested in the characteristic topography of the surface—the presence or absence of faults, mountains, channels, volcanoes, etc.—these images provide little for analysis. To explore Mars "close up" was a major part of the National Aeronautics and Space Administration's thrust for better understanding of the origin and evolution of the solar system. Thus far, six U.S. spacecraft have been sent to Mars and have acquired data to be transmitted back to armchair explorer-scientists on earth. We will discuss three of these missions to see how the returned data have increased our understanding of Mars.

In late 1971, the Mariner 9 spacecraft, which had been traveling through space toward Mars for six months, was commanded to fire its retro-rockets in order to reduce its velocity and, as a consequence, to be captured into orbit about the planet. After a successful orbit insertion, television cameras aboard the spacecraft began imaging parts of the Martian surface and transmitting the data back to earth in digital form. The first pictures returned were disappointing, to say the least: nothing could be seen of the surface because of a thick, planet-wide dust cloud. The beginning of the storm had been observed from earth during the summer of 1971 and it apparently had continued to rage. Several years earlier, Mariners 4, 6, and 7 had flown past Mars and had shown with spectroscopic measurements that the atmosphere was predominantly carbon dioxide, with a surface pressure of only about .05 per cent that of the earth. Although the atmosphere of Mars is very thin, the first Mariner 9 observations dramatically demonstrated that winds...
are capable of eroding dust from the surface even though wind velocities needed to erode dust are estimated to be as high as 125 miles per hour.

Within two months, the dust storm subsided and Mariner 9 began systematic imaging of the surface. Within three-fourths of a year, Mars was completely imaged with a ground resolution of about three kilometers, giving geoscientists an unprecedented view of a largely unknown and mysterious surface. Mariner 9 finally died in October, 1972, when the last of its attitude control gas was consumed during a maneuver to point the instrument platform to a particular place on Mars.

Professor Arvidson is one of twenty members of the Viking Lander Flight Imaging Team responsible for photographing the Martian terrain and analyzing the thousands of photographs beamed to earth from the two lander cameras. A recognized authority on the chemical and physical sedimentary processes affecting the surface of the terrestrial planets, he studied for his Ph.D. at Brown University under the Imaging Team leader, Thomas A. Mutch. He is a co-author of the new book The Geology of Mars, published by the Princeton University Press.(384,75),(758,127)

GEOLOGICALLY, Mars can be divided into two hemispheres: a rugged, highly cratered terrain and a smooth, sparsely cratered region that is dotted with a number of extinct volcanoes. The division between the two terrain types lies along a great circle that is inclined to the equator at about 30 degrees, with the cratered terrain located in the southern hemisphere. The cratered terrain contains a myriad of craters that range in size up to the basin Hellas, roughly 600 miles across. The abundance of craters is comparable to that found on the bright highlands of the earth's moon. We know from samples collected during the Apollo missions that the lunar highlands gained their present appearance about four billion years ago and that most of the craters are the result of torrential bombardment of the lunar surface by interplanetary debris left over from accretion of the solar system. Because of the abundance of craters, Martian cratered terrain is thought to record a similar period of time, thus constraining almost half of the surface of Mars to be an ancient terrain that has remained intact for some four billion years. For comparison, the oldest rocks that can be found on earth are about 3.8 billion years in age, and these are extremely rare.

The northern hemisphere of Mars, as discussed, is sparsely cratered. These terrains probably formed after cessation of heavy bombardment, and the few craters present record the occasional impact of a stray asteroid or comet. Unfortunately, there is not yet a confident way of estimating the ages of these surfaces other than to say the crater abundances span a large range, implying a large range in ages. There are twenty or so volcanoes as large or larger than the island of Hawaii (even with the ocean removed) located on the smooth plains. One, Olympus Mons, is fifteen miles high, three times as high as Mt. Everest, and covers a region comparable to the combined areas of Missouri and Illinois.

Early morning on Mars from the Lander 1 camera. Rocky bedforms in the drifts suggest that they are older deposits being eroded away. The large rock at extreme left is about one foot high and three feet wide.
The Exploration of Mars

Parts of the northern hemisphere plains are reminiscent of the mare regions on the moon, with abundant wrinkle ridges and lava flows. These terrains are clearly volcanic in origin. Other parts of this hemisphere appear to consist of wind-blown debris, perhaps mixed with volcanic products.

Both polar regions are covered with massive deposits of wind-blown dust and ice. Recent measurements by the Viking Orbiters demonstrate that the ice component is predominantly frozen water. Apparently, conditions have been conducive to suspending great quantities of debris in the atmosphere. That debris must have then been carried poleward by high altitude winds, where it was deposited as the atmosphere cooled and froze out on the surface. However, such events are restricted to some former epoch on Mars, since the deposits are presently being eroded by wind, exposing thick layered sequences and sweeping the eroded material into massive dune forms.

Another of the provocative features seen by Mariner 9 are large channels that are primarily located in cratered terrain and that often end at the contact between cratered terrain and plains. The best physical analog for these features, in terms of both scale and form, is the channeled scablands of the northwestern United States. There, during the last ice age, a large ice-dammed lake existed over much of Montana. Occasionally one of the dams broke, sending water rushing out to the Pacific Ocean. Such large discharges carved and scoured the landscape, producing large channels with hydrodynamically shaped bottoms. The similarity with Martian channels is striking and implies a similar process: release of a ground-hugging fluid in large amounts. However, because of the low temperatures, both carbon dioxide and water, which we know are present in at least fair amounts, are stable on Mars only as gas or as ice. The average annual temperature of Mars would have to be raised by somewhat more than 30 degrees Celsius to have rainfall.

Two explanations were offered to explain the formation of channels. The first was that conditions had in fact been noticeably warmer and therefore wetter in the past, either because of changes in energy given off by the sun or because of changes in the orbital parameters of Mars. An alternative explanation was that much of the outer few kilometers of Mars contained large amounts of water ice that had frozen as it was released during volcanic activity. Heat rising from the interior of Mars, because, among other things, of decay of radioactive isotopes such as potassium-40 could have melted or kept as liquid some of the water, especially at depths exceeding a kilometer or so. Occasionally, reservoirs of water could have broken through to the cooler surface and rushed out as a massive flood of water, ice, and debris.

By the end of the Mariner 9 mission, then, we knew a great deal about Mars. Parts of it were very old, volcanic activity dominated some regions, the polar regions recorded some previous climatic epoch, and water, wind, and impact cratering had played roles in shaping the surface. However, neither the atmosphere nor the surface had been directly sampled and analyzed. We were ready for the next, more detailed phase of exploration—landing on the surface, examining details of the terrain, measuring the composition of the surface and atmosphere with precision, and synthesizing all data to increase our understanding of Martian evolution.

Viking actually consists of four spacecraft: two orbiters and two landers. They traveled to Mars linked together—Lander 1 to Orbiter 1 and Lander 2 to Orbiter 2. Viking 1 was launched on August 20, 1975, and Viking 2 lifted off from Cape Kennedy three weeks later.
Three of the Washington University members of the Viking Lander Imaging Flight Team: Marcello Coradini, a guest investigator from the University of Rome; Ray Arvidson, assistant professor of earth and planetary sciences, and Ed Guiness, graduate student in earth and planetary sciences.

Simplified geologic map of Mars, plotted on the Fanson-Flamsteed projection. The north pole is at the top and the equator runs across the middle of the map. Location of the two Viking landers are shown as "X's." Mars can be divided into two hemispheres: ancient cratered terrain and younger plains. Cratered terrain near the contact with the plains has often been dissected by wind and water into irregular valleys and ridges, called fretted terrain.
After a long transit to Mars, Viking 1 was successfully captured into Mars' orbit on June 19, 1976. The targeted landing site was in the low-lying basin, Chryse Planitia, at the mouth of a series of convergent channels. It was thought that such a location would allow sampling of both local material and of debris brought in by ancient rivers. After orbit insertion, Orbiter 1 was commanded to begin imaging the chosen landing sites. At the same time, two spectroscopic instruments on board the orbiter measured the temperature and water vapor content of the potential landing site.

Meanwhile, earth-based radar measurements of the same area were made from Arecibo Observatory in Puerto Rico. Changes in the characteristics of the radar signal between sending and receiving are primarily due to interaction of the signal with the surface of Mars. Such changes can be examined to provide information of the roughness of Mars for scales comparable to the radar wavelength. In this case, radar was telling us about surface roughness at the 3 to 12 centimeter scale—about the scale needed to be smooth for a safe landing, since the Lander is only 22 centimeters from footpad to underbelly. Synthesis of orbital observations and radar data demonstrated that the landing site was much too rough for a reasonable chance of landing successfully. The search moved northwest, toward the basin center, where it was thought that fine-grained sediments would have accumulated as the streams began to lose their energy and to dissipate. After rejecting several sites, a region was chosen on the western flanks of the basin, a region containing a few wrinkle ridges and craters.

The command for the Viking 1 lander to separate from the orbiter was given on the morning of July 20, 1976. The lander successfully decoupled itself from the orbiter and began to descend toward Mars. Several hours later the lander began to enter the atmosphere. All descent maneuvers had to be planned far in advance and executed under the control of a pre-programmed on-board computer, since the transit time from upper atmosphere to the surface is only twenty minutes. Round trip travel time for radio beams takes thirty-six minutes. For this reason, the lander carried a gravity sensor that told the spacecraft when it was close enough to Mars to orient itself for entry into the atmosphere. The lander successfully oriented its aeroshield to take the brunt of entry heating. At the same time experiments designed to measure characteristics of the upper atmosphere began acquiring data. Soon, pressure sensors told the spacecraft that enough atmosphere existed to deploy the parachute. Within sixty seconds after deployment, the spacecraft slowed from nearly 1000 miles per hour to less than 200 feet per second and was at an altitude of about two miles above the surface. The parachute was then jettisoned. Soon, on-board radar told the lander that the surface was fast approaching and that the retro-rockets should be ignited. Finally, the lander successfully touched down on Mars, with a jolt similar to that of falling off a two-story building.

The lander had touched down on a nearly level, rock-strewn plain. The rocks range in size from pebble to automobile size and quite a few of them look very much like rock solidified from lava. More specifically, the texture, color, and presence of gas pockets in several of the rocks are reminiscent of basalts. Basalts on the earth are primitive iron and magnesium-rich volcanic rocks that are mostly derived by tapping of the deep, hot interior just below the earth's crust.

Areas between the rocks consist of fine-grained sediment. In some areas the sediment, blown by winds, has accumulated behind and among large boulders. Smaller sediment tails emanate from many of the boulders. The direction of streaming of the tails is consistent with the wind directions inferred for that area during the last stages of the 1971 dust storm, when Mariner 9 began its observations. Color images acquired by the lander showed that the sediment is reddish, a result not startling in the light of observations from earth. However, somewhat unexpectedly, it was found that the sky was also red, or at least pinkish in color. The cause must be that reddish surface material has been eroded somewhere from the planet's surface and suspended in the atmosphere. Such a result was somewhat unexpected since the lander touched down during the northern hemisphere's spring season, a time that earth-based observations show to have the least number of dust storms. Apparently, some amount of dust is continually in the atmosphere.
The second lander successfully touched down in the Utopia Planitia area on September 2, 1976. The search for the second site centered partly on the wish by the scientific community to land in a region geologically distinct from the first site, but still smooth enough for a successful landing. The Utopia Planitia region is part of the vast plains that occupy the northern hemisphere. From orbit, the landing site appeared to be covered by windblown debris. Orbital observations also showed that the surface is cut by a number of polygonal fractures. The fractures were thought most likely to have been formed by cooling of lava. From the lander perspective, the second site looks superficially like the first site, in that the region is a rock-strewn plain. Many of the rocks are similar in appearance to terrestrial basalts. Indeed, almost all of the rocks at the second site are full of gas pockets. Such holes result when lava reaches the surface and begins to cool. Gas that was dissolved within the magma at higher temperatures and pressures begins to separate and boil away, adding volatiles to the atmosphere.

One striking difference from the lander's perspective between the two sites is that the second site is cut by a series of polygonal troughs. The troughs are about three feet wide and four inches deep. Trough edges are slightly turned up. The scale and form of the troughs are much smaller than those seen from orbit, although both features could have a similar origin. The scale and form of the troughs are, in fact, a perfect physical analog for the "patterned ground" found in the earth's cold regions. Patterned ground on earth forms in ice-saturated soil, where very low temperatures lead to thermal contraction and fracturing. The fractures usually form a polygonal pattern. During the spring, thawing of ice leads to water-saturated soil. The water accumulates in the fractures, only to be frozen again during the fall freeze. During the winter, fractures reform within the relatively weak ice deposit. The spring thaw leads to further accumulation of water in the cracks, and numerous seasonal cyclings of this process produces a terrain that is cut by polygonal troughs, with the troughs occupied by ice wedges. The only problem is that temperatures on Mars, at present, are always below freezing. If the troughs are formed by a freeze-thaw process, then a much warmer climate is needed sometime in the past.

On both landers, a surface sampler, much like a shovel, dug into the surface and acquired a number of samples and delivered them to one of three openings in the spacecraft. One opening is for an x-ray fluorescence experiment to determine the abundance of various elements, one is for analysis of organic constituents, and one is for biological experiments designed to test for the presence of living organisms. The x-ray fluorescence experiment showed that the soil material at both landing sites, even though the sites were 6500 km apart, is remarkably similar. The material is a mixture of clay minerals, sulfates, and iron hydroxides. Such a mixture is produced on earth when basaltic material is chemically weathered in the presence of water. The high degree of chemical similarity between the two sites indicates that either surface materials have been homogenized by winds, or that similar types of parent materials and processes of chemical alteration are going on at both locations.

Organic analyses of the collected sediments indicate that there are no detectable organic molecules. Results of the biology experiments are difficult to interpret. A slightly positive result suggests to some that living organisms exist on Mars. However, the lack of organic molecules argues against that conclusion, and instead, forces an examination of the inorganic processes going on within the first few centimeters below the surface.

In summary, the surface of Mars contains records that testify to a range of chemical and physical processes. Climatic changes can be inferred during Martian history. Volatiles have certainly played an important and unique role in shaping the surface. Much unraveling and understanding of these phenomena will come after the Viking results are fully synthesized. Undoubtedly, understanding Mars will impact upon and improve our understanding of the evolution of the earth itself. As of this writing, both orbiters and both landers, in fact, continue to operate and to send back valuable information. The next major dust storm is expected to occur within the first several months of 1977, allowing on-site observations of changes in the surface and atmosphere as the whole planet is engulfed in a massive dust cloud.
Robert P. Morgan (at left) is professor of technology and human affairs and chairman of the new department in the School of Engineering and Applied Science. He first came to the campus in the summer of 1967 to “define a new program in the area of technology and international development” and joined the full-time faculty in 1968.

In early December, the University's newest academic department, Technology and Human Affairs, celebrated its first anniversary by sponsoring a national conference on university education for technology and public policy. The two-day meeting was attended by some 140 representatives of universities, government, industry, and public interest organizations from throughout the country.

The new department serves as a focal point for undergraduate and graduate degree programs concerned with the application of technology to contemporary problems and the assessment of the impact of technology on society. The department offers bachelor's, master's, and doctor's degrees. Only two other institutions—Stanford and Carnegie-Mellon—are believed to offer related doctorates.

In his keynote address at the conference, Professor Robert P. Morgan, chairman of the new department, spelled out the objectives of the new program. “We want our students,” he stated:

1. To receive a holistic education, not a series of course fragments, but a coordinated, “big picture” view of the relationship between technology and society; a broader perspective than conventional engineering curricula often provide.

2. To acquire a significant degree of understanding of a particular problem or issue at the technology-society interface, such as energy, environmental quality, food supply, or public health.

3. To acquire marketable skills, including conventional engineering and social science skills, combined with emerging techniques of technology assessment, technology forecasting, policy analysis, and systems synthesis and simulation.

4. To be literate and articulate, to be able to express themselves, to be capable of understanding scientific and technological concepts and their applications, and to be able to communicate those ideas to the public as well as to other scientists and technologists.

(5) To understand how the system, both U.S. and global, works, how science and technology policy are made, how decisions concerning research and development priorities are made, and how to become a part of the decision-making process.

Washington University participants in the conference included Chancellor William H. Danforth; James M. McKelvey, dean of the School of Engineering and Applied Science; Professor Morgan, and Christopher T. Hill, associate professor of Technology and Human Affairs and Chemical Engineering.

Among the many distinguished speakers on the program were Melvin Kranzberg, Callaway Professor of the History of Technology at Georgia Institute of Technology, and David R. Pittle, commissioner and vice chairman of the U.S. Consumer Product Safety Commission.

At a recent talk before the Engineers Council for Professional Development, Professor Morgan presented his own revised definition of engineering which reflects some of the ways in which people active in the field of Technology and Human Affairs perceive their profession. The definition, quoted at the conference by Commissioner Pittle, is as follows:

“Engineering is the profession in which a knowledge of the mathematical, natural, social, and policy sciences, gained by study experience, and practice, is applied with sensitivity and judgment to develop ways to utilize, economically and ecologically, the materials and forces of nature for the benefit of all persons and to assess the impacts of such utilization upon the individual and society.”
DESIGNING THE ENGINEERING FUTURE

Excerpts from the address by Melvin Kranzberg, Callaway Professor of the History of Technology, Georgia Institute of Technology

LET US SEE where the engineering profession stands today as a result of the many and rapid changes which have occurred during three decades following World War II. For one thing, the scope of engineering in terms of technical practice has been greatly enlarged. Although we still need engineers who can do all the things which engineers did before, we also need engineers who are involved in designing lasers, solid-state circuits, and advanced electrical equipment for high speed computers. Special kinds of engineers design nuclear reactors, synthesize chemicals and biochemical compounds, devise telemetry systems, and range in their work from subatomic particles to the boundless realms of space; from mining the ocean floors to gathering energy from the sun.

In order to cope with that growing body of knowledge and these new complexities, more and more engineers have had to go to graduate school. There's been an almost exponential growth in master's and doctor's degrees among engineers.

The new fields which opened after the war required engineers to solve more difficult technical problems than those which they faced only a few decades ago. A whole host of social questions new to engineering have been posed. However, our engineers' education has not been restructured to meet these new problems and issues. Nineteenth century engineering problems were classifiable under such categories as mechanical, metallurgical, electrical, chemical, structural, and the like.

The professional societies were organized around the same categories of engineering practice as were the engineering schools, but the technical problems, at least in some fast-moving areas of technology, have changed in our times and old disciplinary boundaries can no longer contain them. For example, we learn that materials of whatever nature are determined by their structures, and specialties in metallurgy, physics, and the like become part of a new interdisciplinary field known as materials science and engineering. Other disciplinary specialties have also developed, bringing together civil, electrical, mechanical, and the like dealing with such areas as urban planning, bioengineering, and computer science.

As a result of the growing complexity of today's engineering, the fundamentals of undergraduate engineering have been transformed. Math and physics, in which the engineer had but a passing acquaintance before, have now become the basic core of all engineering education, while practical courses in surveying and mechanical drawing have largely been relegated to the subprofessional technical institutes. On the other hand, the humanities and social sciences, only a minuscule part of engineering education before the war, were enlarged to about 20 percent of the student work load a few years after World War II.

I was part of this revolutionary process, and those of us engaged in teaching humanities and social sciences to engineering students introduced general education courses in the 1950's. These courses were designed to civilize the "plumbers," as engineering students were known on many campuses, by acquainting them with the best that man had thought and done in the past. We attempted to integrate vast areas of knowledge—literature, art, music, history—into some kind of meaningful package for engineering students.

The reason for the changing status of the humanities and social sciences in an engineer's education is the intrusion of public concern and socio-political problems into the practice of engineering. Why did this come about? Largely, I think, because of some disillusionment with the way that things have been going.

A hundred years ago, when Americans celebrated the centennial of our independence, they were inspired with optimism about the future. I don't have to tell you things have not quite turned out that way. A funny thing happened on the way to Utopia. Not only have we not reached the material paradise promised by technology, but every step we take along the way makes it seem as if we were running madly on a gilded treadmill. As we approached the ideal of producing enough goods and services to provide middle-class comfort for all America, we discovered that we still had an enormous number of people living at or below the poverty level.

Our astronauts can whiz around the earth in less than an hour and anyone with a credit card and a reservation on the supersonic Concorde can breakfast...
both in New York and London, or celebrate New Year's Eve three times. Yet our suburban commuters can't get to work on time, our cars are the most luxurious in the world, but we are running out of gas to run them.

**Men feel** less and less capable of understanding the world in which they live. Despite our vast communications network, people agonize as never before over the failure to communicate. We find ourselves baffled by this series of paradoxes. Who in this nation of unlimited reserves bowing from the enormous treasures extracted from the earth would not be concerned by the profligate squandering of that treasury? Who thought America the Beautiful would be pockmarked with the rash of urban blight, the scars of strip mining, and the varicose arteries of freeways? Who thought our cities would become so large as to be unmanageable, traffic so heavy it's quicker to walk than drive, and the right to drive itself threatened by political events in faraway countries?

Some of our social critics place the blame of these paradoxes on our technology, and, hence, technology is responsible for all our problems. That might be true to a limited extent, but I should like to suggest that it is not technology itself, but rather the way in which it has interfaced with other aspects of our society so that technical development frequently has unforeseen social and human consequences. This can be expressed in the form of what I call Kranzberg's First Law: "Technology is neither good nor bad, nor is it neutral." By that, I mean, technological interaction with society is such that technical developments frequently have human consequences which go far beyond the immediate purpose of the technical divisions and practices themselves.

Rather than retracing all history to demonstrate the validity of Kranzberg's First Law, all I have to do is mention the automobile, whose profound repercussion on America's culture, economy, and politics prove that technology has social ramifications which do not seem necessarily inherent in the technology itself. Some people viewed the automobile as a sex symbol, and it is now said that America's love affair with the automobile is over. That is not quite true. Instead, we have married the automobile, and, as in many marriages, the cost of divorce is simply too high to contemplate. We cannot immediately eliminate the private automobile, because we have organized our society economically and socially around the automobile and the mobility which it offers us.

As the citizenry becomes increasingly aware of the impact of technology upon our daily lives, the public is beginning to demand some voice in decisions regarding technology. People want to have some say over their own destiny. Because technology has so much to do with that destiny, they want some control over it. Hence, a new and powerful theme in public policy called participatory democracy is beginning to invade technology and attempting to democratize its professional activities and directions. The attempt of participatory democracy to control technology goes by various names: technology assessment, environmentalism, consumerism, accountability.

Let's look at the nature of problems which are going to confront engineering and all society in the future. Increasingly, the problems which engineers will be forced to deal with in the years to come are interface problems, that is, the interface between society on one hand and technology on the other. These problems can be solved, if they can be solved at all, only with the aid of scientific knowledge, technical expertise, social comprehension, and human compassion. These socio-technical problems have one thing in common: the engineer cannot solve these problems alone, nor can anyone else without the aid of the engineer.

Hence, engineers have centered upon the technical aspect of their work. Their watchword was efficiency, measured in terms of input, output, raw materials, and other factors. Now, the public has begun to demand that new factors be considered—environmental, social, and the like—and this means that the old efficiency equations must be enlarged to include these new and different kinds of parameters.

In order to enable engineering to work on these interface problems, we must give them greater awareness of the social-human parameters of their technical work. After all, engineers love to define engineering as the systematic application of science and other forms of knowledge to solve problems relating to the material needs of society.

**However, our present engineering curricula** deal with only half that definition. They provide the technical skills, but they do not relate these skills to the social context. If engineering is aimed at the needs of man in society, the engineer ought to know something about that society and its interactions with technology. So, just as the sciences and mathematics were made an integral part of the engineering curriculum in the years following World War II, I believe that the humanities and social sciences must now be integrated into the curriculum in the years to come. I am not talking about more courses or credit hours, but a realignment of our social sciences and humanities courses so as to join with the science and engineering courses in order to bring out the totality of the interface problems which our embryonic engineers will be faced with in that magic year 2000, when the students we are graduating this year will be running our country.
AT PRESENT, there is an enormous push to provide the opportunity for increased public participation in governmental activities. At our commission, for example, we have just granted a request of the consumers' union for us to develop regulations to provide money to consumer and public interest groups for them to hire technical experts so that they can participate in their own way in our proceedings. These consumer groups, for example, will be looking for competent and economically unattached engineers, lawyers, and economists to help them make and present their own views and to make an impact on the development and analysis of our standards.

To my mind, the university campus will be the prime source of this talent. If Senate Bill 2715 passes, and there is all likelihood that it will, all federal agencies will have this program available to them. Senate Bill 2715 is one which says all federal agencies who have these types of process-developing standards will be able to give money in some limited and regulated way to public interest groups who want to hire technical experts so that they can participate, because right now the only people that do participate are the industries that are being regulated. But this will require that your curriculum be threaded through and through with the philosophy that places a major impact on the public interests. Your students need the ability and the determination to consider both the long-term and broader view of actions that they take when they become professionals.

Case studies of successful industrial procedures would be a highly useful experience. As starters, I would send some of my better students out to study the operating philosophies and procedures of the major toy manufacturers, such as Mattel or Play-School. They really do a job in finding out how people are going to interact with their product.

For my very best students, I would assign them to study the quality control and safety procedures that have been instituted at the Gillette Company, and I would get in contact with that company's vice president for quality control and safety.

The use of scientists and engineers in developing public policy has become an extremely delicate activity. You are here working out ways to integrate technical education with the social implications and ramifications of applying that technology. Just not too far down the road there are some public policy makers who are trying to separate and control the many influences that technologists have on public policy decisions. Now, most issues I deal with and most of the regulatory decisions have both a technical component and a very heavy value-laden component, neither of which I think can be evaluated by the same techniques as the other.

And most issues usually have considerable uncertainty associated with each component. A case in point is the recent fluorocarbon issue and the government's decision to ban aerosols that have fluorocarbons as propellants. In a case such as this, when an agency is faced with a high degree of scientific uncertainty, there is clearly a need for some formal method of scientific peer review in order to assure the correctness of the technical aspects of the decisions we make. However, in this connection I would like to emphasize that there is an important distinction between the method of assessing the degree of certainty and the separate judgment that sufficient certainty is present to commence government activity.

The latter question involves examination of the agency's mandate in
order to determine the level of certainty intended by Congress. The degree of certainty that is required before action may vary from agency to agency or may vary within an agency, depending upon the particular statute under which the regulation is proposed. More often, the decision that regulation is needed in the face of any uncertainty is not a scientific judgment; it’s a social one that requires regulators to weigh the degree of potential future illness and misery against the potential harm of economic disruption and unemployment and the restrictions on consumer choice that arise from changing or removing products from the market.

Peer review mechanism should be limited to an assessment of the available data and the weight that it should be given in view of the facts as yet unknown and theories as yet untested. Ideally it would also include a full description of how to reduce uncertainty by specific amounts and the cost in time and resources for that reduction.

In the case of the Consumer Product Safety Commission, the trigger for regulatory action is a finding by the Commissioners that a risk exists and that the risk is unreasonable in nature. In the House report accompanying the Act, Congress directed the Commission to determine whether risk associated with a product is unreasonable by balancing the probability that a risk will result in harm and the gravity of such harm against the effect on the products, utility and cost.

Some people have suggested that there is another mechanism that might help to resolve some of these technical issues: a science court. This general concept calls for a panel of scientific experts who would hear and judge cases presented by opposing scientific advocates. Those cases would concern current problems facing regulatory agencies and other governmental bodies, where there is substantial disagreement on questions of science and technology. Ideally the court, which would use an adversary system, would concern itself only with technical matters and not with social or policy judgments. This concept appears to answer one of the major concerns that I expressed about turning the ozone problem over to NAS. However, the creation of an entire court structure simply to attempt to remove the value judgments from scientific conclusions strikes me somewhat akin to the left-handed use of a sledgehammer to drive a carpet tack. It seems that the tool is much more potent than is needed, and, it could do some harm.

While I am in complete agreement with the desired goals, I have a major reservation about the need for and the utility of a science court as a technique to aid government decision-making. The conclusions reached again would have a very strong binding effect on the agencies involved, simply because of the public aura that would be associated with such an impressive character. What scientist is going to stand up to a science court where the finest minds in the country have made an evaluation and say they are wrong? But more importantly, the length of time needed for that body to deliberate will hamper responsive government regulation of public health and safety.

Moreover, highly complex scientific matters about which there is disagreement seems to me likely to have two natural characteristics. The first is that disagreement exists precisely because the answers are uncertain in resolving the uncertainty. Questions of policy are just plain difficult to avoid.

The second is that there will be more than two sides to the disagreement. No company is going to let somebody else's lawyer or somebody else's advocate go in and argue about the survival of his product. Everybody who manufactures fluorocarbons is going to want to have his chance to defend them, and so there are not going to be two sides, but many sides, and everybody is going to want due process.

There needs to be some experimentation on improving the process of arriving at decisions in complex and uncertain matters, and I think these could be good research projects. My suggestion is to try to add adequately funded public participants in various informal agency processes before considering the idea of a formalized procedure such as a science court.

I am only one of five charged with jointly considering and arriving at decisions that we hope are in the best interests of the public. The Commissioners are persons of diverse backgrounds, and include at the moment a chemist, a lawyer, a business man, an engineer, and myself. The decisions that we make are constrained by the standards set forth in the laws that we administer and the evidence of the record before us. Very importantly, we are accountable to the courts and to Congress for the exercise of our judgment. We could be reversed by the courts if we act arbitrarily, and Congress can cut off our funding or amend our laws if we fail to carry out their intent.

Panels of scientists, on the other hand, whether they are convened by the National Academy of Science or by a court of inquiry, are accountable only to their peers. In my opinion, this is an extremely important reason why such panels should not make decisions that go beyond the bounds of their scientific expertise. However, that does not mean that I think that scientists and engineers shouldn’t be permitted to express their views on policy. On the contrary, their recommendations as to policy should carry no more weight than those of any other informed and enlightened citizens.
January Hall was the first building on campus exclusively designed by and credited to James P. Jamieson. He sketched it in 1914 (appearing here) although the building was not completed until 1923.
The Fred R. Hammond collection of original drawings, renderings, and photographs of Washington University's Hilltop campus came to the University Archives last spring. It is a gift of the firm of Hammond, Charle, Burns and LePere, St. Louis, in memory of the late Fred R. Hammond, an alumnus of the University and one of the architects of the middle building period of the campus.

About 1900, Cope and Stewardson of Philadelphia dispatched James P. Jamieson to St. Louis to direct the building of the original Hilltop campus, which they had designed. Two years later, following Walter Cope's untimely death, Jamieson was called back to Philadelphia and, for a decade, he commuted between the two cities. In 1912, however, by mutual consent, Jamieson took over the St. Louis office as his own. He was joined by George Spearle in 1918. Fred Hammond joined them in 1924 and was made a partner in 1937. Together they continued to design and build Washington University's main campus. This firm evolved to today's Hammond, Charle, Burns and LePere, Architects and Planners.

The original competition drawing submitted as a part of the Cope and Stewardson plan is shown. The closed quadrangle idea of the English college was almost completely abandoned as the campus was continued west from the Brookings Quadrangle, but the shape of the campus was set by this concept.

This rendering by Jamieson and Spearle, showing development of a “forecourt,” is dated 1929. On north portion, balancing existing southern buildings, was to be a great hall and other art and performing arts buildings.
Drawing of 1928 shows a proposal for a University stadium to be built near Millbrook and Big Bend intersection. Designed to seat 50,000, the stadium was planned to help the University stay in big-time athletic competition. It was to cost $450,000 to construct, but was never built.

It is the continuity of campus architecture brought by Jamieson and Spearle and its associates that is, in large part, responsible for the beauty of the campus today. The firm continued to carry out the brilliant master plan for the campus originally developed by Cope and Stewardson. January, Wilson, Bixby, Rebstock, the Field House, Wilson Pool, the Women’s Building, Brown, fraternity houses, and even the Power Plant, with its Gothic smokestack, were designed by the firm. All continued to carry on the original scheme of quadrangles and green malls, unviolated by the automobile.

F. F. Lincoln sketched this view of the south side of the Brookings Quadrangle in 1900. His connection with the University architect is unknown, but from its date, the sketch is obviously an artist’s conception. Busch was the first building to be constructed, but its cornerstone was laid on October 20 of the year of the sketch.
The Hammond Collection includes a scrapbook containing 156 original pencil sketches of the "bosses" which ornament the original buildings on the Hilltop. The artist, or artists, who drew the sketches is unidentified, and it is not known whether the sketches served as models from which stonemasons worked, or if they came after execution. Jamieson carefully explained, however, that the word gargoyle was inappropiate because water from the roofs is carried away by copper pipes and does not "spill out over the campus by means of a 'gargoyle.'" The carved stone heads, figures, and grotesques are ornamental rather than functional, he said, and one can almost hear him sigh "Thank heavens."
A Gallery Of Trustee Profiles

I. E. Millstone

TRUSTEE I. E. MILLSTONE, whose seventieth birthday was celebrated recently at a dinner sponsored by many of the community organizations he has served through the years, has been a part of Washington University for a good many of those seventy years.

Growing up in the central west end of St. Louis, he played as a child on the grounds of the old Manual Training School, then a part of the University, and he later attended the Ben Blemet school in the same building. He entered the University in 1923 and graduated in 1927 with a degree in architectural engineering. He has been actively associated with the University ever since as friend, adviser, benefactor, and since 1964, as a member of the Board of Trustees.

Looking back on the occasion of his seventieth birthday, Millstone said recently, "Four things have really been important in my life: my family, my religion, my profession, and Washington University."

As an undergraduate, Millstone was kept extremely busy with an academic program that covered both civil engineering and architecture. He did find time, however, for the swimming team. For four years, he was a diver and freestyle sprinter on a team that won national recognition. Goldie Gollin, who later became Mrs. Millstone, was at the University at the same time, receiving her A.B. in 1928.

After graduation, the young architectural engineer was co-founder of a small structural engineering company, Perbal and Millstone. In 1930, when Perbal left the field for other interests, the firm became Millstone Construction Company. Through the intervening years, the company has become a giant in its field and has built a strong reputation as an outstanding corporate citizen and as a pioneer in both technological innovation and enlightened human relations.

The list of Millstone Construction projects seems endless. One of the firm's first major jobs was the Malcolm Bliss Hospital, completed in 1937. In the same year, Millstone built the first public housing project in the United States—500 homes in St. Petersburg, Florida. In St. Louis, the company later built the Clinton Peabody project, the Cochran Apartments, Pruitt-Igoe, Blumeyer, and many others. Of great significance both to the St. Louis area and as a national model is Laclede Town in the Mill Creek Valley. Millstone Construction built, owned, and operated Laclede Town, in Millstone's words, "to prove that people of different races and backgrounds can live together in harmony."

When the new state of Israel came into existence after World War II, Millstone was asked by Prime Minister David Ben-Gurion to round up a team of architects and builders to plan housing for the thousands of immigrants who were pouring into the area. After thorough study and field work, Millstone and his team recommended that indigenous materials could be used for building, so that little precious hard currency would have to be spent on importing foreign materials. They recommended further that new immigrants be used to do the work, which would give the new citizens jobs and a real participation in building their country.

A major concern in Millstone's life is young people and the need to help them develop their potential and the kind of leadership they will have to provide if the world is to survive. Long active in the community center work, he was president of the St. Louis YMHA and served as president of the Jewish Community Center in St. Louis County.

After serving as president of the Jewish Community Centers Association of St. Louis and as vice president of the National Jewish Welfare Board, he was elected in 1970 as president of the World Federation of YMHAs and Jewish Community Centers. He is currently vice chairman of the board of Hebrew Union College, where he has been director for the past fifteen years.

At present, Millstone is a member of the executive, development, educational policy, real estate, and buildings and grounds committees of the WU board. As chairman of the buildings and grounds committee for many years, he has done much to help preserve the beauty, maintain the efficiency, and safeguard the investment in plant and property of both the Hilltop and the medical campuses.

In the late 1960's, Millstone was asked to head the Visiting Committee of the School of Dentistry. At the time, the School was trying to cope with hopelessly inadequate facilities, mounting deficits, and the very real possibility of having to close its doors. The Visiting Committee, working with the School's faculty and alumni, made recommendations that turned the entire picture around. Today, the School of Dental Medicine is a vigorous teaching and research center with completely modernized and efficient facilities.

In 1973, Millstone was recognized by Washington University with the naming of the Millstone Lounge and Plaza in his honor. The plaza is the main pedestrian entrance to the campus from the north, and the lounge in the bridge above, spanning Bryan and McMillen Halls, is used by the students and faculty of the School of Engineering from which Millstone received his degree fifty years ago this spring.

Looking back on his long and busy career, Millstone observes, "I have always felt that I must give back something to any individual or organization that has helped me. That is why I felt an obligation to help minorities achieve positions in the construction industry, why I have worked with youth organizations, and why I have tried to give as much of my time as possible to Washington University."
With the addition of a beard and a red cap, John Merrill Olin would make a wonderful Santa Claus. His eyes are merry, his cheeks are pink, and his voice would do nicely in Ho! Ho! Ho! But at 84, Olin is a tough campaigner whose opinions were hard to figure out.

Olin believes that if you seek the fundamentals of a problem, you can make a decision easily. Over those decisions he has battled with corporate and civic boards and university administrators for more years than he cares to remember. He joined the Washington University board thirty-three years ago, and he recalls distinctly that he and Chancellor Harry Wallace disagreed over a basic principle at that time.

"After some lengthy board deliberation, Wallace said the matter discussed was not one he really had to bring to the board, as it could have been made by the faculty. I said, 'Wait a minute. If you are saying the board does not set fundamental policy, then I and all others should resign.' That is what boards are for."

A decade ago, when Olin Mathieson Chemical Corporation bestowed the title of honorary chairman on Olin, he told them he didn't believe much in titles, but if they dropped the "h" to make it "onery," he would try to live up to it.

Olin's style is to listen patiently and, when the bare bones of the matter become clear to him, act. "I've never been through an hour meeting, that the substance couldn't be boiled down to three or four fundamentals. There is no sense floundering around after those are clear."

He recalls learning that lesson as a college student working with Cornell Professor Emil Chamot, an expert on microscopic analysis. "Our work was done at night, and once, very late, he pushed back his chair and said, 'Olin, we are being defeated by this problem because we have not determined why it occurs. Often, when one learns why something occurs, the remedy suggests itself.'"

The second son of Franklin and Mary Olin of Alton, Illinois, John was born the year his father founded Equitable Powder Manufacturing Company. The elder Olin trained his sons for the business. Franklin, the eldest son, went to Cornell for a mechanical engineering degree, and John followed a year later. At Cornell, however, he discovered he had a better aptitude for chemical engineering than mechanical. After a stormy session with his father, he switched his field.

He entered Western Cartridge Company and Equitable Powder in 1913. During World War I, he was assistant to the president, and, in 1919, became first vice president and a director.

"With the war, we worked eighteen hours a day, but I began to see that after the war, the future of the company lay in places for people to shoot. I started to work to establish preserved shooting complexes. At that time, it was illegal to sell even pen-raised wild birds, so we started by getting some laws changed. That's how I got into the conservation business. It wasn't all altruistic, as it advanced preserve shooting and game breeding related thereto to economic success."

This interest led later to the establishment of NILO farms and NILO Kennels, north of Alton, where an outstanding experimental and demonstration shooting complex was developed. Also, Labrador Retrievers and English Springer Spaniels were bred, raised, and trained there for use on the preserve shooting complex and, further, to demonstrate the value of such dogs to hunters as a very important contribution to game conservation by retrieving downed and crippled birds.

In 1944, when the Olin family merged its interests into Olin Industries, John became president. When that company merged with Mathieson Chemical Corporation in 1954, he was named chairman of the board. He held the position until 1957, when he left the full-time responsibilities for the chairmanship of several important committees.

In Olin's spare time, he bred and raised thoroughbred horses, among them Cannonade, the 1974 100th Anniversary Kentucky Derby winner. Recently, he disposed of all of his racing stock except the stallions. He also owns a plantation in Georgia, where he raises peanuts and pecans. Of another Georgia planter he says, "Well, I'm an acquaintance, not a friend."

Olin now is devoted to educating generations of Americans in the ways of American business and the importance of free enterprise. "I believe revitalizing the free enterprise system is the only way to save the country. Higher education may be a critic of the system, but must not condemn it, and in my opinion, should assist in attaining the objective of revitalizing the free enterprise system which has made this country what it is. When we entered the era of public ownership, we did not also enter a strong program of public education. I saw an opportunity at Washington University to do that, and I am encouraged by the progress."
Edward A. O'Neal

Edward A. O'Neal, chairman of the board of the Monsanto Company from 1965 to 1968 and a Washington University trustee since 1966, grew up on his family's cotton plantation in Alabama. His father was the organizer and a long-term president of the American Farm Bureau Federation.

Ed's family wanted him to become a minister and he entered Davidson College to pursue a divinity program but soon transferred to science, graduating in 1926 with a degree in physics.

When he finished college, however, he decided that what he really wanted to do was to raise cotton on the family farm. "The only thing wrong with the idea," he recalls, "is that at the time cotton was selling for seven cents a pound."

Instead of raising cotton, Ed went into the chemical industry—an industry that among myriads of other products has produced astronomical quantities of synthetic "cotton." He started work in research at a small Alabama firm, the Swann Company. "I was no chemist," he relates, "but I made out somehow for a couple of years until they finally put me in the manufacturing end where I belonged."

A few years after O'Neal went to work for the Swann Company, Monsanto acquired the firm and O'Neal soon became plant manager. A little later, he was called on to set up and then manage a phosphate plant in Michigan. His rapid rise up the corporate ladder had begun.

When World War II ended, Edgar M. Queeny, then head of Monsanto, sent O'Neal to England to determine whether the company's British subsidiary in view of government might nationalize the industry.

"Why don't you take the job?" So, he resigned his Monsanto positions and became president of Chemstrand, going back to his native Alabama, where the company has its main plant.

After Chemstrand became a division of Monsanto in 1961, O'Neal returned to corporate headquarters, where he was re-elected to the board. He was re-elected a vice president in 1962 and became chairman of the board of the Monsanto Company in 1965. He retired from that position in 1968, but remained a member of the board until September, 1975.

O'Neal joined the Washington University Board of Trustees in 1966. Believing that "if you agree to serve on a board, you should be willing to work," he accepted the challenge to be chairman of the corporate division of the University's Seventy by Seventy campaign, undertaken to raise $70 million from private sources by 1970. Later, he became chairman of the board's advancement committee, which was responsible for the successful conclusion of the drive. Not only was the drive successful, the $70 million goal was met a year in advance.

In 1972, Edward A. O'Neal received the William Greenleaf Eliot Society Award, presented annually for outstanding service to Washington University. In making the award, Morton D. May, president of the Society, made a statement that summarizes Ed O'Neal's service to the University. "His vigorous enthusiasm," May said, "has succeeded in gaining many new friends for the University, and has helped bring support from the business community to a new high."
George E. Pake

George E. Pake, vice president of the Xerox Corporation, has spent most of his life in a university atmosphere. He grew up on the campus of Kent State University, where his father was a professor of English and where George attended the university's laboratory school and took college math courses when he was still in high school.

From the time he enrolled at Carnegie Tech as a freshman until he received a Ph.D. degree from Harvard, he missed his goal of "a Ph.D. by twenty-three" by three months. He earned both the bachelor's and master's degrees from Carnegie in thirty-two months, but because of that year off with Westinghouse, he missed his goal of "a Ph.D. by twenty-three" by three months.

Pake was the first Harvard graduate student to work in the field of nuclear magnetic resonance with Edward Purcell, who was later to win the Nobel Prize. Pake came to Washington University—in 1948 as assistant professor of physics. Four years later, at age 28, he earned his Ph.D. degree from Harvard.

"I realized that I had been out of physics too long to work on the frontiers of science anymore," Pake relates. "In addition, I felt that I knew all the problems of universities—not the answers but the problems—and I was interested in learning more about the corporate world and its problems and challenges."

"When Xerox came to me," he continues, "and said, 'We want to start a brand-new research center in a university environment and would like you to set it up and manage it,' I couldn't resist."

Pake felt, too, that perhaps he could do something in the new position "not just for Xerox but also for the state of science in the country at a time when the Viet Nam war seemed to be turning people off from science and technology."

For many years, George Pake has been an important figure in the national science picture. He was appointed by President Johnson to serve a four-year term on the President's Science Advisory Committee. The Committee, abolished by President Nixon in his second term, consisted of eighteen eminent scientists who met at least monthly with the President's science advisor and several times a year with the President to give the results of their thorough study of areas of national importance in science and technology.

Pake was elected to the National Academy of Sciences and the American Academy of Arts and Sciences. He is the incoming president of the American Physical Society for 1977. He has served on the High Energy Physics Advisory Panel of the Atomic Energy Commission and on the Committee on Grants Administration Policy of the Department of Health, Education and Welfare.

In 1964-66, Pake served as chairman of the National Academy of Sciences' Physics Survey Committee, which made an exhaustive study of the nation's needs, facilities, and priorities, and recommended guidelines for national priorities in physics research and graduate education.

When Pake decided to go into industry, he was asked to join the University's board. "Actually," George says, "one of the conditions I made with Xerox was that I would have sufficient time to serve on the board. Xerox agreed enthusiastically because it encourages its executives to take that kind of responsibility."

George Pake brought an unusual background to the board. "I've had the opportunity now," he says, "to view the board from three vantage points: as a faculty member, as an administrator, and finally, as a trustee myself."

As Provost and Executive Vice Chancellor, Pake for many years would make the recommendations to the board's Committee on Educational Policy which considers faculty appointments and promotions. Since coming on the board, he has headed that committee.

"Washington University is almost unique in the nation in that, as a private institution of higher learning, it has managed to build and to maintain such a strong and mutually beneficial involvement with its community."

Regardless of the great financial pressure that Washington University shares with other private institutions of higher learning, Pake is convinced that the University will endure. "The challenge is not just to survive," he declares, "but to keep the University strong and thriving and to maintain its steady increase in academic excellence."
ON ALUMNI ANNUAL GIVING

During the period from July, 1972, through July, 1976, the number of alumni donors to Washington University has doubled. Over the same period, the total dollar contribution from alumni increased by nearly 15 percent.

In 1972, fewer than 6,000 alumni, or about 10 percent of the total number, were donors; this past year, more than 11,500 alumni, or about 20 percent, gave to their university. The national average of alumni givers at all colleges and universities is approximately 17 percent.

This has been a heartening development because the period covered has been one of growing economic problems and galloping inflation. That the number of alumni who chose to give to the University during this trying period has doubled is a tribute both to the alumni and to the University.

It is a tribute also to the hundreds of alumni throughout the country who have become involved in helping the University to raise funds in these trying times. These volunteers have reached thousands of other alumni personally and through the “phonathon” telephone solicitations sponsored by alumni groups in Washington University “alumni council cities” throughout the nation. A great deal of credit is due, too, to the many student volunteers who manned the phones in the St. Louis area phonathons.

It was a strong and impressive achievement to double the number of alumni donors in just four years, but the alumni-giving program continues to set higher goals. The next target is 25 percent participation, which would mean somewhere between 15,000 and 16,000 alumni contributing what they can to the University on an annual basis. It is interesting to note that some similar institutions receive annual support from 25 to 30 percent of their alumni. Washington University’s target is a realistic next step.

The successful conclusion of the drive to match the $60 million grant from the Danforth Foundation has helped the University maintain its scope and quality. The $60 million Danforth grant will go into the general endowment fund to help enable the University to operate without dismantling or weakening existing programs. The matching funds were given mainly for special programs of great value to the University’s major educational goals, but only a small part of those funds are available to meet the ongoing costs of operating the institution. Careful fiscal management and stringent budget control are very much the order of the day. It is the kind of dependable unrestricted annual giving that so many of the alumni gifts represent that is essential to the continuance of Washington University as a first-rate educational institution devoted to excellence.

When the portrait of Eli Robins, shown on the facing page, was unveiled, one of the speakers was Dr. Samuel B. Guze, vice chancellor for medical affairs and chairman of the Department of Psychiatry. Dr. Guze used the occasion to take stock of the psychiatry department today. His appraisal merits quoting in full:

At a recent meeting, leaders of American academic psychiatry were nearly unanimous in their expressed belief that American psychiatry had made a serious mistake in permitting its medical orientation and identification to become attenuated, a mis-

Recently unveiled at the School of Medicine was this portrait by Gilbert Early, BFA 59, of Dr. Eli Robins, Wallace Renard Professor of Psychiatry, who served as chairman of the Department of Psychiatry from 1963 to 1975.

take in which, they recognized, we had not shared.

We have stood consistently for the medical model in psychiatry, for the importance of systematic data, for a broad spectrum of research, and for encouraging young people to embark upon academic careers. We will continue to follow the path that Eli Robins mapped for us. We represent something special in American psychiatry, and we believe that others think so too.

We speak for and defend psychiatric patients and their families. We do not blame them for their disorders. We do not ignore or demean their suffering by denying the reality of psychiatric illness.

We understand that psychiatry does not yet know enough to do justice to the seriousness of psychiatric disability and that to teach this is one of our responsibilities. We believe that only through research can psychiatry hope to do better.

We accept our responsibility as physicians to relieve as much suffering as possible—through compassion, support, encouragement, and symptomatic treatment—when we cannot cure or prevent. We accept our responsibility to attract and train imaginative and creative psychiatric investigators as well as careful, thoughtful, caring psychiatric practitioners.

We believe that research of all kinds is needed: neurobiologic, genetic, clinical, sociologic, epidemiologic. We recognize that scientific psychiatry depends on understanding how the brain works and how people react to varying familial, social, and cultural forces. We believe that there is no conflict in these twin goals.

The Fall, 1975, issue of this magazine carried an article about a student named Stephen Lockhart, Arthur Holly Compton Science Fellow, mathematics major, author of a nationally recognized paper on urban planning, violinist, composer, karate student, cross-country runner, and amateur magician, among other things.

Lockhart, who is completing his undergraduate work at Washington University in three years and now is a senior, has been selected as a Rhodes Scholar. He is one of thirty-two students chosen from colleges and universities throughout the country by the Rhodes Scholarship Committee to receive a two-year scholarship for graduate study at Oxford University in England. He plans to study mathematics at Oxford and eventually to pursue a career in biomathematics.

---FO'B