Massachusetts Institute of Technology

TECH TALK

June 2, 1976
Volume 20
Number 42

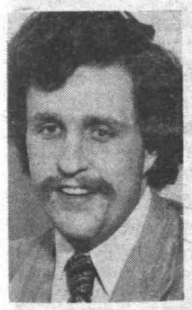
Corporation Elects New Members

Mr. Cook

Dr. Landau

Mr. Littmann

Mr. Mills



Mr. Moody

Mr. Mueller

Mr. Olsen

Mr. Richardson

Mr. Vetter

Mrs. Whitaker

The MIT Corporation Friday elected three Life Members, five Term Members and one new Representative from Recent Classes. The Life Members formerly were Term Members.

The elections were held at the quarterly meeting of the 87-member Corporation which preceded MIT's 110th annual commencement exercises and were announced by Howard W. Johnson, Chairman of the Corporation.

The three Term Members elected to Life Memberships were:

Paul M. Cook, president of Raychem Corp. of Menlo Park, Calif. He is a 1947 graduate of MIT in chemical engineering. He was elected a Term Member of the Corporation in 1971. Mr. Cook has served on numerous visiting committees for the Institute. In addition, he has been a leader in alumni activities in the San Francisco area, served on

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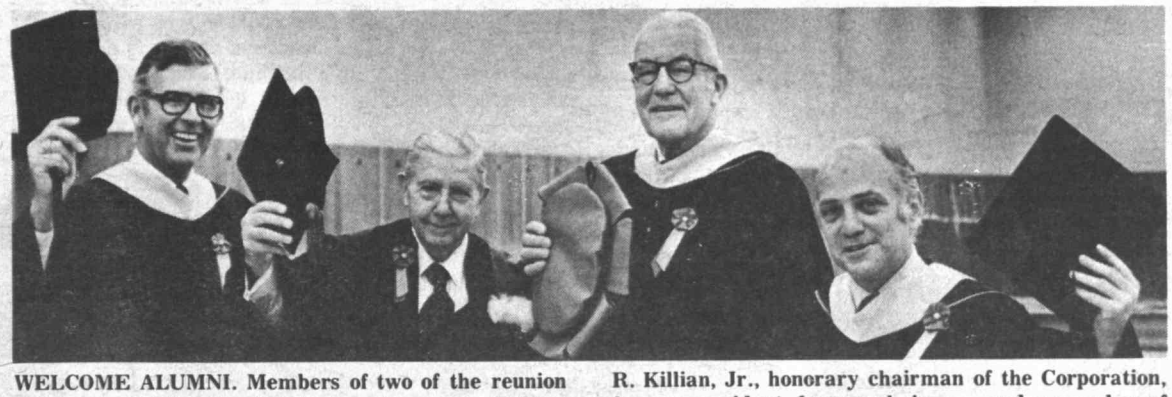
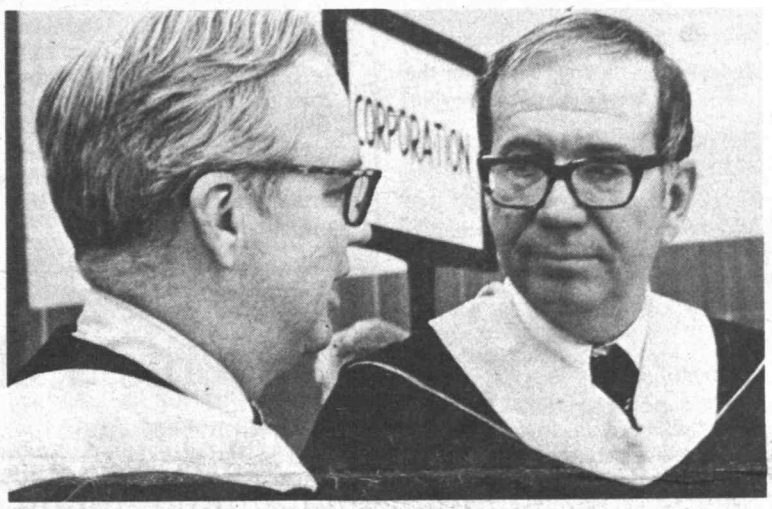


WELCOME ALUMNI. Members of two of the reunion classes that will be meeting this week as part of MIT's Technology Days marched in last week's Commencement exercises and took the occasion to doff their hats in welcome to alumni who will be attending the annual alumni gathering this week. Shown above are Breene M. Kerr of Oklahoma City, of the 25 - year Class of 1951 and a member of the MIT Corporation; Dr. James R. Killian, Jr., honorary chairman of the Corporation, former president, former chairman, and a member of the 50-year Class of 1926; David A. Shepard of Greenwich, Conn., a member of the Class of 1926 and also a member of the Corporation; and Dr. W. Gerald Austen, chief of surgical services at Massachusetts General Hospital, a Corporation member and a member of the Class of 1951. *—Photos by Calvin Campbell*

MACE BEARER and Chief Marshal at MIT's 110th Commencement Friday (May 28) was John J. Wilson, Secretary of the MIT Corporation.

Those students who received degrees last week and who are continuing at MIT in the fall are requested to notify the Student Accounts office so that they will receive fall term pre-billing statements and literature. Continuing graduate students should call ext. 3-3335 and students who received undergraduate degrees should call ext. 3-5132.



EDWARD O. VETTER of Dallas, Texas, right, former executive vice president of Texas Instruments Incorporated, and president elect of the 60,000-member Alumni Association of MIT, chats with Howard W. Johnson, chairman of the MIT Corporation, just before the start of Commencement. Mr. Vetter, a member of the Class of 1942, is a member of the MIT Corporation.

Graduates Urged to Foster Diversity, Freedom, Initiative

Technology, the hallmark of modern industrial societies, must be managed in ways that foster and promote human diversity, freedom and initiative, MIT President Jerome B. Wiesner told 1,300 graduates Friday at the Institute's 110th commencement exercises.

"The greatest challenge we face," Dr. Wiesner said, "is that of managing our technology more effectively, but doing it in ways that preserve the diversity, freedom and initiative of our people and institutions, industrial and educational.

"I have confidence in the American people's ability to meet this challenge."

More than 3,000 people attended the commencement ceremony in Rockwell Cage. The main address is traditionally delivered by the MIT president.

Dr. Wiesner said he believes that humanity, "in a halting way with many ups and downs," is struggling forward "toward a more satisfying life for people."

He said the roles of science and technology "loom large in any discussion of modern society, and particularly any examination of future prospects...Although there is genuine basis for the frequently expressed fear of large-scale technology, I am convinced that there is no other viable option for humanity."

Dr. Wiesner also said that a successful technologically based society must be "in a continuing state of change and evolution, requiring new technologies and new organizational forms, new relationships, and probably even new life styles as it evolves."

But there is no reason, he went on, why change must be traumatic.

"Our goal should be to do things better, with less impact on the environment, less burden to the

(Continued on page 8)

MIT's Olympic Hopes Plentiful

MIT's potential and real involvement in the Olympic Games at Montreal this summer takes in shooters, rowers and a rowing official, as well as a wrestler.

Tech Talk reported last week that MIT student Erland Van Lidth de Jeude, a wrestler and singer of some note, is trying out for the Olympics in the heavyweight division of Greco-Roman wrestling and also would like to sing the National Anthem at the international competition.

But that is only part of the MIT Olympics story, it turns out.

The rest involves:

Two members of the MIT Rifle Team, **Jerome F. Dausman**, who received his SB in architecture last week, from Grand Rapids, Mich., and **Alan M. Marcum**, a sophomore in computer science from Syracuse, N.Y.

A member of the MIT Pistol Team, **Stephan C. Goldstein**, a senior in electrical engineering, from Providence, R.I.

Two rowers, **John G. Everett**, a senior in civil engineering from South Easton, Mass., and **Gary G. Piantedosi**, a member of the Class of 1976, from Burlington, Mass.

Also, **Jack H. Frailey** of Concord, Mass., MIT director of student financial aid.

The only one certain of going to the Olympics in an official capacity is Frailey, who has been named manager of the US Olympic Men's Rowing Team, putting him in charge of arrangements for a squad of 43.

Frailey, who received the SB, SM and AE degrees in aeronautics and astronautics from MIT, rowed in his undergraduate years from 1941 to 1944 as a lightweight oarsman. He was captain in his last year and received the Molinar Trophy, the inspirational trophy award.

In 1954, while working at MIT, he was asked to coach the lightweight crew. It won the national title and went to the Henley Royal Regatta in England, where it won the Thames Challenge Cup—a feat repeated a

(Continued on page 5)

Technology Days

Medicine, Energy Sessions Friday

A Nobel Laureate and an internationally known authority on nuclear engineering will be among the lead-off speakers at a Technology Day program for some 2,000 MIT alumni and their families Friday (June 4).

A morning program on "The Medical Revolution" will have two speakers—Dr. Salvador E. Luria, Nobel Prize recipient in 1969 and director of the MIT Center for Cancer Research, and Dr. Irving M. London, director of the Joint Harvard-MIT Program in Health Sciences and Technology.

At a simultaneous session on "The Energy Revolution," one of the speakers will be Dr. Norman C. Rasmussen, head of the MIT Department of Nuclear Engineering and director of a study that gained worldwide attention on the risk to the public from nuclear power plant accidents. Others on the panel will be Dr. David C. White, director of the MIT Energy Laboratory, moderator; Dr. Morris A. Adelman, MIT professor of economics; Dr. Jean F. Louis, MIT professor of aeronautics and astronautics, and Dr. Ronald R. Parker co-director of the ALCATOR project, MIT's fusion machine.

The afternoon programs will have 11 simultaneous sessions, the majority focusing on research in energy technology. The sessions:

"Discussions of Research Waste Heat Management at the Parsons Laboratory for Water Resources and Hydrodynamics," Dr. Donald R. F. Harleman, MIT professor of civil engineering and Ford Professor of Engineering, and Dr. Gerhard H. Jirka, lecturer in civil engineering.

"Fossil Fuel Research in the Sloan Laboratories," Professor Louis.

"Fuel Conversion of Primary Sources to Usable Forms," Dr. Jack B. Howard, professor of chemical engineering; "MIT's Energy Laboratory: Research and Outlook," Professor White; "Nuclear Engineering Department Tour," Professor Rasmussen; "Panel on Energy Policy, National and International, and the Effects of Technology," Professor Adelman, moderator; "Solar Energy Research at MIT," Dr. Roy Kaplow, MIT professor of materials science and education; "Tour of ALCATOR and the Francis Bitter National Magnet Laboratory," Dr. Donald T. Stevenson, assistant director.

"Cancer and the Cell Surface," Dr. Richard Hynes, MIT professor of biology; "Viruses, Cell Regulation and Cancer," Dr. Phillip A. Sharp, MIT associate professor of biology.

"A Special Look at MIT in the 1920's," Dr. James R. Killian, Jr., former MIT president and now Honorary Chairman of the Corporation; Dr. Charles Stark Draper, Institute Professor emeritus and professor of aeronautics and astronautics emeritus, and Warren A. Seamans, director of the MIT Historical Collections.

In the panel moderated by Professor Kaplow, a report will be presented on a new solar energy converter with the potential for providing supplemental electricity and hot

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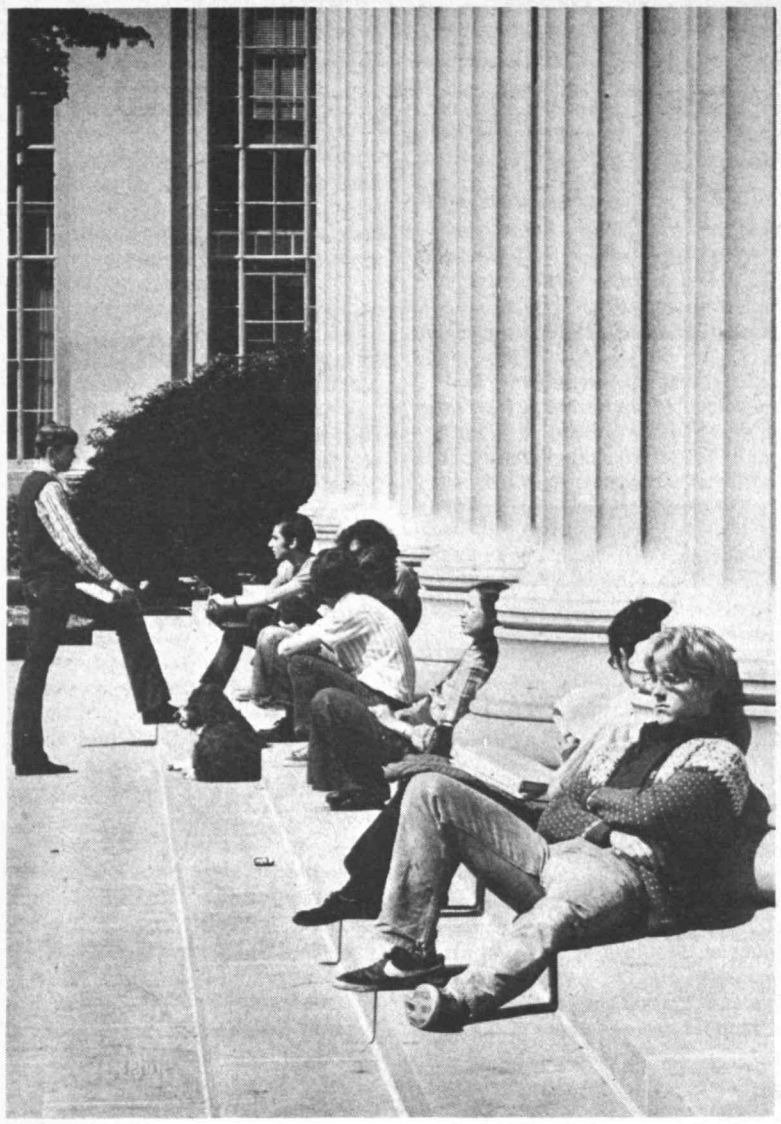

MAUD, A SPRINGER SPANIEL, joins students at a midday siesta on the steps of the Maclaurin Building. *—Photo by Calvin Campbell*

Cause Found for High-voltage Line Noise

Sizzle of Bacon, Murmur of a Brook

MIT electrical engineers believe they have found the cause of often irritating noises produced by wet high-voltage electrical transmission lines.

Alternately described as the "sizzle of frying bacon" and the "murmur of a babbling brook" the noise is at the very least a headache for electric power companies and was given as one reason for a recent moratorium in New York State on construction of new high-voltage lines.

MIT engineers have found the noise is produced in much the same way as thunder. They also have found a low-cost way to reduce the noise levels by a factor of 10 and their remaining problem is to demonstrate that the solution will work for long periods of time.

The group consisted of Dr. Inge Johansen, visiting professor from the Norwegian Institute of Technology; former graduate student David Tong; and Dr. Gerald Wilson, MIT's Philip Sporn Associate Professor of Energy Processing. (They based their studies on previous work by former graduate student Donald Bosack.)

The group found that the noise is caused when water from rain or fog condenses on the transmission line. The high electric field of the transmission line makes the drops of water become pointed; these pointy drops, in turn, intensify the electric field.

The electric field then produces both light and noise in much the same way that lightning and thunder are produced. The electric field separates the surrounding air into charged particles, producing a glow of light called corona.

But some of the electrical energy goes to heating the air, producing waves that we can hear as a sizzle—or babble.

How could this be avoided?

"Johanson and Tong decided that the thing to do was to make the water go inside the transmission line, which is made of several smaller strands," Professor Wilson said.

"If you could make the water hitting the line get pulled inside, where there is no electric field, you could eliminate the noise," he said.

Of course no one wants a waterlogged conductor. But since a transmission line sags between two towers, Professor Wilson said, the water would run down to the center, where it could be made to leave the conductor.

At that point, he said, one could reduce the electric field, to keep the noise to a minimum. The electric field couldn't be reduced all along the line because the line couldn't support the extra weight.)

"The next question," Professor Wilson said, "was how to make the water go inside?"

After experimenting with various ideas, the researchers found that by threading the conductor and anodizing it (coating it with aluminum oxide) the conductor would become very water-absorbing.

Tests at MIT and at a fog chamber in an Ohio Brass Co. laboratory in Mansfield, Ohio, showed that the technique reduced the noise by a factor of 10.

The final step, Professor Wilson said, will be to see if the method will stand up against the elements and man-made pollutants to which transmission lines are subjected year after year.

If it does, the MIT method will provide a cheap way to reduce the transmission line noise.

The researchers were originally told that a solution costing $20,000 a mile would be of interest to utility companies. Professor Wilson estimates that the MIT method will cost between $2,000 and $3,000 a mile.

Moreover, it meets a series of stringent requirements—it's not too heavy, doesn't increase line to ice up, isn't made of anything that might rot, and won't deteriorate due to corona.

"By the time we had listed everything we couldn't do, it seemed as if the only thing we could do was to look at the lines and cross our fingers," Professor Wilson said.

"That's what made it challenging."

Summer Ballet Courses Offered

Registration will be held Friday (June 4) for beginner and intermediate ballet courses to be offered by the Department of Athletics this summer.

Classes will be open to all members of the MIT Community who have athletic cards. A special card for the class may be purchased. Undergraduates may receive physical education credit for the courses.

The courses, taught by Reeva Gibley, will meet twice a week in the T Club Lounge, duPont Gymnasium.

First session, June 7 to July 30, will offer beginner ballet on Monday and Wednesday and intermediate ballet on Tuesday and Friday. All classes will meet from 11:15am to 12:45pm.

A second session, Aug. 2 to Aug. 26, will offer both ballet and exercise instruction. Ballet will meet Tuesday and Thursday from 10 to 11:30am, and exercise will be offered Monday and Wednesday from 10 to 11am.

First session courses will cost $24. Second session courses will cost $12. Registration will be Friday, 10am to 1pm in the T Club Lounge. Tuition will be due with registration.

Very Honest Weight

Electronic Scale Aids Nutrition Studies

By ROBERT C. DiIORIO
Staff Writer

A highly accurate, extremely versatile electronic scale, capable of readings to within one-one-hundreth of a pound, has been invented by James Williams, a researcher in the MIT Department of Nutrition and Food Science's Instrumentation Laboratory.

The scale—its capacity is 114 kilograms (250 pounds)—is so sensitive that it can measure and record the change in a subject's body weight represented by taking one bite from a donut.

Mr. Williams' invention combines precision strain gauges and low-drift electronics. The platform is made up of four bonded strain gauges distributed symmetrically. The strain gauges, together with linearizing resistors, form a bridge network. When the bridge is excited a linear voltage output with respect to weight is generated at the output.

Dr. Nevin S. Scrimshaw, professor of human nutrition and head of the Department of Nutrition and Food Science, said the electronic scale has value in the direct clinical metabolic research of the department, particularly in measuring sweat losses.

Dr. Scrimshaw said the scale represents a "methodological breakthrough that might lead to a development of wider usefulness."

Dr. Vernon R. Young, associate professor of nutritional biochemistry, said the electronic scale is a vast improvement over the conventional metabolic scale now being used in the department's Clinical Research Center, which has limitations of accuracy and sensitivity and cannot be moved easily.

"Body weight change is an extremely important parameter of body composition in clinical studies of this department, and, in particular, in those concerned with the estimation of protein and energy utilization and the assessment of human requirements. It is a considerable advantage to have available a scale that can be transported and, at the same time, offers improved sensitivity, accuracy and automatic data recording and storage," he said.

The electronic scale makes possible precise, frequent monitoring of body weight changes over short as well as long-term periods, measurements which are important in studies of energy balance. The new scale also makes possible measurement of miniscule, previously insensible water losses.

Since the scale employs sophisticated body motion filtering it is ideal for weighing restless infants and young children. Normally, motion on a scale makes stable readings difficult, if not impossible.

In addition to providing an unambiguous, ultra high precision readout, the electronic scale, according to its inventor, offers these advantages:

—Elimination of human factor errors since the scale does not require calibration or adjustment.

—Ease of interface to auxiliary devices such as computers and specialized circuitry.

—Extreme strength and lightness. The scale can withstand overload, rough handling and can be moved by hand.

Two Named Visiting Professors in Math

Michael B. Woodroofe, professor of mathematics and statistics at the University of Michigan, and Glenys L. Luke, tutor and fellow at St. Hugh's College and Common University Fund Lecturer in Mathematics at the University of Oxford will be visiting faculty members in the MIT Department of Mathematics during the next academic year.

Dr. Woodroofe will be visiting professor of mathematics for the fall and spring terms. A graduate of Stanford with advanced degrees from the University of Oregon, he taught at Carnegie-Mellon University from 1966-68; was assistant professor of mathematics, the University of Michigan, from 1968-69; and has been at Michigan since 1968.

Dr. Luke will be visiting associate professor for the fall term. A graduate of the University of Western Australia, she received the DPhil degree from Oxford in 1970 and has taught there since then.

INSTITUTE NOTICES

Announcements

MIT Student Furniture Exchange—Open to buy and sell furniture all year, Tues & Thurs, 10am-2pm, 25 Windsor St, x3-4293.

Spring Term Degree Candidates—All spring term degree candidates who are planning to continue in fall term should notify Student Accounts in order to receive fall term pre-billing statements and literature. Continuing graduate students: x3-3335, new graduates x3-4132.

Transcripts—Transcripts without June grades may be ordered up to June 11.

Freshman Advisors—Faculty and graduate students are needed to serve as freshman advisors for 1976-77. Please contact the FAC Office, Rm 7-103, x3-6771, for details.

New UROP Listings

For more detailed information on UROP opportunities listed, MIT undergraduates should call or visit the Undergraduate Research Opportunities Program Office, Room 20b-141, Ext. 3-5049 or 3-4849 unless otherwise specified in the listing. Undergraduates are also urged to check with the UROP bulletin board in the main corridor of the Institute.

Appalachian Mountain Club Gorham, NH

The AMC would like a student to work with them in developing and implementing a waste disposal system for their mountain huts. The system will include composting so that the waste can be recycled as fertilizer for vegetation around the huts. Work will be done over the summer at Gorham. College work study funding available.

Beth Israel Hospital Boston, Ma.

A Beth Israel laboratory is engaged in biochemical and physiological studies of the effect of adrenergic agents on adenylate cyclase and cyclic AMP accumulation in erthrocytes and human platelets. A project is available for a student to perform enzyme assays using radioactivity labeled substrates and column chromatography. College work study funding available.

Children's Hospital Boston, Ma.

The following projects are available: 1) Determining the motions and instantaneous centers of rotation of various joints in the body. 2) Determining the anthropomorphic spatial geometry of various joints of the body. 3) Developing electrical or other devices to measure the forces and pressures in various prosthetic and orthodic (braces) equipment.

Faculty Opportunities

Preliminary Announcement of Lilly Postdoctoral Teaching Award Fellowship—The DSRE anticipates that the Lilly Postdoctoral Teaching Award Fellowship will again be funded next year by the Lilly Endowment. Since final word on approval will not come before early June, the Division would like to alert the Faculty before the term's end of the probable continuation of this program. The two year old program is open to all MIT faculty, but stipulates that at least five of the fellows be in their first three years of teaching. The program offers faculty with a deep interest in and concern with teaching and innovation in education modest support for their projects and participation in seminars and other activities. Next year's seminars will focus on how both individuals and institutions learn and consider specifically those interventions that support institutional learning. Faculty interested in submitting a proposal to develop their ideas related to this focus should contact DSRE Administrative Officer, Elaine Medverd (Room 20C-126A) at 3-7362, for further information. Proposals are due July 15.

Club Notes

MIT/DL Bridge Club**—ACBL Duplicate Bridge. Tues, 6pm, Stu Ctr West Lge.

Hobby Shop**—Mon-Fri, 10am-6pm, Rm W31-031. Fees: $10/term for students, $15/term for community. Info, x3-4343.

Religious Activities

The Chapel is open for private meditation 7am-11pm daily.

Jesus Christ's Full Gospel Meeting*—Singing, praise, prayer, testimonies and other preaching. Sun, 2:30pm, Stu Ctr Rm 355. Info: 494-8888.

Tech Catholic Community*—Sunday masses thru June 6; 9:15am & 12:15pm, Chapel. Beginning June 13: 10am, Chapel.

Echoes

50 Years Ago

The Class of '26 held a farewell picnic at Pemberton. The following night, the class attended Tech Night at the Pops in Symphony Hall.

Cass Gilbert '80, noted architect of the Woolworth Building in New York City, was elected President of the National Academy of Design. Gilbert replaced another MIT alumnus, Edwin Howland Blashfield '69 (who painted the Walker Memorial murals) as president of the Academy.

40 Years Ago

The annual moonlight sail and dance of the Commuters' Club was held on board the Steel Pier.

Miss Phyllis M. Needham (Redcay) '36, a graduate in Architectural Engineering, received the first prize offered by the Institute's national honorary scientific society, Sigma Xi, for the best undergraduate thesis. Her subject was "A Study of the Stratification Effect of Concrete."

25 Years Ago

The Hydrodynamics Laboratory and Ship Model Towing Tank were dedicated at the opening session of a three-day symposium on the role of hydrodynamics in modern technology. The new lab was the first building to be completed under the development drive for MIT's expansion.

TECH TALK
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All in the Family

Faculty, Staff Relatives Among Graduates

NEARLY 25 YEARS after she matriculated at MIT, Elisabeth Wiebolodt King received the SB degree in architecture at the Institute's 110th commencement exercises last Friday. Her husband is Professor John G. King, Francis Friedman Professor of Physics and associate director of the Research Laboratory of Electronics. Mrs. King was one of several graduates with ties to MIT's "family."

—Photo by Calvin Campbell

Several members of MIT's unofficial "family"—the sons, daughters, spouses of faculty, staff and employees—were among those who received degrees from the Institute Friday, May 28. They included:

Mark D. Abkowitz, son of Professor Martin A. Abkowitz of the Department of Ocean Engineering and Mrs. Abkowitz, who received the SM in civil engineering.

Eric L. Blomberg, son of Mr. and Mrs. Leslie Blomberg of Harwich, Mass., who received the SB in electrical engineering. Mr. Blomberg, former group leader of the physical plant and engineering group at Lincoln Laboratory, retired last year.

Ned C. Forrester, son of Professor Jay W. Forrester, Germeshausen Professor at the Sloan School of Management, and Mrs. Forrester, who received the SM degree in electrical engineering.

Ethan E. Jacks, son of Mr. and Mrs. Stanly M. Jacks, who received the SB degree in political science. Mr. Jacks is a senior lecturer at the Sloan School of Management.

Elisabeth King, whose husband is John G. King, Francis Friedman Professor of Physics and associate director of the Research Laboratory of Electronics, who received the SB in architecture.

Jonathan D. Lettvin, whose parents are Professor Jerome Y. Lettvin, MD, of the Department of Biology, and Margaret B. Lettvin, lecturer in the Department of Athletics. He received the SB in physics.

Robert Lambe, son of Professor T. William Lambe, Edmund K. Turner Professor of Civil Engineering, and Mrs. Lambe, who received the SB degree in life sciences.

Curtis R. Menyuk, whose parents, Norman and Paula Menyuk, are, respectively, a Lincoln Laboratory staff member and a research affiliate at the Research Laboratory of Electronics. He received the SB in physics.

Neil E. Rasmussen, son of Dr. Norman C. Rasmussen, head of the Department of Nuclear Engineering, and Mrs. Rasmussen, who received the SB degree in electrical engineering.

Paul F. Robbins, son of Professor Phillips W. Robbins of the Department of Biology and Mrs. Robbins, who received the SB degree in life sciences.

Car Pool Forms

There is still time for MIT employees to turn in the car pool questionnaires they received in the mail.

Because of a mailing delay, the deadline for the return of the questionnaires has been extended to Friday, June 4. They should be sent to Patricia Paula at the Campus Patrol (W31).

The Parking Committee urges employees to turn in the MASSPOOL questionnaires whether or not they are interested in participating in the car pool program. The committee said data is needed —even if the cards are returned anonymously— to help develop better parking and public transportation services for all employees.

Dr. Gray Elected Wheaton Chairman

MIT Chancellor Paul E. Gray has been elected to a four-year term as chairman of the Board of Trustees of Wheaton College at Norton, Mass.

Dr. Gray has served on the board for the past five years. His wife, Priscilla King Gray, is a 1955 alumna of Wheaton and he and Mrs. Gray have a daughter who will be a freshman there this fall. Dr. Gray is chairman of Wheaton's Long Range Planning Committee studying the college's needs over the next decade.

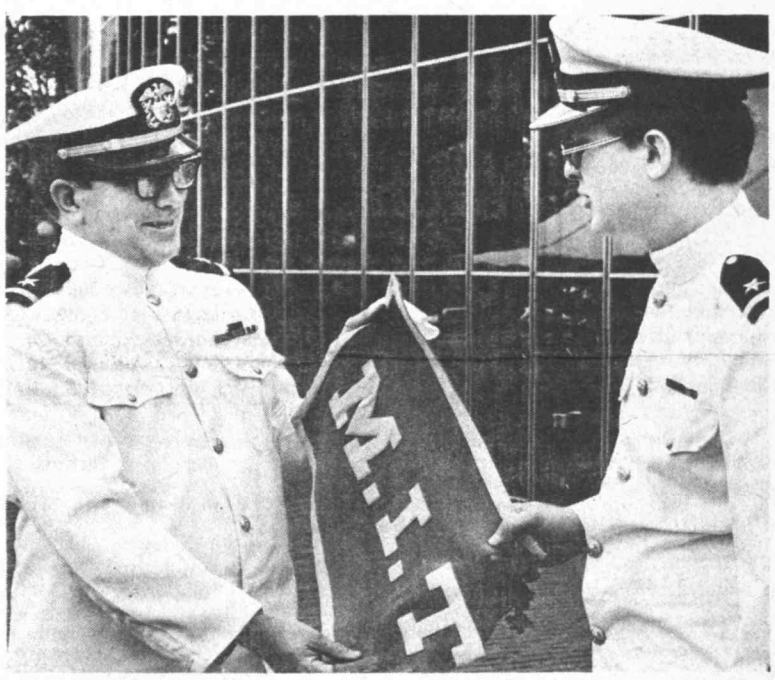
Abby Mauzé Dead at 72

Abby Rockefeller Mauzé, in whose honor a fund was established at MIT in 1963 to support distinguished women professors, died last week in New York City. She was 72.

Mrs. Mauzé was the only daughter of the late John D. Rockefeller, Jr. Her brothers include Vice President Nelson Rockefeller. Another brother, Laurence S. Rockefeller, and the Rockefeller Brothers Fund, established the fund at MIT to "inspire the women students at MIT as well as enrich their professional education. Mrs. Mauzé had been a life-long champion of women in the professions, in industry and in the arts.

Dr. Mildred S. Dresselhaus of the Department of Electrical Engineering and Computer Science, has been permanent Abby Rockefeller Mauzé Professor since 1973. From 1963 to 1973, the professorship was held on a visiting basis by several distinguished women scientists including Dr. Dresselhaus, Dorothy Crowfoot Hodgkin (who won the Nobel Prize in 1964 for chemistry), Physicist Margaret Burbridge, Biologist Rita Levi-Montalcini, Denise Levertov in humanities, Esther M. Conwell in electrical engineering and Laura M. Roth in physics. Since 1973, the fund has supported both a permanent professor and, from time to time, a visiting professor, the most recent being the Hungarian physicist, Dr. Judit Nemeth.

20 Receive Commissions



SIXTEEN YEARS OF NAVY SERVICE are represented by these two new ensigns, commissioned at MIT last week. Both Carl A. Wales, left, of San Diego, Cal., and Arthur P. Minar of Evansville, Ind., joined the Navy as enlisted men, Wales in 1966 and Minar in 1970. They attended MIT as members of the Navy Enlisted Scientific Education Program. The tattered MIT banner was flown by Wales during the summer of 1973 at Fletcher's Ice Island T-3 in the Arctic Ocean where the sailor, then a sophomore at MIT, was assigned by the Navy to a research project.

Ten Army cadets, eight Navy midshipmen and two Air Force cadets were commissioned last week at MIT.

The 20 new officers—second lieutenants in the Army and Air Force, ensigns in the Navy—received their degrees from MIT at the Institute's 110th commencement ceremony Friday, May 28.

MIT is one of only a small number of schools which offer programs involving all three major branches of the military service.

Maj. Gen. Rush Blodget Lincoln, Jr. (Ret.), of Wellesly Hills, was the speaker at the commissioning ceremonies which were held in Kresge Auditorium. Gen. Lincoln, who received a master's degree in civil engineering from MIT in 1935, is former commander of the Defense Traffic Management Service.

The annual Tri-Service Commissioning Luncheon for the new officers, their families and friends was held immediately after the ceremony in the Sala de Puerto Rico in the Student Center.

Two of eight midshipmen commissioned as ensigns in the Navy have several years military service behind them as enlisted men. They are Ensigns Carl A. Wales of San Diego, Calif., and Arthur P. Minar of Evansville, Ind. Wales, a sonar technician first class before his commissioning, joined the Navy in 1966. Minar, formerly a machinist mate third class, joined in 1970. Both attended MIT under the Navy Enlisted Scientific Education Program. Other new Navy ensigns are Richard L. Jamison, Johnstown, Pa.; Nicholas A. Koreisha, Monterey, Calif.; Richard C. Michel, Riveredge, N.J.; Robert G. Struth, Jr., Wichita, Kan.; Donald C. Warren, Jr., Pittsburgh, Pa.; and Robert J. Winkler, Omaha, Neb.

The New Air Force officers are Thomas A. Gaskin of Tiburon, Calif., a distinguished military graduate, and Robert J. Sand of Pittsburgh, Pa.

The New Army officers are: Timothy J. Allen, Portland, Ore.; Roger B. Allison, Sherwood, Ore.; Bruce T. Blankinship, Oxon Hill, Md.; Richard B. Buxton, Carmichael, Calif.; John H. Hagman, Mesa, Ariz.; Vincent J. Maconi, Nashua, N.H.; Floyd B. Mitman III, Cocoa Beach, Fla.; Paul J. Robershotte, Tempe, Ariz.; Mike A. Royal, Ayer, Mass., and John D. Schoedel, Spokane, Wash.

Lts. Allison, Blankinship, Buxton, Hagman, Maconi, Mitman, Robershotte and Royal are distinguished military graduates.

Five more MIT students will be commissioned second lieutenants in the Army following six weeks of summer camp at Fort Bragg, North Carolina.

Conference Next Week On Optical Communications

The latest developments in optical communications will be discussed by researchers and users at MIT June 8 and 9 at a meeting sponsored by the National Science Foundation.

Dr. Robert S. Kennedy and Dr. David J. Epstein, MIT professors of electrical engineering, are co-chairmen of the organizing committee for the semi-annual meeting, the eighth held by the NSF Grantee-User Group in Optical Communications.

Optical communications use frequencies in the infrared, visible and ultraviolet portions of the electromagnetic spectrum. The meetings are held to foster cooperation and an exchange of information among NSF-sponsored academic research groups and industrial and governmental groups.

Other members of the organizing committee, with Professors Kennedy and Epstein, were Professors Warde and Shapiro and Drs. Hans P. Jenssen and Arthur Linz of MIT.

The sessions will be held in the Kresge Little Auditorium and are open to the MIT community. The program:

June 8, Session I—Quanta, Systems and Channels, Julius Feinleib, Itek Corporation, chairman.

Roy J. Glauber, Harvard University, "Photons and Fields," 9:30am. Robert O. Harger, University of Maryland, "Signal Filtering with Quantum-Mechanical Measurements," 10; Donald L. Snyder, Washington University, St. Louis, "Information Processing for Random Point Processes," 10:20; Frederick Davidson, John Hopkins University, "Measured Performance of an Atmospheric Binary Pulse Position Modulation Optical Communication Link," 11; Charles M. McIntyre and J.R. Kerr, Oregon Graduate Center, "Diversity Receivers for Optical Communication," 11:20; Jeffrey H. Shapiro, MIT, "Propagation Characteristics of Low-Visibility Atmospheres: An Experimental Program," 11:40.

June 8, Session II—Optical Technology, Cardinal Warde, MIT, chairman.

Ira Jacobs, Bell Laboratories, "Bell Laboratories Atlanta System Experiment," 2pm; Monte Ross, McDonnell Douglas Co., "High Data Rate Space Laser Communication Experiment," 2:45; Leo J. Sullivan, MIT-Lincoln Laboratory, "Coherent Infrared Radar," 3:50; Joseph A. Hull, Office of Telecommunications, US Dept. of Commerce, "Progress Report on Optical Communication Activities of the Office of Telecommunications," 4:35; discussion, 5.

June 9, Session III—Optical Devices, David Whitehouse, Raytheon Corp., chairman.

Hermann A. Haus, MIT, "Filter Design with Cascaded Index Corrugations," 9am; Chen S. Tsai, Carnegie-Mellon University, "Wideband Guided Wave Acousto-Optic and Electro-Optic Devices," 9:30; Frank K. Tittel, Rice University, "Recent Development of Dye Laser Technology," 9:50; Oscar Gaddy and S.W. Merritt, University of Illinois, Urbana, "The Effect of an Isolated Photocathode in the Dynamic Crossed-Field Photomultiplier," 10:10; Kenneth Gustafson, University of California, Berkeley, "Localized and Nonlocalized Excitations in Electron-Tunneling Devices," 10:50; Steven E. Schwarz, University of California, Berkeley, "Infrared Detectors and Circuit Elements," 11:10; Discussion, 11:30; Tours of campus laboratories, National Magnet Laboratory and Lincoln Laboratory, 1:30.

Strattons Honored

DR. AND MRS. STRATTON HONORED. Dr. Julius A. Stratton (left), MIT president from 1959 to 1966 and a Life Member of the MIT Corporation since 1966, and Mrs. Stratton (second from right) were guests of honor at a luncheon on Commencement Day last week on the occasion of Dr. Stratton's transfer to Life Member Emeritus of the Corporation. The luncheon was given by Howard W. Johnson (right), Chairman of the Corporation, and Mrs. Johnson (second from left). Luncheon was given at the Johnson residence, 100 Memorial Dr.

—Photo by Calvin Campbell

Brown Edits Book

Sanborn C. Brown, professor of physics, emeritus, in the MIT Department of Physics, and Alexandra C. Oleson of the American Academy of Arts and Sciences are editors of *The Pursuit of Knowledge in the Early American Republic: American Scientific & Learned Societies from Colonial Times to the Civil War* just published by John Hopkins Press ($16.50).

More than a dozen authors contributed papers to this comprehensive examination of scientific and learned societies as they developed in America up to the time of the Civil War.

THE INSTITUTE CALENDAR

June 2 through June 13

Events of Special Interest

1976 Technology Day — This is not a complete schedule.For further details consult the Technology Day brochure, which also contains registration forms for those events which require tickets for admission. Registration packets are available in the Technology Day Information Area in Kresge Lobby. Please check in.

Thursday, June 3

Registration — 4-7pm, Kresge Lobby.

Arthur Fiedler Conducts Boston Pops Orchestra — 8:30-10:30pm. Free round-trip bus leaves 77 Mass Ave 7:30-8:15pm, parking available in Kresge Lot. Tickets required.

MIT Chapel Memorial Service — The Reverend Richard S. Armstrong, '65. Non-denominational tribute to alumni whose deaths have been reported during the year. 8:45-9:15am.

MIT Historical Collections Open House — Shuttle Bus to and from Kresge, 9am-5pm.

Morning Programs — Two simultaneous programs, 9:30-11:45am. **The Energy Revolution:** David C. White, Ford Professor of Engineering, director of MIT Energy Laboratory, moderator. Speakers: Morris A. Adelman, economics; Jean F. Louis, aero/astro; Ronald Parker, EE '63, co-director of ALCATOR Project; Norman C. Rasmussen, PH '56, Head of Department of Nuclear Engineering, Kresge. **The Medical Revolution:** Salvador E. Luria, Institute Professor, Nobel Laureate in Physiology or Medicine, director of MIT Center for Cancer Research; Irving M. London, biology, director of Harvard-MIT Program in Health Sciences and Technology. Rm 26-100.

Alumni Luncheon and Class Gifts Presentation — Presentation of special awards and class reunion gifts, Rockwell Cage, 12n-2:15pm.

Afternoon Programs — There are 11 simultaneous programs,all beginning at 2:30pm and open to the public. Specific room information is available in the Technology Day Information Area, Kresge Lobby.

A Special Look at MIT in the 1920's — Charles Stark Draper, '26, Institute Professor Emeritus; James Rhyne Killian, Jr., '26, Honorary Chairman of the MIT corporation; Warren A. Seamans, director, MIT Historical Collections.

Cancer and the Cell Surface — Richard O. Hynes, LI '71, biology.

Discussions of Research in Waste Heat Management at the Parsons Laboratory for Water Resources and Hydrodynamics — Donald R. F. Harleman, CE '50, civil engineering; Gerhard A. Jirka, CE '73, civil engineering.

Fossil Fuel Research in the Sloan Laboratories — Jean F. Louis, aero/astro.

Fuel Conversion of Primary Sources to Usable Forms — Jack B. Howard, chemical engineering.

MIT's Energy Laboratory; Research and Outlook — David C. White, Ford Professor of Engineering, director of MIT Energy Laboratory.

Nuclear Engineering Department Tour — Norman C. Rasmussen, PH '56, head of Department of Nuclear Engineering.

Panel on Energy Policy; National and International and the Effects on Technology — Morris A. Adelman, economics, moderator.

Solar Energy Research at MIT — Roy Kaplow, '54, materials science and education. Tour of ALCATOR and the Francis Bitter National Magnet Laboratory — Donald T. Stevenson, PH '50, assistant director.

Viruses, Cell Regulation and Cancer — Phillip A. Sharp, biology.

Technology Day Reception — 5-6pm Sala. Enjoy cocktails and hors d'oeuvres with alumni and faculty.

Seminars and Lectures

Wednesday, June 2

Albumin Systhesis and the Amino Acid Supply* — Victor M. Rosenoer, MD, head of GI research, Lahey clinic. Nutrition & Food Science Seminar. 9am, Rm E18-408.

Physics of Slowly Varying Wave Trains in Continuum Systems* — Wilson C. Chin, G. Aero/Astro Doctoral Seminar. 10am, Rm 33-419.

The Short-Wave Instability of Vortex Rings and Filaments* — Chon-Yin Tsai, G. Aero/Astro Doctoral Seminar. 3pm, Rm 33-206.

Thursday, June 3

The Influence of Compliant Walls Upon Turbulent Boundary Layers* — G. Zimmermamm; Investigation of Pressure Fluctuations Beneath a Turbulent Boundary Layer by Means of an Optical Method* — A. Dinkelacker, both from Max Planck Institut fur Stromungfforschung. Applied Mechanics Seminar. 3pm, Rm 3-133.

Tuesday, June 8

Economic-Technological Modeling and Design Criteria for Programmable Assembly Machines* — Paul M. Lynch, G. Mechanical Engineering Doctoral Thesis Presentation. 2pm, Rm 3-446.

Community Meetings

The Wives' Discussion Group** — Led by Myra Rodrigues, social worker; Charlotte Schwartz, sociologist, & Carol Hulsizer, faculty family in residence, Ashdown. Wed. 2:15pm, Stu Ctr West Lge. Babysitting Stu Ctr rm 473.

MIT Women's Forum** — Meetings Mon, 12n, Rm 10-105 (Tues in case of holiday.)

Gould Users Society* — Meeting open to any group who owns a Gould printer/plotter. Meeting Thurs, June 3, 2pm, Rm 54-915.

Summer Art Program** — Registration for Student Art Association evening classes, running from June 14 to Aug 20, is now in progress. Register by Mon, June 14, 1-5pm, Stu Ctr Rm 429. Info: x3-7019.

Sloan Grant for Telecommunications and Education — Open meeting of participants in first Sloan Grant for Telecommunications and Education Wed, June 9, 1-5pm, Rm 9-450. Participants will discuss their individual projects; screening of films and video tapes made under the grant.

Technology Children's Center Cooperative Nursery School — Classes at Eastgate & Westgate for children ages 2 years 9 mos to 4 years. **Summer Session:** June 14-July 23, both schools, 9am-1pm, bring lunch. **Term-time Sessions:** From Sept, 9am-12n at Westgate, 9am-1pm at Eastgate (bring lunch.) Info: x3-5907.

Movies

Blood of the Condor (Sanjines)* — Film Society. Fri, June 4, 7:30 & 9:30pm, Rm 6-120. Admission $1.

The Man Who Shot Liberty Valance** — LSC. Fri, June 4, 8pm, Rm 26-100. Admission 75¢, MIT or Wellesley ID required.

The Bedford Incident** — LSC. Sat, June 5, 8pm, Rm 26-100. Admission 75¢, MIT or Wellesley ID required.

Land in Anguish (Rocha)* — Film Society. Fri, June 11, 7:30 & 9:35pm, Rm 6-120. Admission $1.

Adam's Rib** — LSC. Fri, June 11, 8pm, Rm 26-100. Admission 75¢, MIT or Wellesley ID required.

Adventures of Sherlock Holmes** — LSC. Sat, June 12, 8pm, Rm 26-100. Admission 75¢, MIT or Wellesley ID required.

Dance

Summer Course in Dance and Exercise** — Sponsored by Athletic Department, taught by Reeva Gibley. Offered June 7-July 30, 11:15am-12:45pm, duPont T Club Lge. Beginner ballet Mon &/or Wed, intermediate ballet Tues &/or Fri. Undergraduates may receive credit for the course. Registration Fri, June 4, 10am-1pm, duPont T Club Lge. Payment due at registration. Athletic card required. Classes will also be offered Aug 2-Aug 26.

American Dance Guild National Conference* — Conference Thurs, June 10-Sat, June 12, sponsored by Council for the Arts. Theme: American Dance into the Future: Trends, Resources, Environments. Concert Fri, June 11, 8:30pm, Kresge, including new works by Gus Solomons, Jr ('61), Toby Armour, Anna Nassif and Rudy Perez. Tickets: $5, $3 students, some free tickets available to people w/MIT ID; write or call Council for the Arts, Rm 20D-220, x3-4003. Info on rest of conference and workshops: *Tech Talk* article (5/26) or the Council.

Exhibitions

Architecture and Urbanism: A Fantastic Voyage* — Exhibition of photographs and slides from Rotch Library collection. Sat, May 1-Sun, June 6; Mon-Thurs, 9am-11pm; Fri, 9am-8pm; Sat, 10am-6pm; Sun, 1-11pm; Rm 7-238. Free.

Works on Paper from the MIT Permanent Collection* — On display thru Wed, June 30 in Hayden Corridor Gallery. Open daily.

Recent Acquisitions of MIT Permanent Collection* — On exhibit in Hayden Gallery Fri, May 21-Fri, July 2. Sponsored by Committee on the Visual Arts. Major paintings and drawings by American artists including Susan Shatter, Lowell Nesbitt, Katherine Porter, Friedrich St. Florian, Natalie Alper and many others.

Strobe Alley* — High speed photographs by Harold E. Edgerton, Insitute Professor and Professor of Electrical Measurement, Emeritus. Bldg 4, 4th fl.

Music of the Celestial Dieties* — Music Library exhibit of manuscript facsimiles & pictures. Daily, Bldg 14E.

Hart Nautical Museum* — Permanent exhibit of rigged merchant and naval ship models of yachts and engine models. Bicentennial exhibit: "1776-1976" — a frigate, 2 schooners, a gondola, and the Durham boat of the American Revolution. Open daily in Bldg 5, 1st floor.

MIT Historical Collections* — Permanent exhibition Mon-Fri, 9am-5pm, Bldg N52, 2nd floor. **Bicentennial Exhibits:** Katharine Dexter McCormick, '04; Vannevar Bush, '16; Karl Taylor Compton, and Norbert Wiener, Bldg 4 corridor. **The New Technology Exhibit:** 2nd floor balcony.

Athletics

MIT Community Softball League — Important meeting of designated team representatives Wed, June 2, 5pm, Rm 4-231. Entry fees due at meeting. Competition begins Mon, June 7. Umpires may still apply at duPont bulletin board.

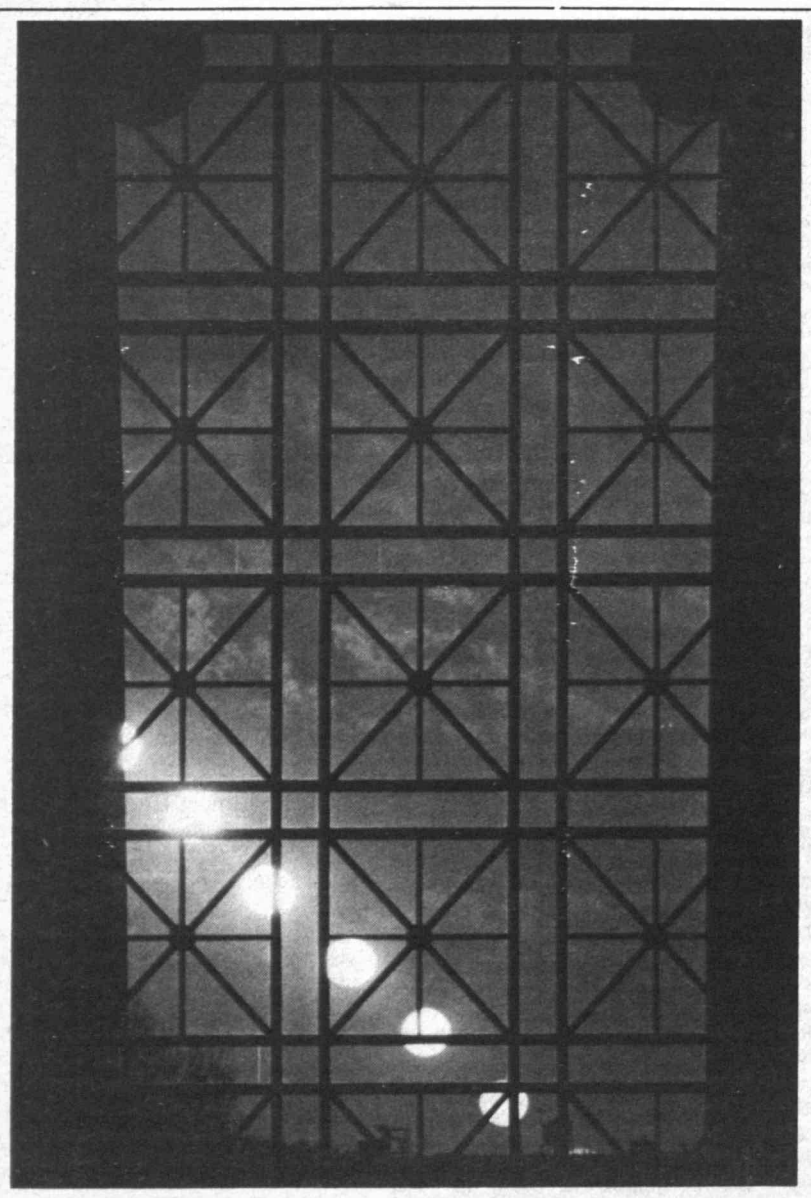
Individuals for Summer Softball — Persons without team affiliation: practice session Thurs, June 3, 5:15pm. Fast pitch Field #2 (by tennis bubble), slow pitch Field #8 (between baseball diamonds). This may be last time to join teams. Sam Benichasa, x8-3686 or x8-3639 Draper.

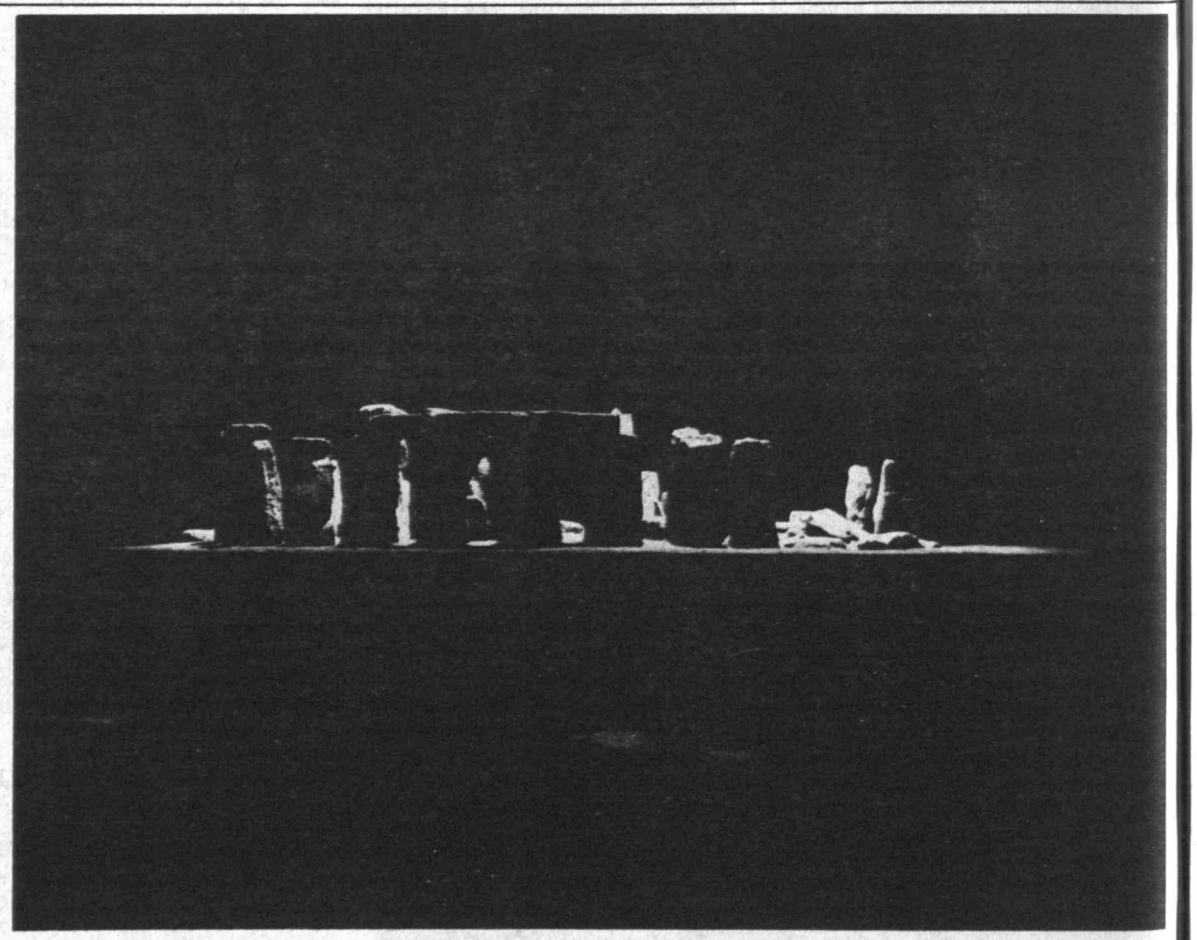
Home Schedule* — Wednesday, June 2 — W Sailing. Nationals, Charles River Lower Basin.

Freshmen are encouraged to attend departmental lectures and seminars. Even when these are highly technical they provide students one means to learn more about professional work in a department and field.

***Open to the public**
****Open to the MIT community only**
*****Open to members only**

Send notices for June 9 through June 20 to the Calendar Editor, Room 5-111, Ext. 3-3279, before noon Friday, June 4





STONEHENGE ON THE CHARLES? This multiple-exposure photograph of the setting sun taken by Professor Harold E. Edgerton and Charles E. Miller, illustrates what many MIT people have long known: Namely, that the Institute's main buildings are aligned such that on certain days the rays of the setting sun shine through the windows (left) of the 77 Massachusetts Ave. entrance and straight down the entire length of the building's main corridor. The phenomenon suggests a similarity with Stonehenge, which some observers believe was laid out for astronomical purposes. Stonehenge itself was photographed during World War II by Professor Edgerton, known as the "father" of strobe photography, who is now Institute Professor emeritus. The nighttime picture used light from a Xenon flash unit that he developed for night aerial photography and which was carried over Stonehenge by a photo reconaissance plane. The phenomenon also occurs at St. Peter's Cathedral in Rome, built in 1626, and is believed to have occurred at the Temple of Amen-Ra, Karnak, Egypt, built in 3700 BC.

Wiesner Commencement Text Cites Three Proofs for Hope

(Following is the text of the address presented by Dr. Jerome Bert. Wiesner, president of MIT, at MIT's 110th commencement Friday, May 28, 1976.)

By JEROME B. WIESNER

Good morning. Welcome to this 110th Massachusetts Institute of Technology graduation ceremony. A hearty congratulations to students receiving degrees this morning and to all of their guests. Welcome, too, to Dr. Johnson, Dr. Killian, Mayor Vellucci, and honored guests.

I would like to recognize particularly the families and friends of these men and women on whom we confer degrees today. There is no adequate way to express appreciation for what you have done to help make this day possible. I congratulate all of you who are mothers, fathers, brothers and sisters, wives, husbands and sweethearts, young children, grandparents and aunts and uncles. This is the one day of the year when our favorite expression, "the MIT family," takes on its deepest possible meaning. The old graduates used to have a saying: "Tech is Hell." In recent years they have been saying, "It's great—but it's expensive!" (in both dollars and energy). You have given both kinds of support to your students while they have been here. I would like to ask the Corporation and Faculty to join me in giving you our recognition.

Graduation is above all a joyous occasion. For each of our newest generation of graduates it is a time to celebrate the completion of a difficult and important course of personal development. Though it may be a bit unfashionable to talk of excellence and hard work, MIT still pays homage to those virtues. So on this occasion it is appropriate to congratulate you on your accomplishments—that is, your abilities and what you have done with them.

To help me focus my thinking for today, I conducted an informal minipoll, asking some members of your Class and some faculty members what they would like to hear about. Not surprisingly the response almost always focused, in one way or another, on the future and on the more than usual uncertainty that people, young and old, feel about it at this time. The issue was put to me most interestingly by one of your colleagues who expressed it in terms of her alternation between hope and despair, her inability to weigh the countless events, large and small, hopeful and discouraging, good and bad, that demand her attention each day. She found it difficult to derive from them even a *consistent* view of the future, much less an enduring sense of hope. I am sure that this audience and most of the reasonably well-informed inhabitants of the world share this bitter-sweet sense of confusion as they try to imagine what the next half century will bring. Can we venture a picture of even the next decade that we can agree upon?

I should say at the outset that I am basically hopeful and this morning I will try briefly to tell you why. Fundamentally, I *believe* that in a halting way, with many ups and downs, humanity is struggling forward toward a more satisfying life for people. The resulting pull between hope and despair is one which women and men have always confronted. The challenge for those who want to be active in the struggle is to maximize the ups and minimize the downs. Let me see if I can show you what I mean.

My sense of (cautious) optimism is based on three things: the positive balance of our national strengths and weaknesses; the continuing opportunities provided by science and technology, tempered by our increasing recognition that they have costs as well as benefits; and the emphasis on the role and well-being of the individual that exists today.

In assessing our future, especially in this bicentennial year, we turn first to our past. History allows us to look back on our nation's origin and ponder our strengths and weaknesses, our achievements and errors—and there is much there to give us hope. We are the beneficiaries of one of the most successful experiments in humanity's long history. Our ancestors created a uniquely effective engine for personal, social and economic development which we perhaps appreciate too little. Consequently, we have the natural and human resources and industrial capabilities to continue to lead the way to a more satisfying life if we can "put it all together," so to speak.

On the other hand, we have paid a very substantial price for these achievements in terms of separation from nature, changing human relationships, the spectre of nuclear annihilation, and the threatening concentrations of governmental power, to mention just a few, and we should support the various counter trends developing in the society. I draw comfort from the fact that much of the present turmoil is the result of an effort to find the proper balance between the urge for freedom and the need for responsibility at all levels in the society.

In the sixties, the conviction was developed that our society could treat *everyone* much better, support *every* need, and quickly rectify *every* trouble and inequality. In the process of trying to meet all these expectations simultaneously the great engine that is the United States economy was taken for granted, became seriously overworked and faltered.

Now we have the task of putting it back to work and matching our demands to its capabilities. To do this, we will need to develop consensus on some goals and accept a substantial degree of self discipline, both group and individual. Because of the inherent strengths in our democratic society, I weigh in on the side of hope in my first basis of choice between hope and despair.

Turning now to my second point—

The roles of science and technology loom large in any discussion of modern society, and particularly any examination of future prospects. I have time for only a few thoughts on this subject. First: although there is genuine basis for the frequently expressed fear of large-scale technology, I am convinced that there is no other viable option for humanity. In fact, the tradeoffs have been very much on the positive side. I doubt that many of us would prefer the living conditions of 1776 or 1876, if examined realistically, or even those of a typical traditional, i.e., undeveloped, society today, to those of contemporary life. Secondly: a successful technologically based society is—must be—a dynamic system— a learning system—in a continuing state of change and evolution, requiring new technologies and new organizational forms, new relationships, and probably even new lifestyles as it evolves.

Many people find this premise troublesome, for they have been hoping that the world might one day—sooner rather than later—approach a steady state in which change, especially technologically induced change, would cease. Sad to say, they, and we, must accept the fact that there is not likely to be a stable state in the sense that new problems won't arise, demanding in turn new technologies and social inventions for their solutions.

But there is no reason why change must be traumatic. Our goal should be to do things better, with less impact on the environment, less burden and danger to the individual, less expensively, more reliably, and with more emphasis on individual well-being. In fact, I predict that humanistic and environmental issues will dominate decisions in the years ahead. In the future, there will be much less social and human dislocation caused by new technology. Let me explain this. The highly industrialized nations of the world have entered a new phase of their evolution, in which new technologies must increasingly be what I would call sophisticated *replacement* technologies. New energy technologies, energy conservation techniques, systems to improve environmental quality, and technologies to increase food production are all in this category. Replacement technologies do not carry with them the severely dislocating effects on huge numbers of people which initial technologies did. Rather they seek to correct, if anything, the social effects of first-generation technologies. The likelihood of producing violent, traumatic discontinuities by the introduction of new technologies is also considerably smaller because societies are learning to be on guard against such occurrences. I am not saying that there cannot be other threats as serious as the invention of nuclear weapons, perhaps in the life sciences, but rather that the effects of new *industrial* technology will be much less disorienting. In fact, I suspect that any serious discontinuities which may occur are much more likely to be of a degenerative character, the result of the failure to have new technologies available when needed. The failure, for example, to develop alternative energy sources or to meet food needs, obviously would have very damaging effects on the conditions of life.

The biggest problem in the future may be how to make things happen. For the needed new technologies to exist, long-range actions of many kinds are required that go beyond our current capabilities; for example, research and development with a long lead time and effective ways of choosing the most promising among a great variety of possible long-term goals. It also requires assurance that incentives exist for the innovators, especially those in industry, to innovate, even when the rewards are deferred for a long time.

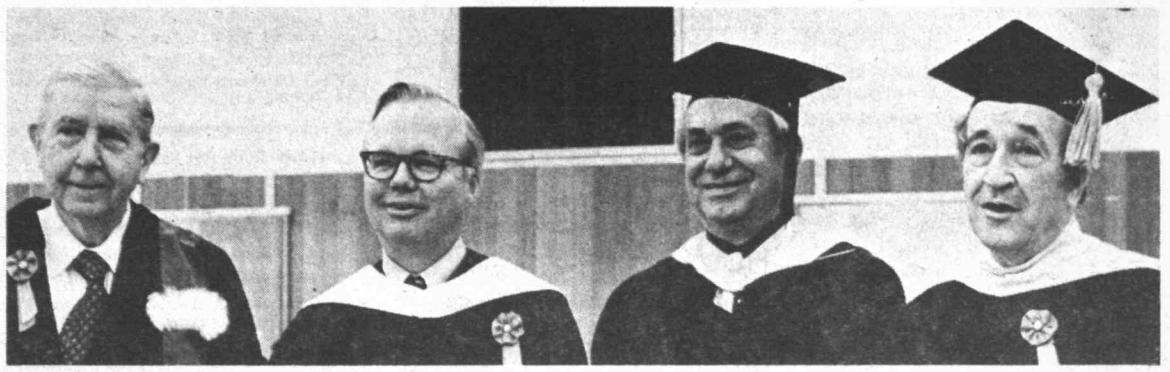
The greatest challenge we face is that of managing our technology more effectively, but doing it in ways that preserve the diversity, freedom and initiative of our people and institutions, industrial and educational. I have confidence in the American people's ability to meet this challenge.

Most hopeful to me of my three proofs against despair is the increasing number of individual citizens who are taking the time to become knowledgeable about the major issues of the day—the many people, young and old, who have learned to insist that ultimate human values always be weighed along with economic benefits, however difficult this may be. During my lifetime there has been a continuous trend in this direction, strengthened by a growing conviction that there is in our country a synergism between individual and collective welfare.

My graduation, 40 years ago, was at the time of the Great Depression. (Incidentally, I cannot remember who the commencement speaker was, much less what he said!) But I do remember that there was suffering on a scale unknown to many here today—there was little welfare and no unemployment insurance. There were no jobs for college graduates or anyone else. Unemployment was 25 percent. Hitler's mad voice was rising. Despair then was deep and worldwide, and perhaps most important, deeply fatalistic. Forty years ago, massive malfunctions of the economy and the severe suffering that accompanied them were thought to be inevitable.

Clearly there has been much social and economic progress in those forty years and perhaps most importantly, following World War II, we exchanged the fatalistic view of life for one even a bit overoptimistic; namely, that we merely had to define a problem and legislate a solution in order to solve it. At the moment, we are on the rebound from that attitude in the maturing phase of realizing that there are very few solutions that don't require persistence and continuous learning. But on the positive side, we have a better educated nation than ever before. We appreciate increasingly that the joy of life is at least as much in the journey—in the doing—in the quality of the experiences along the way—as in the goal. We as a nation are looking inward for our sources of strength, hoping to rediscover a worthy national purpose.

All of you who graduate today have shown great natural talents, a strong desire to learn, an ability to concentrate your efforts. Very many of you, too, have demonstrated a strong sense of personal responsibility, and a deep concern for the well-being of other people. You will find plenty of opportunities in the decades ahead to put these varied talents to work. You will also find many frustrations. Ours is a society which challenges you to be a problem solver, to keep on learning, to keep on trying. For each of you, there is much to do that is worthy of the best that you can give. What other reason do you need for hope?



CAMBRIDGE MAYOR ALFRED E. VELLUCCI was among the guests of honor at MIT's 110th Commencement. With the mayor just before the start of the academic procession are three of the men who have been president of MIT during Mr. Vellucci's years on the City Council. From the left, Dr. James R. Killian, Jr., honorary chairman of the Corporation and president from 1949-59; Howard W. Johnson, chairman of the Corporation, president from 1966-71; Mayor Vellucci; and Dr. Jerome B. Wiesner, president since 1971. Dr. Wiesner was principal speaker at Commencement.

Graduation

(Continued from page 1)

individual, less expensively, more reliably, and with more emphasis on individual well-being."

Dr. Wiesner said he finds encouragement in the "increasing number of individual citizens who are taking the time to become knowledgeable about major issues of the day—the many people, young and old, who have learned to insist that ultimate human values always be weighed along with economic benefits, however difficult this might be."

In the current state of technical evolution, Dr. Wiesner said, "new technologies must increasingly be what I would call sophisticated replacement technologies.

"New energy technologies, energy conservation techniques, systems to improve environmental quality, and technologies to increase food production are all in this category. Replacement technologies do not carry with them the severely dislocating effects on huge numbers of people which initial technologies did. Rather they seek to correct, if anything, the social effects of first-generation technologies."

Dr. Wiesner, following another MIT tradition, personally handed the 1,467 degrees to the graduates (some receive more than one degree) as their names were called by the deans of their schools.

A reception for the graduates, their guests and faculty members was held immediately after the commencement exercises on Kresge Plaza.

Chief Marshal for commencement was John J. Wilson, secretary of the MIT Corporation. Following in the procession were the members of the MIT Corporation, the faculty and the guests of honor, including the deans of MIT's five academic schools, the Dean of the Graduate School, the Dean for Student Affairs and the Registrar.

Howard W. Johnson, chairman of the MIT Corporation, presided at the exercises.

In addition to Mr. Johnson and Dr. Wiesner, commencement principals included Chancellor Paul E. Gray, who was Marshal of the Principals; Dr. James R. Killian, former chairman and honorary chairman of the MIT Corporation; Professor Walter A. Rosenblith, MIT provost, who was Marshal of the Guests of Honor, and the Rev. Robert Moran, Roman Catholic religious counselor at MIT, who gave the invocation.

Olympics

(Continued from page 1)

year later.

Frailey was varsity heavyweight coach at MIT from 1959 to 1970, when he returned to the lighweights before ending his coaching career in 1972. During his tenure as varsity coach, MIT won the Compton Cup in 1962 for the first and only time. It is an annual race between MIT, Harvard and Princeton originally sponsored by former MIT President Karl T. Compton.

Frailey was an Olympic rowing coach at Mexico City in 1968 and was elected chairman of the US Olympic Men's Rowing Committee in 1973.

The student rowers, Everett and Piantedosi, will be seeking places in Olympic boats at tryouts in Philadelphia June 6.

Everett, a Gold Medal winner at the World Championships in Switzerland in 1974 and at the Pan American Games in Mexico City last year, seems virtually assured of an Olympic role, probably in the eight-man shell.

Piantedosi, who also competed in the Pan Am games, hopes to win a place in the four-man crew without coxswain.

The MIT shooters—Dausman, Marcum and Goldstein—were invited to the Olympic tryouts in Phoenix, Ariz., June 8-14 on the basis of their average scores shot in competition over the last year.

Dausman, who shoots mainly the .22 calibre rifle, was the national collegiate champion and the Massachusetts state champion in 1975. He also had the highest average in the Greater Boston College Rifle League and the New England Collegiate Rifle League. He was named the most valuable player on the MIT Rifle Team this year.

Marcum, who shoots mainly the precision air rifle, won the collegiate air rifle championship this year and placed sixth overall at a national invitation tournament at West Point this spring.

Goldstein, who shoots mainly the .22 and .45 calibre pistols, was chosen all-American three times—in 1974, 1975 and 1976. It was the first time any MIT student has done this in any sport.

He was the national collegiate champion, in international-rules competition in 1974-75-76, and was also the conventional-rules champion in 1976. It was the first time any shooter had won championships in both rules categories in the same year.

He has set eight national collegiate records for different types of shooting, was on the US pistol team at the Pan Am games last year and was selected for the national civilian .45 calibre pistol team at the National Championship matches in Camp Perry, Ohio, this year.

Goldstein was named the most valuable player on the MIT Varsity Pistol team, which has won the championship the last four years in the Greater Boston Pistol League, the largest in the United States with 32 teams.

He has the highest individual average in the Greater Boston League and the highest average in the New England Collegiate Pistol League, which includes all the service academies and eight other universities.

CLASSIFIED ADS

Ads are limited to one per person per issue and may not be repeated in successive issues. All ads must be accompanied by full name and Institute extension. Only Institute extensions may be listed. Members of the community who have no extensions may submit ads by coming in person to the *Tech Talk* office, Room 5-111, and presenting Institute identification. Ads may be telephoned to Ext. 3-3270 or mailed to Room 5-111. **Please submit all ads before noon, Friday, June 4. They will be printed on a first come, first served basis as space permits.**

For Sale, Etc.

Raleigh Competition 21½", 8 mos, exc cond, 23 lbs, $190. Albert, 247-8355, aft 6.

Polaroid SX-70 deluxe, almost nw, best. Call 494-8882, kp try.

GE 17" TV, 8 mos, $195; K tbl w/4 chrs, $55; crib w/matt, $30; lamps; flwrs, etc. Call 628-4350.

Bikes, 2 girl 20" Columbia Spiders, lk nw, $25/ea firm. Dom, x8-3689 Draper.

Unused twn bed sheets, fit MIT beds; small frypan, $1; med sz pot, $1.50; 2 brnr elec stove, $3.50; toaster/broiler, $5.00; sq glass cake pan, $3; elec coil for boiling water, $.50. Kathleen, x5-6204.

Slide proj & screen, GAF 2680, lk nw, $65; Schwinn Varsity 10 spd, $75; yel 9x12 rug, $25. Rett, x3-7566.

Pr radial snows, SR-13 (155), gd for Fiat, Toyota, etc, lvg for south, must sell, $40. x3-7107.

Auto-focus Kodak Carousel 860 proj, nw, $125 firm; 15 Carousel 140 slide trays, $2/ea. Donna, x3-1801.

Universal Tiger amps, 2 chnl, 80W/chnl, $100; PAS-1 preamp, $50. Neil, 267-2199, lve msg.

(2) 10 cu ft refrigs, $30 & $20, nego. Len, 868-8873, evgs.

Swing set, gd cond, free. Paul, x8-4596 Draper.

Pr crtns, 45" W, 65" L, hemmed; ceiling track type rod 82", screws, whls, etc; 5 mtch pillow covers for 18" sq pillows, hvy cloth, blurred flwr pattern grn, wht, some blk, nego. x3-7582.

Baldwin aquasonic piano, 57" L, 36" hi. Linda, x3-6322.

Must sell dining tbl & 4 chrs, $90; sofa & chr, $70; 8500 BTU Hotpoint AC, used 1 seas, $125. Call 861-6797.

Intnl Harvester AC, exc cond, wndw mdl. Ben Dores, x8-2818 Draper.

Port playpen, $9; folding hichr, $7; crib, $19; changing tbl, $3; sliding doors for tub enclosure, $15. David, x8-3652 Draper.

Les Paul cstm guitar, nw frets & bridge, $400. Monica, x3-4021.

Wndw fan, 3 spd fwd & rev, super powerful, $15; early Amer bunk bed ladder w/2 sets guard rails, $10; camp cot, $5; asst hand tools. Hank, x8-4166 Draper.

Couch w/beaut wd frame, wht cshns, $100; bed w/matt, frame, box spr, v gd cond, $50; wd bkcse w/4 adjustable shlvs, $30. Sy, x3-7566.

F gold watch bracelet, elegant, kps gd time, hrdly worn, $50 nw, $25. Harmon, x3-3736.

Grateful Dead, 2 tckts for 6/9 concert, $8.50/ea, wl trade for tckts for 6/10 or 6/11 concert. x3-3124.

Datsun 710 carb, nds work, $25; VW 1600 technical manuals, 2, $5/both. Chris, x3-2375.

Mamiya-Sekor 1000 TL 35 mm camera w/f1.8 lens, $70. George, x3-7220.

Vac clnrs: Hoover canister & Eureka upright, almost nw, orig $120 & $60, now $60 & $30. Yak, x3-1807.

Pr D 78x14 snows, 4 ply polyester, 8 K, exc cond, $35, x3-6918.

Packing boxes; bkshlvs; magnetic computer tapes & racks; shelving for printout or cards; Acco-Press printout binders; Wilson T2000 tennis rckt. Call 547-3336.

Wall shlvs, $10; coffee tbl, $5; oak bkcse, $25. Mike, x3-2784.

Advent 201 dolby cassette deck, $350 nw, $175. Mark, x3-7489.

Pr C78x13 blk wall tires, b nw, gone only 10 miles, $20/ea; '69 Val whl, $5. R. B. Adler, x3-4651.

Patio set, 5 pc, wht wrought iron w/glass top tbl, also Victorian secretary & Empire sofa. Allen, x3-6279.

Skimmar 8' fbrglas dinghy, yr old, exc cond, $195, Bill, x3-7971.

Stereo component sys: Harmon Kardon's best fm rcvr, Garrard trntbl, pr XAM spkrs w/treble cntrls, $275 or best. Mike, x5374 Linc.

Qn sz bed, exc cond, $100. Miloslav, x3-5620.

Lightning 19' sailboat no. 605, w/trlr, bttm nds work, $500 or best. Joan F, x3-2697.

Smith Corona port manual typwrtr, old, works well, $20; Sony TC-8 8 trk crtrdg rcrdr, play, w/mics, $60 or best. Gene, x3-5338.

B flat clarinet, wd, gd cond, w/case, $80. Dominic, x3-3674.

RCA 21" b&w port TV, UHF, VHF, roll around cart, $60. JK, x8-3977 Draper.

Qn sz box spr & matt, cstm made, w/shls, $75; wlnt desk, best. Call 237-6111.

Yard sale: June 5, 10-4, antiques, furn, hsehold gds, elec equipmt 57 Andover Rd, Billerica.

Verdi's Macbeth, Bos Opera Co, 6/2, 1 tckt avail, gd seat, $6. Call 494-8876

Nw leath framed Polaroid SX-70 Land camera w/compl accessories, orig over $200, must sell, $120. Donna, x3-4271.

Wd 4'x2' bureau w/4 drwrs, $35. Judy, x3-1493.

Solid teak 5 sect hand carved wd screen, $350; bronzeware w/rosewd handles, svc for 12, $150; 6'2" L Medit style credenza, $75; embossed Thai rubbings, framed, $50/pr; 2 Thai ceremonial swords, make offer. Call 862-2895 (Lex).

Sears Coldspot 2 dr refrig/frzr, apt sz, 7 cu ft refrig w/1.6 cu ft frzr, 2½ yrs, $100; 36x80" sgl matt, $15. Sheri, 275-1618.

Telescope, diagonal prism, solar, lunar & erecting lenses, 5x24 finder scope, 8000 mm focal length, 400 power explorer, 3 lenses, 2X Barlow, 6x to 400x, Altazemuth mnt, $120. x3-2674.

Snows, E78x14 glass belted, used 1 seas, $30. Mark, x3-4549.

Mahog bureaus; Victorian bed & 2 chrs; apt clothes washer; TV; antique cradle; nw Xcntry skis, boots & down ski swtr; f skates; lots more; all nego. Call 868-0745.

Desk & chr, ask $25; 3 spd bike w/front & rear bskts, $45. Fereydoon, x3-4204.

Spinet piano, exc cond, w/rare elec organ combo, moving, must sell, $550. Uri, x3-6081.

Kirk & Sons sterling slvrware, florentine pattern, exc cond: luncheon knife, 4 teaspoons, 2 forks, sugar spoon. Carol, x3-1332.

English pram-Pedigree, gd cond, $50. Call 256-0542.

Stu sz desk, $30; door sz desk w/bureau sz drwrs, $35; var K cabs, incl combo sink w/dishwasher, best. Gundersen, x3-6085.

Vehicles

'63 VW, runs well, all fine xcept eng believed ill, as is $300, w/reblt eng $550. Jim, x3-7566.

'64 VW, selling parts. x8-3379 Draper.

'64 VW, sunrf, runs well, body rust, $160. Dave, x7635 Linc.

'66 (late) Opel Kadett, economical, over 34 mpg, gd cond, sparingly used, 47 K, nw water pump, etc,$500 or best. Call 862-4826.

'66 Olds Delta 88, V8, v gd run cond, power, 2 nw tires, radio, $350. Call 566-7397, evgs.

'67 VW bug, gd cond, $675. Ed. x3-4723.

'67 Chevy Malibu, 6 cyl, auto, p st, gd cond, runs well, $350. Mel, x3-1870.

'67 Ply Fury, 6 cyl, reliable, some rust, $300. Mike, x3-6039.

'68 VW bug, 46 K, semi-auto, gd cond, $800. Call 492-0731.

'69 Rambler, body fair, eng gd, nw exh, hoses & front end, $350 or best. Ed, x8-4432 Draper.

'69 Toyota SW, runs ok but nds love, $300. Call 731-4994.

'70 Ford wgn, auto, p st, AC, am, luggage rack, trlr hitch, stud snows w/rims, 79 K, $1,000. Frank, x8-1576 Draper.

'70 BMW 2002, blu w/blk int, amfm, radials, recent tune up, v gd cond, best. Call 491-2716.

'70 Ford Gal wgn, nw starter & tires, must sell, $600. Call 232-5316.

'70 VW, 49 K, auto, v gd cond, $1,150. Call 275-1239.

'70 Chevy Imp, 2 dr hdtp, 58 K, tilt whl, exc cond, best reas. x3-2772.

'71 Pont Grand Prix, AC, snows, power wndws, gd road car, $850 or best. Ross. x3-1607.

'71 Mustang Grande, V8, 302 cu in eng, 15 mpg, auto, p st & br, radials, exc cond, $1,650. Tulga, x3-6646.

'72 Audi 100 LS, 4 spd, sunrf, 43 K, amfm, red, nw exh & tires, exc cond, $2,700. Gary, x3-3021.

'72 Ply Valiant Scamp, 6 cyl, auto, p st, vinyl top, just tuned, 70 K, $1,500. Dick, x7606 Linc.

'72 Fiat sport cpe, showrm cond, 63K, $1,900. George, 729-0862.

'74 Ford Pinto, 4.7 K, v gd cond, $2,300. Call 267-2245.

'74 MGB roadster, 29 K, amfm radio, full tonneau cover, $3,200 or best. Call 887-8418.

'74 Mustang II, std, radials, exc cond, $2,000 or best. x8-3374 Draper.

'74 Grand Prix Cpe, 35 K, wht w/brgndy landau roof, dent rt rear qrtr, otherwise exc cond, $2,900; also Farfisa port organ w/Leslie 123 cabinet, $700. W. Derry, x3-2777.

'74 Honda CB 100, 3K, exc cond, 2 hlmts, lock & chn, $390 firm. Maggie, 643-5603, aft 5pm.

'75 Honda CB 360T, 6 spd, disc, fairing, elec start, lugg rack, showrm cond, nw $1,200, wl take $820. Tom, 661-3339.

'75 Kawasaki KZ400 w/2 helmets, 1.2K, lk nw, $1,250. Pete, x7284 Linc.

Housing

Back Bay, 12 min walk to 77 Mass Ave, 2 lg Br, LR, big K, open for 1-2 m at $76/mo, or $340/mo sum sub. Call 267-2606.

Bedford, beaut 4 BR home, wded lot on dead end str, 2 frpl, finished lg fam rm, 1½ B, garage, avail 7/1 furn or unfurn, ask $425 + util. Call 275-2304.

Belmont, nr Cushing Sq, T, pleasant 3½ BR colonial unfurn hse, 1½ B, mod K, sunrm, Wellington Sch, approx yr lse beg 7/1, $525. x3-3223.

Bklne, twnhse avail 8/1 for yr, 4 BR, 2 studies, LR, DR, lg nw K, sauna, 2 car htd garage, nr T, playgrounds, tennis, fam pref, $600. Call 731-0224.

Bklne, spac furn rm w/K priv, pkg, exc res area, qt for study, nr T. Call 734-2168, aft 3pm.

Bklne, cln 2 BR apt in priv home, qt nbrhd, nr T, sep entrance, lg LR, bkfst rm, K, washer, nw B, no pets, fully furn incl K utensils, some linen, all util, pkg, ideal for visit fac w/sm child, avail 7/1, $350. x3-1661.

Camb-Som line at Inman Sq, BR, mod, yr lse, free off-str pkg, $175 + util. Call 354-3706.

Camb, nr H Sq, sunny, mod BR, sum sub, AC, furn/unfurn, $300/$285. x7524 Linc.

Camb, sum sub Westgate studio w/K & B, compl furn, avail 6/25-9/5, $154/mo. Call 494-8423.

Camb, nr H Sq, lux apt, 2 BR, 2 B, balc, ww, dw & disp, pkg, AC, 4th fl, nr T, $365. Call 868-1585., evgs & wknd.

Camb, hse for rent end of June, cpl or 2 sgl people, nr H Sq off Brattle. Call 491-4258, evgs.

Chelsea, Wdlawn area, 2 apts, ea w/patio yd, pkg, no pets, sec dept req: 3 rms, $160 + util; other 3 rms, $220 + elec. Angelo, x5437 Linc.

Dover, sub 1½ BR cottage on beaut estate, avail 6/19. x3-3871.

Natick, 8 rm gambrel cape, lake/cntry club area, lg panelled K & fam rm alum siding, 2 frpl, exc cond, ride free bus to MIT, $59,900. Ken, x3-4426.

Som, nr Porter Sq, MIT affil housing, 2 BR apt, avail beg 6/15-7/1, sum sub w/opt, nice intntnl atmosphere. $285. x3-5216.

Som, BR, LR, K, mod, AC, ww, dw & disp, etc, free pkg, sub 7/1 w/Sept opt. Stavros, x3-7107.

Som, nr Porter Sq & T, 4 rms & use of bsmnt, 1st fl, qt str, avail 7/1, $205 incl ht, hw, cooking. Jane, 628-8513, evgs.

Somb, sub 2 BR apt 6/15 w/Sept opt, AC, dishwasher, lndry facil in bldg, unfurn, $285. x3-5216.

Som, sub avail 6/15 w/Sept opt, nr Porter Sq, mod 2 BR, ww, Ac, pkg, ideal for fam, no pets, $280 incl ht. x3-4938.

N Quincy, 2 BR Baltimore twnhse, nw ww, alum siding, nw B, must be seen, taxes only $700, mid 20's. x8-2856 Draper.

Winchester, yng colonial, 3 BR 1½ B, study, many xtras, conv to Rt 93 + T, all nw ww & paint, jalousied porch, lg lot, hi 60's. x8-1193 Draper.

Winchester, 9 rm Victorian hse, 15 min drive MIT, frpl LR, fam rm, 1½ B, $54,900. Call 729-2283.

Lg 2 BR apt, 6 min walk Harv Sq, lg yard & grdn, avail 6/15-8/15, $285/mo + phone. Call 661-8359.

Pt Judith, RI, sum cottage, 90 mi Bos, 2-3BR cape, fully furn, screened porch, on wtrfront, ovrlks Naragansett Bay, call for avail wks, $200. Demetris, x3-5557.

Rangeley, Me., nw lux 3 BR contemp on huge lake, superb view, mtn & wldrness, swim, fish, hike, canoe incl w/rent. x8-2577 Draper.

Glencoe, Nova Scotia, sum rental, 2 BR + loft hse, slps 6, 12 acre hillside site overlks E River valley, farm cntry, $100/wk. Alex Parker, x7453 Linc.

Conway, NH, 3 BR chalet, $100/wk. Jim, x366 Linc.

Mt Snow chalet avail for entire sum, v reas to responsible party, 3 BR, 2 B, nr swimming, boating, tennis, riding. J. T. Woo, x3-7303.

Animals

AKC blk & wht siberian husky, f, w/shots, 8 wks, $150. Jane Kosut, x3-3258.

Sold our home, must sacrifice AKC schnauzer pups, champ lines, tails, ears, shots, best over cost. Ralston, x339 Linc.

F puppy, 9 wks, mthr gldn retriever, playful & v affectionate. Call 923-8870.

Lost and Found

Lost: pr gold-metal frame glasses, 5/24, on Briggs Field #1. Bethellen, x8-1163 Draper.

Wanted

Fully furn apt for parents of grad stu visiting Bos during sum. Sunil, 661-7794.

Really cheap car that runs, to use for commuting to & from MIT during sum. x3-6666.

Rental of motor home, slps 8, for Aug. F. Marshall, x8-4455 Draper.

Visit prof & wife want to rent apt w/AC in Camb, 6/7-8/26. x3-4160.

Visit prof (sgl) nds suburban hse or apt for sum, wl hse-sit or pay reas rent, MIT refs. Ann, x3-7484.

Want to rent 3-4 BR hse or grdn apt, pref furn, from 7/1 or 8/1, Nwtn, Wellesley, Bklne, Belmont or Lex. Call 332-7936, evgs.

Used but not abused Kodak Carousel slide trays. Janice, x8-2843 Draper.

Want to buy stereo rcvr & trntbl, gd cond. x3-4300.

Luggage rack & 3rd seat for Ply van. Lenny, x3-4215.

Stand for 20 gal aquarium. Yvonne, x3-7843.

Used blender &/or juicer. Sam, x8-3686 Draper.

AC to rent for sum, for sm BR apt. Call 262-6153, 7-9 am or aft 10pm.

Share our farmhse, 30 acres wds, ponds, fields, 35 min N of Camb, sgl prsn over 25 pref, $120. Call 1-887-5900.

Rm avail now until 6/25 in campus frat, $90/mo, $70/3 wks. Cindy, x5-7667 Dorm.

Sub Tang apt 6/1 w/Sept opt, June rent pd. Clara, x3-4170.

Tang, priv BR avail 6/15-8/15, furn, TV, phone, furn LR, all facil, view river & Bos, $100. x3-5095, lve msg.

Wtrtwn, nr Belmont St & T, 2 BR avail for sum in 4 prsn apt, m or f, $100 incl util. Joseph Edwards, x3-3815.

F rmmate to join 6 grad stu/yng professionals in Allston hse, own BR, 10 min Cent Sq, $100 incl ht & util. Call, 783-2610.

Camb, Cent Sq, sum sub w/fall opt, rmmate to share 2 BR apt, LR, mod K & B, AC, lndry in bldg, 10 min walk MIT, 2 min to T, rent under $110, nego. David, x3-5743.

Martha's Vineyard, share beaut, secluded hse w/3 others, 4 BR, 2B, deck, frpl, barn, mooring, $500 7/1-9/6. Call 547-5023, 8-10pm.

Rmmate for furn Allston apt, own rm, K, LR, 2 blks grn line, fall opt, $105 + elec. Dave, 494-8672.

Own lg rm in comf 2 BR Beac Hill apt, well-kept, v cln & qt, conv loc, $107.50. David, x3-6742.

Carpools

Ride needed 4-5 dys/wk from Roslindale to MIT. x3-6736.

Miscellaneous

Wd like to exch 12,000 BTU 220V Fedders AC in exc cond for smaller 5000 + BTU 110V AC, my apt has no 220V line. x8-3611 Draper, lve msg.

F writers forming support group. If interested call Carol, 723-2979.

Nd your hse painted? Pr MIT stus w/sev yrs sum exper, incl trim work. Free estimate: Tom Fetters, 266-2968.

Wl move hsehold goods to San Francisco, lvg 6/8, arriving 6/23. Al, x3-5620.

Elderly f wd like to be companion to same, evgs during sum months. x3-3707.

Theory Explains Galaxy's Spiral

A theory to explain the origin of the beautiful spiral shape of many galaxies, including our Milky Way galaxy, has been proposed by three applied mathematicians at MIT.

The three believe that in a large number of galaxies, the mechanism responsible for the spirals is quite similar to the mechanism that gives rise to certain instabilities in the plasmas (gases of charged particles) contained within some nuclear fusion machines.

In both cases, the cause is a transfer of energy from one part of the plasma or galaxy to another.

Physicists and astronomers have long puzzled over the origin of galactic spiral patterns. The question is complicated by the fact that the spirals are almost as deceptive as they are beautiful: the dark areas around the spiral aren't actually empty space, but are composed of old stars too dim to be easily seen through a telescope.

The spirals contain only slightly more mass than adjacent parts of the galaxy. What causes the formation of these spirals? And why do the young, brilliant stars distribute themselves along these spirals, so we can see the spiral structure?

The theory now proposed by the MIT mathematicians answers the first question, which has stymied scientists the longest. Its authors are Dr. C-C. Lin, Institute Professor and professor of applied mathematics, and his co-workers, Drs. James W-K. Mark and Yue-Ying Lau, both assistant professors of applied mathematics. Their work was supported in part by the National Science Foundation. (Related work has been done by Professor Alar Toomre and his student Thomas A. Zang, who may have discovered yet another mechanism.)

The theory goes as follows. Embryonic spiral patterns naturally begin to form in flat, disk-shaped galaxies because of random motion and gravitation. Left to themselves, these tentative spiral patterns would be irregular and unstable.

But an exchange of energy between adjacent regions of the galaxy amplifies these nascent spirals so that they become stable and organized.

It works like this, Professor Lin says: Inside a certain circle in the galaxy, the energy of the spiral pattern is negative; outside the circle it is positive. (The circle marks the point at which the spirals and the matter of the galaxy co-rotate, or travel at the same speed.)

Exchange of energy occurs across this circle: the part of the spiral structure outside the circle continually carries positive energy away into the distant reaches of the galaxy, leaving the inner part of the spiral structure with more negative energy. This process accentuates the spiral shape.

But why don't the spirals inside the co-rotation circle also travel outwards until they become dissipated in space, like ripples caused by a pebble dropped into a pond?

The answer, Professor Lin says, is that when the waves reach the co-rotation circle, they are reflected back to the central regions of the galaxy. This results in what is known as a "standing wave pattern"—like that of a vibrating violin string.

The co-rotation circle, then, does two jobs. It pushes the spirals back to the center, and it pushes them back with greater negative energy than they had before—like a parent pushing a child on a swing, giving an extra shove each time so the swing goes higher and higher.

Why, though, do the young brilliant stars mark out these spirals, rather than distributing themselves evenly throughout the galaxy?

For the answer, one must turn first to an earlier theory that explains how spirals, once formed, could persist. The problem was this: since the stars and gas near the center of a galaxy revolve faster than those farther out, why don't trailing spirals wind up like a spool of thread?

The answer to this question was provided by the theory developed earlier by Professor Lin with two other colleagues, Drs. Frank Shu and C. Yuan. According to this theory, the spirals don't wind up because the stars and gas that mark out the spiral arms are constantly changing.

Inside the co-rotation circle, Professor Lin explains, the spiral waves revolve around the center of the galaxy more slowly than the gas and stars. As a result, the spirals "jam" galactic traffic as a snow plow jams traffic on a winding road.

As the more swiftly traveling gas and stars catch up with the spirals, the increased gravitational attraction there (because of the slightly greater mass) makes them linger in the spirals before they make their way out again.

The traffic jam (the spiral wave) remains, but the cars that compose it (the gas and stars) change, as some manage to pass, and others catch up with the obstruction.

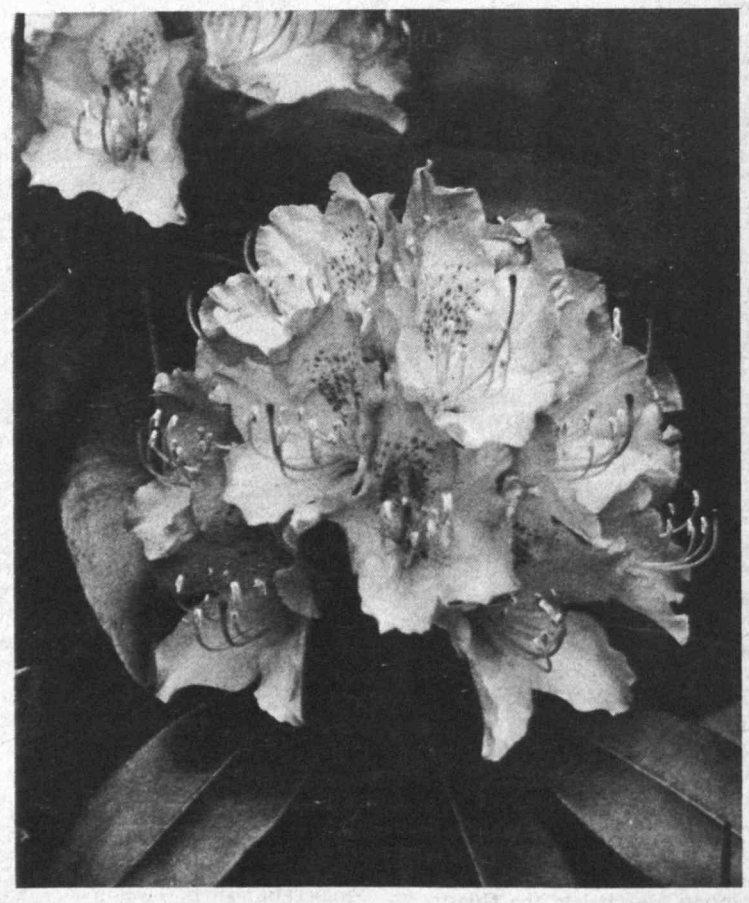
With this theory, it became possible to explain why the bright stars are distributed along the spirals. A former student of Professor Lin's, Dr. William W. Roberts Jr., now associate professor at the University of Virginia, explains it with a theory of galactic shock waves.

As the rotating gas and dust of the galaxy slam into the gravitational field of the spiral wave, a tremendous shock is produced, he says, which caused some of the gas to collapse upon itself, forming young, brilliant stars.

These brilliant, "supergiant" stars are actually mere puppets, Professor Lin says, controlled by the gravitational attraction of the old "establishment" stars behind the scenes.

But because the young stars are the only ones we can see, they look as if they're the whole show, and our telescopes show us the galaxies as beautiful spirals.

Campus in Bloom



RHODODENDRONS ARE IN BLOOM and Killian Court is brightened by their pink and purple hues.

—Photo by Calvin Campbell

POSITIONS AVAILABLE

This list includes all non-academic jobs currently available on the MIT campus. Duplicate lists are posted on the women's kiosk in Building 7, outside the offices of Special Assistants for Women and Work (10-215), and Minority Affairs (10-211), and in the Personnel Office (E19-239). Personnel interviewers will refer any qualified applicants on all biweekly jobs Grades II-IV as soon as possible after their receipt in Personnel. Persons who are not MIT employees should call the Personnel Office on extension 3-4251.

Employees at the Institute should continue to contact their Personnel Officers to apply for positions for which they feel they qualify.

Dick Higham	*3-4278*
Pat Williams	*3-1594*
Carolyn Scheer	*3-1595*
(secretary — Sally Erickson)	
Virginia Bishop	*3-1591*
Mike Parr	*3-4266*
Ken Hewitt	*3-4267*
(secretary — Joy Dukowitz)	
Sally Hansen	*3-4275*
Lewis Redding	*3-2928*
Richard Cerrato	*3-4269*
(secretary — Susan Bracht)	

Sponsored Research Staff, Staff Petrographer in Earth and Planetary Sciences to examine and describe thin sections and crack sections of terrestial rocks with standard and scanning electron microscopy; do compositional analyses of rocks using electron microprobe and x-ray diffraction equipment; prepare technical and petrographic reports. Formal education in petrology at the Masters level, experience in using and interpreting data from electron microscope and x-ray diffraction equipment necessary. D76-89 (6/2).

Sponsored Research Staff, Research Lab of Electronics. Will do research in speech communication: conduct experiments in human speech production and perception; perform acoustic analysis of speech by computer; interpret data; do some experimental design. Requires background in speech science with specialization in methods of acoustic analysis of speech. D76-88 (5/26).

Sponsored Research Staff in the Energy Lab to develop computational methods describing the physics, fluid mechanics and heat transfer processes occurring in energy conversion systems. Emphasis will be in coupling the fluid dynamics with the chemical equilibrium behavior of complex gas mixtures in various combustion processes, including those appropriate to MHD cycles and fluidized bed combustors. Requires PhD plus minimum of 10 years of experience modeling complex flows with coupled fluid mechanics, thermodynamics and chemistry. Experience in management of research programs, proposal preparation and procurement procedures also required. D76-87 (5/26).

Sponsored Research Staff in the Undergraduate Research Opportunities Program (UROP) to have overall responsibility as liaison with Program's off-campus medical and industrial participants, as well as with on-campus medicine participants. Duties include report and proposal writing, public speaking, monitoring of projects and accounts, student counseling, development of new approaches to Program participation. Position includes opportunity to initiate and carry-out work independently. Human relations and organization skills, self-confidence are required. Ability to set priorities and flexibility to work cooperatively as a team member also necessary. D76-83 (5/26).

Sponsored Research Staff, temporary in the Research Laboratory of Electronics to do postdoctoral research on a radio astronomy project studying radio sources and the effects of the earth's atmosphere on radio propagation. PhD in Physics or Electrical Engineering, strong background in electronic systems required. Position is for one year, but may be extended. D76-84 (5/26).

Sponsored Research Staff in the Center for Cancer Research to work in an immunology and leukemogenesis research program: perform cytotoxicity assays; coordinate mouse breeding; inject and bleed laboratory animals; perform a variety of biochemical and tissue culture procedures. Bachelors degree in Biology or Biochemistry required. Two or more years postgraduate research in immunology or related field preferred. D76-86 (5/26).

Ehgineering Asst., Exempt in Materials Science and Engineering to assist in research on archaeological materials. Research involves analysis of artifacts, art objects and reconstruction of original technological production process. Will use photomicrography, metallography, photomacrography, electron microanalyser, x-ray diffraction, fluorescence and related analytical techniques. Bachelors degree and experience in fields of anthropology, archaeology and art history required. Candidates must also be able to train students in various analytic procedures. E76-15 (5/26).

Secretary V in the Counseling section of the Dean for Student Affairs Office to coordinate work among 2 other secretaries and self. Perform varied secretarial duties relating to student counseling functions, special student programs, seminars; handle accounts; assist students in counseling and procedures matters. Opportunities exist for statistical and other research projects, and for writing. Excellent typing and machine transcription skills, familiarity with office procedures required. Candidates should be able to set priorities, to instruct and guide others, and to deal sensitively with people and confidential information. B76-206 (6/2).

Senior Secretary V to the Director of the MIT Alumni Fund to arrange committee and other meetings; assemble relevant materials; prepare travel itinerary and expense reports; type correspondence and other materials. Excellent typing, shorthand and machine transcription skills, ability to edit from draft material and to exercise judgement and sensitivity required. Candidates must also have the poise necessary to deal effectively with a variety of people at the Institute and outside. B76-213 (6/2).

Secretary V to Department Head, Materials Science and Engineering will handle varied duties related to department administration and academic program: arrange meetings and complex travel schedules; organize agenda; answer student inquiries; type technical material and general correspondence; independently respond to routine correspondence. May coordinate work of other secretaries. Excellent secretarial skills and a minimum of 5 years secretarial experience required. B76-215 (6/2).

Secretary IV-V in Preprofessional Advising and Education Office (Dean for Student Affairs) to handle varied duties to support functions of Office: coordinate schedules, publicity for law and medical school representatives' visits; advise students on professional school application procedures; collect and compile statistical data; maintain student records: Type routime correspondence and statistical reports. Typing skills, ability to interact well with people and to work with minimal supervision required. Non-smoking office. B76-199 (5/26).

Secretary IV in the Counseling section of the Dean for Student Affairs Office to share secretarial duties with 2 other secretaries for a 4-person professional staff. Duties include general secretarial responsibilities assisting students; arranging appointments and meetings. Opportunity exists for participation in various research projects and writing assignments. Work will be coordinated by senior secretary. Good typing, machine dictation skills, ability to deal sensitively with a wide variety of people required. B76-207 (6/2).

Secretary IV to three faculty members in the Chemistry Department to answer phones; type correspondence and manuscripts; arrange travel; maintain files. Two to three years secretarial experience, ability to exercise initiative and judgement required. B76-208 (6/2).

Secretary IV in the Laboratory of Architecture and Planning will handle general secretarial duties including monitoring of accounts; arranging meetings; taking telephone messages for part time staff; preparing payroll reports. Typing skill, ability to work without close supervision and to relate well with people required. B76-194 (5/26).

Secretary IV in the MIT Information Center to provide information about MIT activities, facilities and programs to members of the MIT community and others; distribute related brochures, bulletins, etc.; handle general secretarial duties including some editing. Good typing skills, command of English language (written and spoken) required. Non-smoking office. MIT experience helpful. B76-195 (5/26).

Secretary IV, part time to Civil Engineering faculty member, will type technical reports; answer phones; organize and maintain files; independently compose and type correspondence. Machine transcription, technical typing, organization skills required. 20 hrs./wk. B76-196 (5/26).

Secretary III-IV to two Nuclear Engineering faculty members to type proposals, reports, class notes, including some technical material; arrange appointments and travel; file. Will also handle admissions and correspondence files and statistics. Experience with machine dictation equipment, familiarity with general office procedures, organization skill required. Technical typing skill helpful. B76-201 (6/2).

Secretary III-IV in Nuclear Engineering to share secretarial duties for faculty and research group with other secretary: type technical reports, class notes and general correspondence; answer phones, arrange travel; maintain files and statistical data. Good typing, familiarity with office procedures, ability to work with minimal supervision required. Experience with technical typing and dictation equipment helpful. B76-202 (6/2).

Secretary III-IV, Legal Secretary, in Office of Sponsored Programs to transcribe and type technical patent applications and correspondence from shorthand dictation; coordinate related patent activities; maintain files; arrange appointments and travel. Good shorthand and typing skill required. Legal experience desirable. B76-210 (6/2).

Secretary III-IV to faculty members and research staff in the Center for Space Research. Will type proposals, correspondence, articles; arrange appointments and travel. Technical typing skill, ability to work under pressure required. B76-211 (6/2).

Secretary IV in Treasurer's Office to perform general office duties: type correspondence, other materials; draft simple letters; file; answer phones; arrange appointments and travel; open and distribute mail. Will also handle office expense accounts; order supplies. Requires excellent typing and organization skills, shorthand, flexibility. Nonsmoking office. B76-120.

Secretary III in the Housing Office to answer questions about housing services; list apartments available for rent; some typing. Poised, responsible individual who enjoys dealing with a great variety of people, accurate typing required. Candidates must be service-oriented, conscientious and able to handle pressure in a cyclically busy office. B76-198.

Technical Illustrator IV in the Research Laboratory of Electronics to produce camera-ready illustrations from rough sketches for use in journal articles, slides, etc. Experience with Leroy and other drafting equipment, some typing skill necessary. Candidates must be able to work with faculty, students and staff. B76-205 (6/2).

Sr. Clerk IV in Laboratory for Computer Science headquarters office to perform clerical duties to support 3 accountants: compute billings; prepare budget and expenditure reports, travel forms; disburse petty cash. Will also perform some secretarial duties: type; maintain files; answer phones. Accurate typing, ability to work with figures required. Position begins 7/1/76. B76-200 (6/2).

Technical Typist III-IV in Research Laboratory of Electronics Publications Office will handle typing and layout of photo-offset pages and some proofreading. Good typing, spelling, memory skills, ability to work from written and oral instructions and with detail required. Experience with IBM PSM typewriters and mathematics typing helpful. B76-204 (6/2).

Clerk II in Medical Dept. Record Room to pull and file medical records from telephone and written requests; check records for required forms; file material into individual records; maintain patient index file; perform other duties to maintain system. Candidates should have previous office experience which demonstrates capability for accuracy with detailed work, and must be physically able to work on their feet all day. 40 hr. work week (7am-4pm or 7:30am-4:30pm. B76-209 (6/2).

Clerk II in the Admissions Office will type labels, assist in large mailings and other special projects. Excellent typing, ability to handle detailed work with speed and accuracy required. Non-smoking office. B76-189 (5/26).

Senior Technician (Electronic), hourly, in National Magnet Lab will construct, operate and maintain highly complex nuclear magnetic resonance spectrometers which employ UHF-VHF electronics, digital and analytic circuitry and pulse systems. Will also lay out, construct and test prototype circuits and systems; test and operate high field superconducting magnets. Graduation from a 2 year day technical school and a minimum of 5 years applicable experience required. Strong background in UHF-VHF electronics and digital and analog circuitry also necessary (40 hr./wk.). H76-62 (5/26).

Technician A, hourly, in the National Magnet Lab to assist in laboratory research and analytical work. Will be involved in construction, operation and maintenance of a high frequency nuclear magnetic resonance spectrometer. Graduation from a two year day technical school or equivalent and a minimum of 2 years applicable experience required. Experience with construction, debugging of and digital electronics is mandatory. Knowledge of machine shop, chemical and cryogenic techniques desirable. H76-61 (5/26).

The following positions were still available at *Tech Talk* deadline. The date following each position is the date of the most recent *Tech Talk* issue in which the position was described.

ADMINISTRATIVE STAFF:
- A76-12, Systems Manager, Alumni Association (5/12)
- A76-13, Asst. to Wage & Sal. Admin., Office of Personnel Rel. (5/26)

BIWEEKLY:
- B75-543, Sec. IV, Chem. Eng. (5/19)
- B76-90, Sec. IV, MIT Devel. Foundation (3/17)
- B76-109, Sec. IV, Science Library (5/12)
- B76-110, Sec. III-IV, MIT Assoc. (3/31)
- B76-151, Sec. III, Medical Dept. (4/28)
- B76-159, Sr. Clerk III, Resource Planning (5/19)
- B76-161, Sec. IV, Center for Space Res. (5/5)
- B76-162, Sec. III-IV, Meteorology (5/5)
- B76-163, Sec. IV, MIT Press (5/5)
- B76-164, Sec. IV-V, Medical Dept. (5/5)
- B76-166, Sec. IV, Sloan School (5/12)
- B76-173, Sec. IV, Nutrition & Food Sci. (5/19)
- B76-178, Sec. V, Resource Devel. (5/19)
- B76-179, Tech. Asst. IV, Energy Lab. (5/19)
- B76-183, Sr. Clerk III, Medical Dept. (5/19)
- B76-186, Sec. III, Civil Engineering Dept. (5/26)
- B76-187, Sr. Clerk III, Comptrollers Accounting Office (5/26)
- B76-192, Sec. III-IV, Center for Cancer Research (5/26)
- B76-193, Sec. IV, Energy Lab. (5/26)

ACADEMIC STAFF:
- C76-4, Tech. Asst., Biology (4/28)
- C76-6, Microbiologist, Medical Dept. (4/21)
- C76-7, Tech. Asst., Biology (5/19)

SPONS RES. STAFF:
- D75-48, Economist, Energy Lab. (6/25)
- D75-161, Economist/Policy Analyst, Energy Lab. (9/10)
- D75-229, Research Engineer, Energy Lab. (11/19)
- D75-243, postdoc. res., Computer Science, Artificial Intell. Lab. (1/7)
- D75-244, postdoc. res., Computer Science, Artificial Intell. Lab. (1/7)
- D75-250, postdoc. res., Physics, Lab for Nuclear Sci. (1/14)
- D76-12, postdoc. res., Physics, National Magnet Lab. (2/18)
- D76-14, Tech. Asst., Arteriosclerosis Center (2/18)
- D76-17, Biochemist, Res. Lab. of Elec. (2/25)
- D76-18, postdoc. res., Physics, Lab. for Nuclear Sci. (3/3)
- D76-19, postdoc. res., Physics, Lab. for Nuclear Sci. (3/3)
- D76-22, Laser Physicist, National Magnet Lab. (3/3)
- D76-24, Programmer, Artificial Intell. Lab. (3/10)
- D76-30, Staff Scientist, Neuroscience Res. Program (3/24)
- D76-31, Staff Scientist, Neuroscience Res. Program (3/24)
- D76-32, Staff Scientist, Neuroscience Res. Program (3/24)
- D76-40, Tech. Asst., Architecture (3/31)
- D76-44, postdoc. res., Physics, Lab. for Nuclear Sci. (4/14)
- D76-45, Plasma Physicist, National Magnet Lab. (4/14)
- D76-46, Plasma Physicist, National Magnet Lab. (4/14)
- D76-47, Plasma Physicist, National Magnet Lab. (4/14)
- D76-48, Plasma Physicist, National Magnet Lab. (4/14)
- D76-49, Plasma Physicist, National Magnet Lab. (4/14)
- D76-50, Theoretical Solid State Physicist, National Magnet Lab. (4/14)
- D76-53, Curricula Development, Center for Advanced Eng. Studies (4/14)
- D76-56, Asst. Manager, MIT Sea Grant Program (4/21)
- D76-57, Stress Structures Design, National Magnet Lab. (4/28)
- D76-61, Energy Economist, Energy Lab. (5/5)
- D76-67, Biologist/Biomedical Engineering, Mech. Eng. (5/5)
- D76-70, postdoc. res., Physics, Lab. for Nuclear Sci. (5/5)
- D76-71, postdoc. res., Physics, Lab. for Nuclear Sci. (5/5)
- D76-74, Jr. Engineer, National Magnet Lab. (5/19)
- D76-80, Electrical Engineer, National Magnet Lab. (5/26)
- D76-81, Biochemist, Center for Cancer Research (5/26)
- D76-82, Biochemist, Center for Cancer Research (5/26)

EXEMPT:
- E76-7, Nurse Practitioner or Physician Asst., Medical Dept. (3/24)
- E76-12, Asst. Chief Oper., Physical Plant (4/28)

HOURLY:
- H76-45, Mechanic B, Physical Plant (5/26)
- H76-46, Mechanic B, Physical Plant (5/26)
- H76-46, Mechanic B, Physical Plant (5/26)
- H76-47, Mechanic B, Physical Plant (5/26)
- H76-57, Electrician, Physical Plant (5/26)

The following positions have been *FILLED* since the last issue of *TECH TALK*:

B76-183	Sr. Clerk III
B76-160	Sr. Clerk III
B76-170	Sr. Clerk III
B76-190	Lib. Asst.
B76-61	Sec. IV Cancel
B76-177	Sec. IV
E76-14	Exempt
H76-60	Driver Utility
B76-135	Sec. IV
B76-188	Sec. III

The following positions are on *HOLD* pending final decisions:

B76-161	Sec. IV
B76-180	Sec. IV
B76-181	Sec. V
B76-170	Sr. Clerk III
E76-13	Admin Asst.

Alumni

(Continued from page 1)

water for homes and institutions on a cost-competitive basis.

The Technology Day program is the highlight of alumni week. Thirteen major class reunions, seven departmental reunions, five "mini" class reunions and a living group reunion—the most ever held on campus—will take place during the week.

As part of the reunion activity, the advisory board of **Technology Review**, MIT's national journal of science and technology, will be host to a reception for class secretaries.

The Friday program also will include a breakfast, a memorial service, a luncheon at which the reunion classes present their class gifts, and a late afternoon reception.

The traditional MIT alumni night at The Boston Pops will be Thursday night (June 3).

Corporation

(Continued from page 1)

national sponsoring committees for MIT's recently completed Gilliland Professorship and chemical engineering building, and presently is a member of the national steering committee for MIT's five-year $225 million Leadership Campaign.

Ralph Landau, former president and now chairman and chief executive officer of Halcon International, Inc., of New York City. Dr. Landau received the doctor of science degree from MIT in 1941. He is an internationally prominent leader in the chemical industry, and MIT's new chemical engineering building is named in his honor. A Term Member of the MIT Corporation since 1972, he has served on several visiting committees over the years. He was chairman of the 50th anniversary convocation of the Department of Chemical Engineering in 1970, was a member of the national sponsoring committee for the new chemical engineering building, and is a member of MIT's Energy Laboratory Advisory Board. He has served on MIT's Corporation Development Committee since 1966.

Carl M. Mueller, managing partner for the investment firm of Loeb, Rhoades & Co., New York City. Mr. Mueller was graduated from MIT in mechanical engineering in 1941. He has been a Term Member of the Corporation since 1969 and a member of the Corporation's Executive Committee since 1970. In addition, he has been a member of the Corporation's Investment Committee since 1969 and its chairman since 1975. He has been a member of the Corporation Development Committee since 1965 and presently is a member of the National Sponsoring Committee for the $225 million Leadership Campaign.

The five Term Members will begin their five-year terms July 1. They are:

Ellis C. Littmann, president and chairman of the board of Nixdorff-Krein Manufacturing Co., St. Louis, Mo. A 1933 graduate of MIT, Mr. Littmann has been with Nixdorff-Krein since 1933, has been president since 1954 and chairman since 1974. At MIT, he is a member of the Corporation Development Committee and the Alumni Fund Board and is vice president of the MIT Alumni Association.

William H. Mills, founder and president of Mills & Jones Construction Co., St. Petersburg, Fla. Mr. Mills is a 1934 graduate of MIT in civil engineering and began the company he heads in 1946. He has been a member of MIT's Corporation Development Committee since 1965, and a member of the Leadership Committee concerned with the $225 million Leadership Campaign since 1975. He was a member of the Corporation Visiting Committee for the Department of Civil Engineering from 1959 to 1973.

Kenneth H. Olsen, founder and president of Digital Equipment Corp., Maynard, Mass. Mr. Olsen received his SB degree in electrical engineering from MIT in 1950 and the SM in electrical engineering in 1952. He was an engineer at MIT's Digital Computer Laboratory and Lincoln Laboratory for several years before he began Digital Equipment Corp. At MIT, he has been a Term Member of the Corporation since 1971 and a member of the Corporation Visiting Committee for the Department of Electrical Engineering since 1968 and its chairman since 1973. He also is a member of the Libraries Visiting Committee.

Howard L. Richardson, of New Britain, Conn., former vice president of the General Dynamics Corp. and a former president of the Silicon Transistor Corp., now a consultant and corporate director. Mr. Richardson received the SB degree in 1931 and the SM degree in 1932, both under MIT's Electrical Engineering Cooperative Program. Long active in MIT alumni affairs, he was president of the Alumni Association during 1975-76, is president of the Class of 1931, is a former vice president of the association, served many years on the Alumni Advisory Committee, has been an officer of the MIT Club of New York and the MIT Club of Hartford. He has served on several Corporation visiting committees and has been a member of the Corporation Development Committee since 1971.

Helen F. Whitaker of Harrisburg, Pa., Swans Island, Me. and Naples, Fla., trustee of the Whitaker Foundation of Harrisburg, established by her late husband, Uncas A. Whitaker, MIT alumnus and a Life Member Emeritus of the MIT Corporation who died last September. Mrs. Whitaker has long been active in the development of the life sciences at MIT. She is a trustee of the MIT Health Sciences Fund Board. In addition, Mrs. Whitaker and her husband made possible a major building at MIT—the Uncas A. and Helen F. Whitaker Building—which houses elements of MIT's Department of Biology and Department of Nutrition and Food Science.

James Albert Moody of Kansas, Mo., who received the SB degree in management from MIT last year and received the SB in electrical engineering and computer science this year, was elected a member of the Corporation for five years as a Representative from Recent Classes. His term will begin with the annual meeting of the Corporation next October. He was nominated by members of this year's graduating class plus members of the classes that graduated last year and the year before. There are five Representatives from Recent Classes on the Corporation who serve staggered terms. As an undergraduate, Mr. Moody was president of his residence, Baker House, and a vice president of the Undergraduate Association. He received both the William T. Stewart Award and the Karl Taylor Compton Prize for undergraduate service.

In addition to the new members elected Friday, **Edward O. Vetter** of Dallas, Tex., will begin on July 1 a one-year term as an ex officio member of the Corporation by virtue of his election as the 1976-77 president of the 60,000-member MIT Alumni Association.

Mr. Vetter received the SB degree from MIT in 1942. He was executive vice president of Texas Instruments Incorporated, of Dallas, from 1969 to 1975 and before that had been a group vice president and divisional general manager. At MIT, he serves as a Term Member of the Corporation, having been elected in 1973, as well as a member of the Corporation Executive Committee, Corporation Development Committee and Chairman of the Nuclear Engineering Visiting Committee.

Harbison Music

Five Songs of Experience by composer John Harbison, associate professor of music in the MIT Department of Humanities, will be performed by the Cecilia Society at a concert of recent American choral music Saturday, June 12, at 8:30pm in Sanders Theatre, Harvard University.

The Society's music director, Donald Teeters, will conduct.

Mr. Harbison's work is one of three compositions to be sung by the Boston area choral group. The other two are recent compositions by Donald Martino and Daniel Pinkham. Mr. Martino is chairman of the composition department, and Mr. Pinkham chairman of the performance of early music department, at the New England Conservatory of Music.

Tickets, at $5, $4, $3 and $2, will be available at the door. Students with college IDs will receive a discount.

The concert will be repeated June 21 and 22 at the American Guild of Organists' national conference.

Forum Broadcast Include 2 from MIT

Remarks of two MIT professors will be included in a selection of previously broadcast Cambridge Forum programs on "Questions for America's Third Century" to be aired by WGBH-FM, Boston, (89.7) on Saturday evenings at 6pm during the summer.

George W. Rathjens, professor of political science in the MIT Department of Political Science, will be part of a panel discussion "Nuclear War by 1999?" on Saturday, June 5. Lester C. Thurow, professor of economics and professor of management in the MIT Department of Economics, will speak on "The US Economy: What Is It Becoming?" on Saturday, June 26.

Sunlight and Water May Yield Energy for the Future

By BARBARA BURKE
Staff Writer

Sunlight and water may be future sources of electricity and fuel, and may aid in the production of fertilizer.

A year ago, a group of chemists at MIT reported the first conclusive evidence that ultraviolet light can separate water into oxygen and hydrogen. The hydrogen can be burned as fuel, or used to make fertilizer.

Now Mark S. Wrighton, assistant professor of chemistry who directed the earlier work, has used sunlight to produce electricity from a mixture of water and polysulfides.

In this case, the water remains unchanged, while the polysulfide gives up electrons, resulting in the production of electric power.

Professor Wrighton and his co-workers, research associate Dr. Steven W. Kaiser and graduate student Arthur B. Ellis, have been working both with laser light and with sunlight. They hope that by experimenting with various electrodes and electrode catalysts, they will be able to make such systems produce both electricity and hydrogen. The systems are called photoelectrochemical cells.

They also hope to increase the energy conversion efficiency of the cells. (The present systems, which use either cadmium sulfide or cadmium selenide to absorb the light energy, have solar energy conversion efficiencies up to about two percent.)

If this could be done, the electric power could be used directly, while the hydrogen could be stored for use at night or on rainy days—or used to make fertilizers.

The work has been supported in part by the National Aeronautics and Space Administration. Their original system consisted of a beaker of water into which were put two electrodes connected by a wire—a titanium dioxide crystal and a piece of platinum. (Similar work is being carried out on titanium dioxide crystals at MIT's Lincoln Laboratory.)

When ultraviolet light is shone on the titanium dioxide crystal (and a small battery is used to assist the reaction) the titanium dioxide strips electrons from hydroxyl ions in the water.

These electrons travel along the wire to the platinum electrode, where they react with positive hydrogen ions in the water to form hydrogen atoms. The hydrogen atoms then combine to form hydrogen molecules.

This system works only with ultraviolet light, which represents only a small fraction of the light available from the sun. But chemists have found that electrodes made of cadmium sulfide or cadmium selenide respond to visible light. Unfortunately, such electrodes decompose within minutes.

The researchers' most recent advance was their discovery that this decomposition can be prevented by adding polysulfide to the water. In this system, the polysulfide is the active agent.

At one electrode, the polysulfide loses electrons, becoming oxidized. The electrons travel over the wire to the other electrode, where they recombine with the oxidized polysulfide to regenerate polysulfide.

No polysulfide is lost, the electrodes don't decompose, and the flow of electrons can be used for electric power.

Red light from a laser gives an efficiency of about 10 percent. When solar energy is used, about half the light energy is absorbed by cadmium selenide, and electric power is produced from solar power with a two percent efficiency. Although low, this is several times the efficiency of the original titanium dioxide-platinum system.

"But the crucial finding here is not the efficiency, but our ability to stabilize the system," Professor Wrighton said.

"This gives us hope that we will find a system that can efficiently use sunlight to decompose water into oxygen and hydrogen, as well as producing electricity."

Stone Carvings

STONE CUTTER Edward J. DiRocco traces design of limestone ornament atop pier at Sailing Pavilion. Tracing will be used when new limestone ornaments are cut for Sailing Pavilion expansion.

System Measures Reactor Temperature

An unobtrusive thermometer with extraordinarily fast reactions has been built by two MIT nuclear engineers for use in studying the cooling systems of fast breeder nuclear reactors.

The thermometer can measure the temperature of turbulent fluids without distributing their flow. And it can detect temperature changes as rapid as 12 degrees (F) in one millisecond.

Secret to its success is that nothing enters the fluid but a beam of light from a laser.

The instrument was built by Dr. Michael W. Golay, associate professor of nuclear engineering, and graduate student Ralph G. Bennet, with funds from the U.S.Energy and Development Administration.

The two are using it to model and study the cooling system of liquid metal cooled fast breeder reactors. They want to learn how to prevent sudden and severe drops in temperature that could cause the reactor's structural components to fail—for example, to crack, buckle or break.

The system includes a laser, a beam splitter and several mirrors. Light from the laser is split into two beams, directed by a mirror in different directions. One beam goes through the turbulent fluid, the other does not. The beams are then made to come together again.

The extent to which the beams are out of phase when they rejoin is a measure of the density of the turbulent fluid, since the light takes longer to get through a denser fluid. The density, in turn, provides a measure of the fluid's temperature.

The system has limitations, Professor Golay said.

"You need a transparent fluid, that will allow light through, and you can't use a dense fluid—like water—in which a small temperature change produces a tremendous change in the speed of light through the fluid."

Moreover, the "thermometer" can't provide a sensitive measure of the temperature of a turbulent fluid in a wide container: the resulting signal would be determined by the average temperature across the container. To be reliable, the measurements must be taken with a thin cross-section, so that the temperature along the path of the light is approximately uniform.

Despite these limitations, Professor Golay said that the system is a significant improvement over previous methods, and provides a more reliable way to study problems such as the cooling system behavior of liquid metal cooled fast breeder reactors (lmfbr's).

These reactors "breed" more fuel in the form of plutonium than they consume in the form of uranium. Unlike most present reactors, which use water as a coolant, the LMFBR uses a liquid metal, such as sodium: cold sodium pumped into the reactor chamber flows through the nuclear core and carries heat away.

Water can't be used in these reactors because it would slow down neutrons, making the conversion of uranium into plutonium less efficient. Liquid sodium doesn't do this; moreover, it is a very good conductor of heat. But this high conductivity can cause problems.

"When you shut the reactor down, suddenly the sodium coming out of the core becomes much colder," Professor Golay said. "The temperature of the sodium can drop 150 degrees in 20 seconds. This thermal stress could cause cracking and failure of structural components in the reactor."

To prevent this, the reactor vessel of fast breeder reactors is made very large. The designers' intention is that if the cold sodium has a large vessel in which to flow, it will mix well with the remaining hot sodium, making the temperature change less sudden.

But since cold sodium is not as buoyant as hot sodium, the danger is that the two will not mix well.

Professor Golay and Bennett are using their test system to evaluate computer models for predicting thermal shock, and to study ways to prevent it. One possible solution, Professor Golay said, would be to increase the velocity of the incoming sodium, to encourage it to travel throughout the entire reactor vessel.

The experimental system models the Fast Flux Test Facility Reactor being built in the state of Washington. The model has three parallel inlets; hot air is pumped in through the central inlet, and cold air through the two others.

Sodium can't be used because it is opaque; however, Professor Golay says that it is possible to make valid inferences about the mixing behaviour of liquid sodium from that of air.

The heat is provided by a second-hand toaster Bennett bought for $4. He estimates that aside from the laser, he spent $100 on equipment.

Chronic Overgrazing Seen Cause of Sahel Tragedy

Chronic overgrazing on the semi-arid rangelands of sub-saharan Africa eventually would have caused a human and ecological tragedy in that area even without the most recent disastrous drought.

Furthermore, only fundamental changes in the economy and culture of the area—called the sahel—can prevent the ultimate destruction of the rangelands. And there is good reason to doubt whether such changes can be brought about.

Those are some of the major conclusions reached by researchers at MIT and reported in the May issue of *Technology Review*, MIT's national journal of science and technology.

The two-year study of the sahel-sudan region in West Africa was carried out by the MIT Center for Policy Alternatives through a grant from the United States Agency for International Development.

The report was prepared by Dr. William W. Seifert, professor of civil engineering at MIT and principal investigator for the study, and Dr. Anthony C. Picardi, who received his ScD at MIT in 1975 and presently is with Development Analysis Associates, Inc., Cambridge.

When the study was begun in 1973, a severe drought had left 50 to 80 percent of the livestock dead in the region and uncounted thousands of herdsmen and their families destitute and starving in refugee camps.

Focusing on a limited geographical area about the size of Kentucky, the researchers studied the causes of the tragedy first-hand and held discussions with African leaders, aid organizations and people at research institutes.

Then they used this data to create a computer simulation model of the interactions among the ecological system, livestock herds and human population. The purpose of the model was to test long-term policies for the recovery and restoration of the sahel.

The drought was the triggering agent for the sudden collapse of human and animal populations in the sahel, the researchers found, but the collapse "came concurrently with the rapid destruction of the rangeland."

"This destruction, called desertification, indicates that the range can no longer produce adequate green forage because of soil erosion and the plants' losses of their regenerative abilities," they said. "The population growth rates, stock growth rates, rainfall pattern, herd losses and extent of desertification from 1920 to the present all contributed to the tragedy in the sahel."

They added: "Computer simulations and historical accounts agree that chronic overgrazing in the sahel began in the early 1960s. When the last drought began in 1969, overgrazing increased rapidly and desertification became widespread. But even without the last drought to trigger the collapse, simulation studies indicate that chronic overgrazing would have eventually caused similar severe desertification."

The researchers likened the situation to the so-called commons syndrome in which everyone grazes his livestock on a common pasture according to his own desires. Since there is no control over how many animals each individual grazes, the common pasture is inevitably destroyed.

In the sahel, the researchers said, each individual herdsman serves himself and his family best by maintaining the largest possible herd in order to provide milk, to sell for goods in the market and to use as "insurance" should drought or disease destroy some of the herd.

While this behavior is practical from the individual point of view, it encourages overuse of the common grazing land.

The MIT researchers said that most of the proposed technical assistance programs for the sahel—establishment of veterinary services, breeding programs, well-digging programs, reseeding and restocking programs—actually would work against the long-term interests of the region by increasing herd sizes and bringing about swift and total desertification of the range.

"As long as each herdsman is primarily concerned with his own short-term survival," the researchers said, "no combination of economic and technical programs will succeed in preventing the destruction of the range and associated human suffering."

Through their computer models, the researchers added, they had found "one successful, though unconventional, approach which achieves long-term viability in the sahel."

The major elements of this strategy, they said, would be to set maximum grazing levels and to bring about a fundamental change in the herdsman's mode of operations by having them assign top priority to range conservation.

The researchers acknowledged that such a profound change in cultural priorities "is highly unlikely," but they said they wanted at least to show "the extent of changes which must occur to result in a sustained improvement in the range."

"Practically, one is asking the herdsman to put a higher value on the long-term preservation of the ecosystem than on his own perceived immediate welfare," they said. They added that those who live in rich countries, with personal incomes 350 times greater than that of the sahel herdsmen, have yet to accomplish this—as evidenced by the way in which the commons syndrome has led to the overuse of "fisheries, land, and a great many other commonly shared amenities."

"Is it realistic," they asked, "to expect the sahel herdsman, living so close to the limits of survival, to solve this fundamental social problem?"

Nevertheless, they warned, the nomadic and semi-nomadic tribespeople of the sahel can reverse the otherwise inevitable destruction of their land only by establishing long-term preservation "as their first priority."

Schlumberger Fellowship Announced

Lindsay A. Weaver of Metropolis, Ill., senior in electrical engineering, will hold the Schlumberger Foundation Fellowship at MIT for 1976-77.

The Schlumberger Foundation, a non-profit organization established in 1954 by the Schlumberger Well Surveying Co., now a subsidiary of Schlumberger, Ltd., of New York City, established the fellowship at MIT in 1955. It is awarded annually to an outstanding student planning to study for an advanced degree in electrical engineering and computer science and provides a $7,000 grant for tuition and living expenses.

A 1971 graduate of Philips Exeter Academy, Exeter, N.H., Mr. Weaver spent a year between high school and college traveling and studying in Germany. His MIT undergraduate thesis involves measuring systolic time intervals using a microprocessor. From 1972-74 Mr. Weaver worked part-time at Francis Bitter National Magnet Laboratory on the Magneplane Project, developing a magnetically levitated high speed ground transportation system. From 1974-75 Mr. Weaver worked part-time with a bioengineering group at Massachusetts General Hospital on the development of a new anesthesia machine based on a microprocessor.

Mr. Weaver will begin graduate studies at MIT in September working toward the SM degree in electrical engineering and computer science. His long term goal is state-of-the-art analog and digital circuit design, microprocessor applications and biomedical engineering.

Obituaries

Lucia M. Hunt

Lucia M. Hunt, 90, of 10 Sylvan St., Malden, died Tuesday, May 11.

Miss Hunt came to MIT in 1926 and, when she retired in 1951, was a secretary in the Department of Electrical Engineering.

She is survived by two nephews, Robert Harris of California and Robert M. McMahon of Malden.

J.F. Gallagher

James F. Gallagher, of 111 Cushing Ave., Belmont, died Thursday, May 27, at the age of 62.

An employee of Draper Laboratory since 1946, Mr. Gallagher was a foreman when he was placed on long-term disability in 1970.

Mr. Gallagher is survived by his wife, Marguerite M. (Matte); a sister, Elizabeth Ritcey of West Newton; and two brothers, Charles of Calif. and Hugh of Waltham.