

Energy Cost Increase is Cut By Conservation

Energy conservation measures at MIT may save the Institute as much as \$600,000 this year, Thomas E. Shepherd, Jr., said Tuesday.

Mr. Shepherd, superintendent of utilities, said he expected the estimated savings to be about evenly divided between electric consumption and boiler fuels, both oil and gas.

MIT's original energy budget for the fiscal year ending June 30 was \$3.2 million, but increases in the price of fuel could have pushed actual costs to as high as \$5 million, Mr. Shepherd said.

However, he said, energy conservation measures have cut into these projected increases—and could reduce them by about \$600,000.

The Department of the Physical Plant put an energy saving program into full operation this fall in the face of a 30 percent reduction in its fuel oil allocations and steeply rising energy costs.

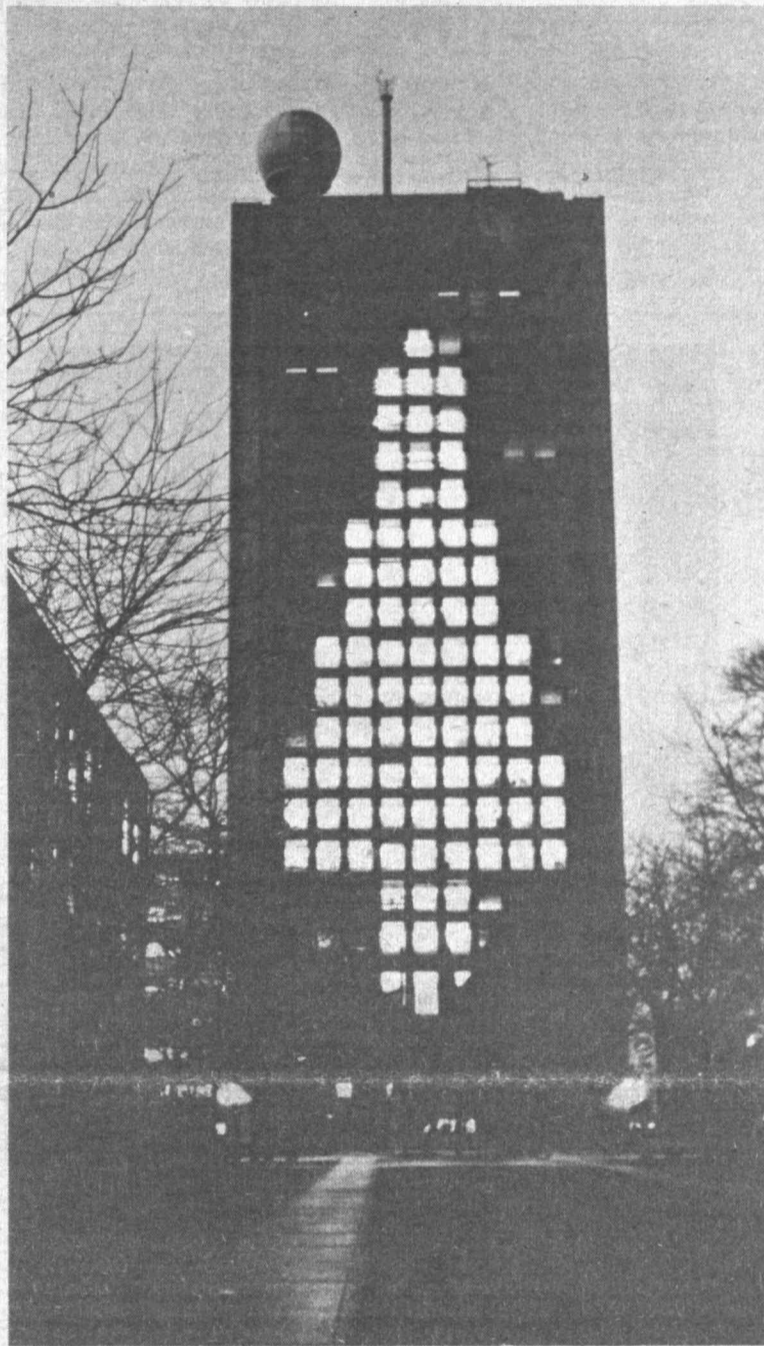
Officials in the department believe that savings of 20 percent or more are possible through conservation measures that concentrate in such areas as lighting, temperature and fan systems.

These projections, and the success of a pilot program last summer, have led MIT to launch a search for a full-time environmental engineer to organize and direct the Institute's conservation program.

On Monday, knowledge being gained at MIT on saving energy, both through operations and research, was passed on to representatives of between 125 and 150 large industrial and commercial users.

The conference, held in Kresge Auditorium, was sponsored by the MIT Energy Laboratory in cooperation with New England utility companies and the MIT Industrial Liaison Office.

Speakers included David C. White, Ford Professor of Engineering and director of the Energy Laboratory; August L. Hessel-schwerdt, Jr., professor of mechanical engineering, emeritus; William R. Dickson, director of the Department of Physical Plant; Mr. Shepherd; Louis A. Felton, a graduate student in the Department of Mechanical Engineering, and Charles J. Faulstick of the Northeast Utilities Service Company.



A 17-story Christmas tree was created last week by student ingenuity with cooperation from inhabitants of the Green Building. Implementation of the tree was carried out by lowering blinds in the building. Next year the student organizers plan to light a similar tree on the other side of the building as well. This tree was lit from 3:30 to 5pm and did not take additional electricity.

Faculty to Get Copyright Plan

Discussion of a proposed Institute copyright policy heads the agenda for a meeting of the MIT faculty which is scheduled to begin at 3:15pm this afternoon, Dec. 19, in Room 10-250.

The other major agenda item is a progress report on the fuel and energy situation from Philip A. Stoddard, vice president for operations.

The Institute's Committee on Patents and Copyrights, headed by Albert G. Hill, vice president for research, in a memo to faculty members, said the intention of the proposal was "to make the

problem of administering policy better defined and more readily accomplished."

A draft of the proposed policy, included with the formal announcement of the meeting, sets out these objectives:

"... To protect and promote the traditional academic freedom of the Institute's staff and students in matters of publications; ... to balance fairly and reasonably the equitable rights of authors, sponsors and the Institute; and ... to ensure that any copyrightable material in which the Institute has

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MIT Expert a Principal Advisor in Watergate Tapes Examination

Dr. Barry Blesser, assistant professor of electrical engineering at MIT and an authority on audio tape recordings, was a principal advisor in planning the examination of seven so-called Watergate tapes given to US District Judge John Sirica by the White House recently.

Dr. Blesser's suggestions were the principal focus of an article in the December 14 Science magazine.

Dr. Blesser's involvement with the Watergate tapes began when, at the request of Carl Feldbaum, a staff member in the Special Prosecutor's office in the Justice Department, outlined several areas of investigation he thought should be covered in any analysis of the tapes and submitted the names of people he thought could do the work.

Dr. Blesser said he was contacted by Feldbaum by telephone,

but he does not know how Feldbaum obtained his name. He said Feldbaum apparently submitted a memorandum to Judge Sirica based, in part, on Dr. Blesser's written suggestions. He said that Judge Sirica then apparently accepted the suggestions, ordered the formation of the panel, and launching of the technical examination of the tapes.

Dr. Blesser said, Feldbaum

13 Million Households 'Housing-Deprived'

Wide spread national attention was focused this week on a major housing report just issued by the MIT-Harvard Joint Center for Urban Studies that raises sharply the nation's housing goals through the year 1980.

The study, made public at a national press conference in New York City, found that 13 million US households were "housing-deprived" as of the 1970 census, a figure that more than doubles previous estimates.

In addition, the study—begun two years ago and continuing—projected that 23 million new housing units are likely to be built between 1970 and 1980, primarily to satisfy population growth, mobility, and changes in life style. That is 20 percent more than previous estimates.

Immediately following announcement of the findings in major news media, requests to purchase copies of the 270-page

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Tunable Laser Opens Up Communication Potential

A highly stable, widely tunable laser system that has been developed by MIT scientists will allow the production of laser light in any wavelength of the visible spectrum. The development could allow lasers to be tuned as readily as radios, opening up the use of the laser in communications.

The tunable laser also enables use of a laser beam to make the most precise analytical probes of atoms and molecules. The scientists have used their beam to obtain the highest resolution spectrum ever achieved with a tunable laser beam. They have been able to resolve a spectrum of two parts in a billion—which is one thousand times better than the resolution obtained with the best spectrometer.

Present lasers produce light at only a few specific frequencies, each frequency depending upon the lasing material used.

Unlike common light beams, which consist of light of differing wavelengths and at different angles and phases within the

beam, laser light is coherent light. A laser beam consists of a single-wavelength beam of light in which all the waves are in phase.

The stable, tunable laser was developed by Shaoul Ezekiel, associate professor of aeronautics and astronautics, and graduate students Robert E. Grove, Fred Y. Wu, Lloyd A. Hackel, and Douglas G. Youmans.

Their laser is one of a general type known as dye lasers—so named because they utilize a liquid dye as a means of producing laser light. Unlike lasers that use crystals or gases to produce coherent light, dye lasers have long been known to be tunable over a wide range of frequencies. This is because dye lasers naturally emit light over a wide bandwidth, while crystals or gases are limited in the light emissions that can be stimulated from them. Dr. Ezekiel and his co-workers used a dye called rhodamine 6G, which can produce laser light in a yellow-red region of the visible spectrum. By using

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Wiesner, Fano Appointed To Commission on Privacy

Massachusetts Governor Francis W. Sargent has named MIT President Jerome B. Wiesner and Professor Robert M. Fano to a blue-ribbon Commission on Privacy and Personal Data. Dr. Fano is Ford Professor of Engineering and associate head of the Department of Electrical Engineering for Computer Science and Engineering.

The commission will examine the privacy and confidentiality implications of the state's computerized record-keeping and information gathering systems. It also will study statutes, regulations and administrative practices,

recommending changes when necessary to insure the confidentiality of the data stored in them.

Chairman for the commission is Harvard Law Professor Arthur Miller, author of *Assault on Privacy* and chairman of the Massachusetts Privacy and Security Council.

Flanagan of Bell Telephone Laboratories, Inc., who holds SM and ScD degrees in electrical engineering from MIT; John G. McKnight of Dictaphone Corp.; Thomas G. Stockham, professor of computer science at the University of Utah, who holds SB, SM and ScD degrees in electrical engineering from MIT and who formerly was an MIT assistant professor and a staff member at

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MIT Expert is Principal Advisor in Tapes Examination

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the MIT Lincoln Laboratory; and Mark R. Weiss of Federal Scientific Corp.

Dr. Blesser said he was consulted because he is familiar with several areas needed in the tape study—speech production, tape recorder dynamics, signal processing, reverberation, and acoustics. Dr. Blesser said he asked Feldbaum to omit him personally from the panel so that "because I do not know exactly what is being done with the tapes, I am free to comment publically on what I think they are doing and on what I think they should be doing."

"It wasn't that I was an expert in any one area, but that I was in a unique position of being aware of the capabilities in several areas," he said.

In a later interview, Dr. Blesser said it might be possible for someone to alter tapes without being

detected, but because of the kinds of tests available the probability of this is very low. Three kinds of analysis can be used, he said, to detect tape tapering: comparisons of various electronic fingerprints left by individual tape recorders; distinctive aspects of the acoustic environment in which the recordings are made; and comparisons of intonation sequences in speech patterns.

One set of electronic fingerprints are the variations in the periodicities introduced onto the tapes in the recording process, Dr. Blesser said, including the 60-cycle-per-second hum of alternating current and the bias frequency—the high frequency sound added to the tapes at the same time as the sound frequencies in order to smooth out nonlinear characteristics of the magnetic tape itself. Since the periodic

variation in bias frequencies and hum are peculiar to each recording machine, analysis could show if one or more machines were used in producing the final tapes.

Also, these periodicities could turn up spliced-in segments recorded on the same machine, since a spliced segment would be out of phase with segments on either side of it.

Changes in pitch of recorded periodicities—particularly the periodicity of the start transient introduced when voice-actuated tape spools begin to turn—could show if any of the tapes were rerecordings, Dr. Blesser said. The start transient would be absent on rerecorder tape because it is too high to be picked up by a playback head.

Other distinguishing marks that could fingerprint a specific recording machine, Dr. Blesser said, are the angle of the recording head

to the tape, the difference in wear between top and bottom halves of the recording head, and flutter caused by imperfections in the rotating shaft that drives the tape in the recorder.

Dr. Blesser said no one test would be definitive. But taken together, they could be used to identify—fingerprint—the specific machine or machines used in making the tapes now in the court's possession.

Moreover, he said, analysis of periodicities—particularly the alternating current hum—could indicate if an 18-minute gap found in one of the tapes was produced by erasure on one particular machine or another. Miss Rose Mary Woods, President Nixon's secretary, has said at least a part of the gap was caused when she pressed the wrong button on her machine.

The acoustic environment is another area of likely study, Dr.



Professor Blesser

Blesser said. Desk drawers, where the White House microphones were said to be mounted, should have acted like sound boxes and each would produce individually distinctive dominant resonances identifiable by analysis of the tapes.

"If any recording was made with a microphone outside the drawer—or even in a different position in the same drawer—there should be detectable discontinuities in the energy patterns of the sound," Dr. Blesser said.

One speech pattern that should attract panel attention, Dr. Blesser said, is the rise and fall in intonation throughout a sentence. Excision or insertion of a phrase will produce a discontinuity in that pattern.

Voice prints or sound spectrograms also could be useful. Precise shapes in voice frequencies are influenced by the previously uttered sounds. If a tape segment is altered, anomalies will appear in the voice prints.

Dr. Blesser pointed out that the power of expert analysis of the tapes is in confirming or refuting already given testimony and not in determining motivation. For instance, he said, if portions of the tape were deleted, analysis could determine how it was done, but could not determine whether it was done accidentally or on purpose.

The Information Center, Room 7-111, will be closed from 6pm Dec. 24 until 9am Dec. 26, and from 6pm Dec. 31 until 9am Jan. 2.



As the Cambridge Symphonic Brass Ensemble sent forth bright music of Christmas at the Building 7 Convocation last Friday, photographer Margo Foote saw this pattern of musicians and their instruments.

vary from country to country. Christmas in Wales is different from Christmas in Rio [where it is summer time] which is different, in turn, from Cambridge, Massachusetts. In a sense, from this view, there is not a single Christmas tradition but many; and we at MIT represent much of the range of the Christmas experience.

We also represent far more, for we here on this campus observe not just the Christian tradition but others as well, coming as we do from many different cultures and creeds. Yet there are in the celebration of Christmas, beyond the trappings and the symbols, feelings of caring and of love and of the kinship of humankind. There are, too, the ideas of peace and of goodwill that are common to people of all ages and all faiths—ideas that have never seemed more crucial to the human experience, or more elusive and fragile. And together these feelings and ideas are drawn from deep within the wellsprings of the human spirit.

And this is why all of us—and not just Christians—can rejoice in the story of the Nativity. It is a story, as we remember, of a babe in a manger and of shepherds and the Gloria. It is told by Saint Luke when, after the birth of Jesus, he reports:

"And there were in the same country shepherds abiding in the field, keeping watch over their flock by night. And lo, the angel of the Lord came upon them, and the Glory of the Lord shone round about them: and they were sore afraid.

And the angel said unto them, Fear not: for, behold, I bring you good tidings of great joy, which shall be to all people.

For unto you is born this day in the city of David a savior, which is Christ the Lord.

And this shall be a sign unto you: Ye shall find the babe wrapped in swaddling clothes, lying in a manger.

And suddenly there was with the angel a multitude of the heavenly host praising God, and saying,

Glory to God in the highest, and on earth peace, good will toward men."

Peace on earth. Good will toward men.

This is the essence of the Christmas story. And it is in this spirit that Mrs. Gray and I wish all of you a very Merry Christmas and a Happy New Year.

'Essence of the Christmas story'

(Following are Chancellor Paul E. Gray's remarks at the Christmas Convocation last Friday in the Building 7 lobby.)

Each year the students of MIT—joined by others from this community—welcome in the Christmas holiday with words and music appropriate to the season.

I do not know when this tradition first began; and it may go back to the very early days of the Institute. By the 1900's, at any rate, *The Tech* was referring to these days as "the usual Christmas convocation before the holidays in Huntington Hall"—and that Huntington Hall was not our familiar 10-250, of course, but a different hall in a different building across the river in Boston.

Later when we moved to these buildings in Cambridge, carols were sung around a Christmas tree in one of the lobbies. And still later, after Kresge was built, we often had full-fledged convocations with great addresses in the manner of old-fashioned New England sermons. But that is not for this occasion on which I do not feel a sermon within me struggling to be let out, nor for this place, where words roll around the rotunda with something less than full fidelity.

Yet I do want to convey to you the warmest Christmas greetings and say, in brief, a bit of what I feel about the meaning of the season.

My first thought is that for many of us—indeed, for all raised in the Christian tradition, I suppose—Christmas is a time of memories, and especially of childhood memories. We may well remember different things—trees and lights and presents and plum pudding—for the customs of Christmas differ from family to family. But surely we remember pretty much in common, behind these symbols, the feelings of peace and joy and love that pervade the Christmas season and so give hope to all the seasons of our lives.

The poet Dylan Thomas has captured this magic of memory, and of its meaning, in his modern classic, *A Child's Christmas in Wales*. This is a fine work of art that has been called "more humorous, more touching, more wise" than Dickens' *A Christmas Carol*. It has a very special appeal to me because it is set in a land I and my family love, where we try to spend some time each year. In our family we have made it a tradition of the Christmas season to read aloud that marvelous poem, and I would like to share with you today its closing lines:

Always on Christmas night there was music.
An uncle played the fiddle, a cousin sang
"Cherry Ripe", and another uncle sang "Drakes Drum."
It was very warm in the little house.
Auntie Hannah, who had got on to the parsnip
wine, sang a song about Bleeding Hearts and Death,
and then another in which she said her heart
was like a Bird's Nest; and then everybody
laughed again; and then I went to bed.

Looking through my bedroom window, out into
the moonlight and the unending smoke-colored snow,
I could see the lights in the windows
of all the other houses on our hill and hear
the music rising from them up the long, steadily
falling night. I turned the gas down, I got
into bed. I said some words to the close and
holy darkness, and then I slept.

The images and the memories are, I suspect, as sharp and as brilliant for each of you as they were for Dylan Thomas or as they are for me. For each of us they provide much of the substance of the Christmas season.

Yet this personal note aside, I would make a more general point—and that is that Thomas' account of a Christmas day in a small Welsh town recalls sights and sounds and sentiments that are special also to that place. For, just as I have said that Christmas customs differ from family to family, so also do they

Sheehan Elected

Dr. John C. Sheehan, professor of chemistry at MIT, has been re-elected to the board of directors of the American Chemical Society (ACS) as a director-at-large.

This will be Professor Sheehan's third three-year term as an ACS director. He was first elected to the board in 1966. He has also been a chairman of the society's Division of Organic Chemistry and a member of the advisory or editorial boards of three ACS publications: *Chemical Reviews*, *Chemical and Engineering News* and the *Journal of Organic Chemistry*.

TECH TALK

December 19, 1973

Volume 18, Number 24

Tech Talk is published 50 times a year by the News Office, Massachusetts Institute of Technology. Director: Robert M. Byers; Managing Director: News Office Publications: William T. Struble; Assistant Directors: Joanne Miller, Margo Foote (Photojournalist); Charles H. Ball, Dennis L. Meredith, Robert C. Dilorio; Business Manager: Paul E. Johnson; Reporters: Sally M. Hamilton; Damon P. Wright; Calendar of Events/Want Ads: Susan E. Walker. Address news and editorial comment to MIT News Office, Room 5-111, Massachusetts Institute of Technology, Cambridge, Ma. 02139. Telephone Ext. 3-2701.

Mail subscriptions are \$5 per year. Checks should be made payable to MIT and mailed to Business Manager, Room 5-122, MIT, Cambridge. Telephone Ext. 3-3676.

MIT Admission Applications Up By 36 Percent

Final applications for admission to MIT were up 36 percent as of Dec. 1, 1973, over the same date in 1972, according to Peter H. Richardson, director of admissions.

Contributing significantly to the general increase were applications from young women, with a rise of 110 percent over 1972. Applications from young men showed an increase of 26 percent.

In addition, Mr. Richardson said, preliminary applications from minority students have shown encouraging gains this year. "But," he said, "the difficulty in attracting minority students with strong backgrounds in mathematics and science remains.

"If the general trend continues through the final application deadline," Mr. Richardson said, "MIT will have the largest applicant pool it has had in recent years." The application deadline is Jan. 10, 1974.

Mr. Richardson said that members of the MIT faculty are being asked to participate in admissions decisions. "The faculty's traditional direct input on the makeup of each class is important," he said, "especially in a year when we have a large applicant pool."

The early evaluation policy adopted last year by the Ivy League and MIT may be responsible for part of the increase in applications submitted so far, Mr. Richardson said. Under this program applicants with completed applications are notified beginning Dec. 15 whether their admission is "likely," "possible," or "unlikely."

"This is the first year the early evaluation program has been in effect," Mr. Richardson said, "and it may be encouraging high school students to complete their applications sooner."

Though the application deadline is still a month away, 188 young people have already been admitted to the freshman class that will enter MIT next September.

They were admitted under a program called Early Action. Applicants who have completed all necessary steps—including CEEBs and interviews—by November may request early action. This year 345 made such requests.

Included in those admitted early this year are 154 men, 34 women, and four minority students. MIT requires no commitment from these young people until the Candidates Reply Date in May.

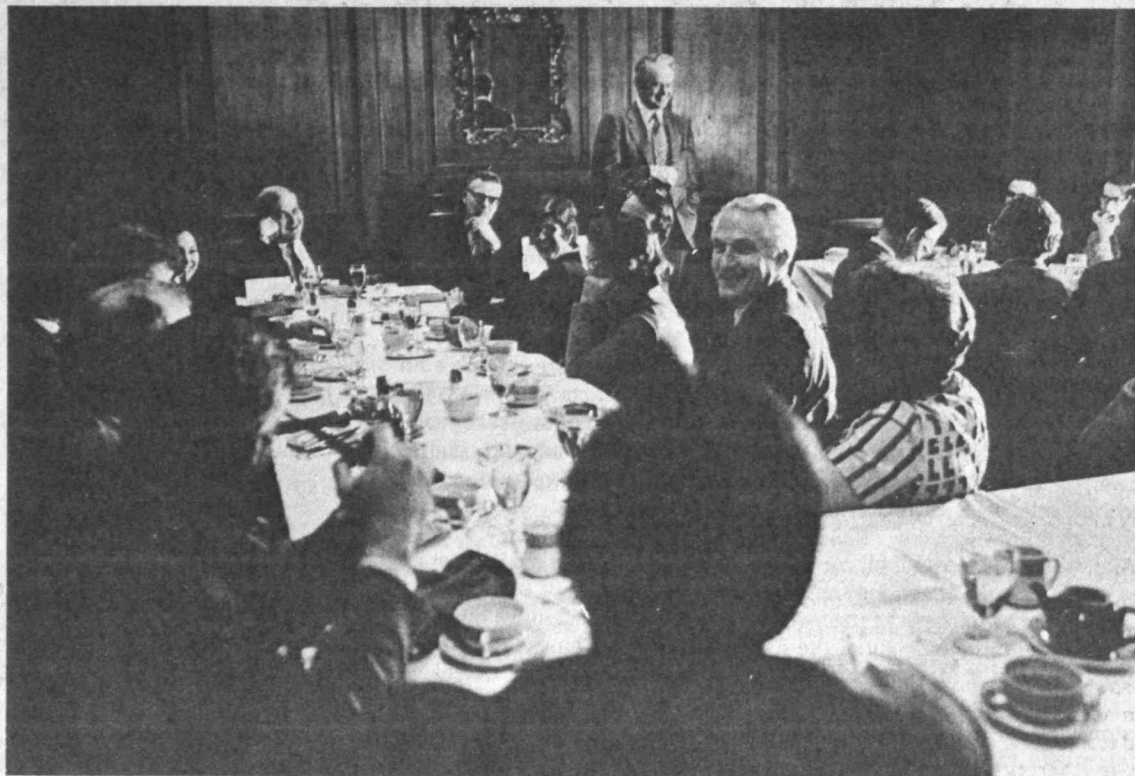
Committees Lists

Tech Talk on Dec. 9 published a list of the committees appointed by the President. We have received several responses welcoming this service, and have also received a few corrections on membership listings and organizational arrangements regarding the offices to which some committees report. A full and corrected reprint of these committees as well as the current membership listings of the Standing Committees of the Faculty, will be published next month as a special supplement to *Tech Talk* for the convenience of members of the community.

Booklet Available

Booklets describing some 60 undergraduate seminars offered in the spring semester are available in the Undergraduate Seminars Office, Room 7-105.

The seminars were started in 1961 to give freshmen an opportunity for close association with faculty members in a small, informal setting. Now, however, the seminars are open to all undergraduates and upperclassmen are encouraged to enroll.



ADP LUNCHEON—John M. Wynne, MIT vice president for administration and personnel, standing, addresses the 19 members of the Institute community who successfully completed Administrative Develop-

ment Program-I (ADP I). MIT Chancellor Paul E. Gray, seated at the end of the table to the left, presented certificates of completion. The luncheon was held Dec. 13 at the Faculty Club.

NCAA Realignment 'Compatibility' Plan

The National Collegiate Athletic Association has made public a new divisional alignment which will permit member schools the freedom to follow their own philosophy of athletic competition.

Under the arrangement, MIT teams will compete in Division III, District 1. (NCAA districts are based on geography. District 1 is New England.)

The new divisional alignment follows a reorganization plan approved in August after long debate.

Professor Ross H. Smith, director of athletics at the Institute, said the reorganization is essentially "a compatibility arrangement."

The plan permits each division to establish its own rules in areas such as financial aid for athletes, academic eligibility and recruiting.

"For example," Professor Smith said, "MIT and other schools within Division III can promote a change in eligibility rules which were never intended to apply to schools like MIT. The transfer rule, for example. This is one on which we're going to work for change."

NCAA rules require a college athlete who transfers to another school refrain from varsity competition for a year.

"That might make sense at schools where people transfer in because of the athletic program,"

Professor Smith said. "But that is not the situation here. People who transfer to MIT do so because of the academic program. So we will seek to have transfer students eligible for varsity sports immediately."

Another divisional rule MIT will propose, Professor Smith said, would be one to make it possible for a masters degree candidate to complete his four years of NCAA eligibility.

Current regulations permit students to play varsity sports for four seasons, but prevent a graduate student from competing.

Consequently, a student who completes his undergraduate requirements in three years under an accelerated program loses his eligibility for NCAA sports as soon as he enters a graduate program.

"We will propose," Professor Smith said, "that a student who is double registered in both a bachelor's and a masters program can complete the bachelors program and continue to play out his four years."

Another change that will be proposed to Division III members would be to eliminate grants in aid for the athletic scholarship. Instead, Professor Smith said, the proposal will call for "need" as a basis for scholarship support.

Such a change is necessary for schools—such as MIT—that do not give athletic scholarships. The NCAA limits the number of athletic scholarships members schools may give. There would be no limit under the proposed rule since scholarships would have no tie to athletics.

Obituary

Charles Abbot, 101

RIVERDALE, Md.—Dr. Charles Greeley Abbot, a pioneering astrophysicist and former secretary of the Smithsonian Institution who at 101 years of age was MIT's second oldest alumni, died Monday.

Dr. Abbot, who lived in Hyattsville, Md., was widely known for his research into relationships between solar activity and weather phenomena. He foresaw today's energy shortages more than a quarter of a century ago, believing the prime energy source of the future to be the sun, which he had spent his life studying.

Just before his 100th birthday last year, he received a patent for an apparatus to convert the sun's energy to power. So far as the Patent Office could recall, he was the oldest inventor ever to receive a patent.

Dr. Abbot, who is survived by his wife, Virginia, was born on a farm at Wilton, N.H., on May 31, 1872. While at Andover Academy, it is said, some classmates persuaded him, more or less as a lark, to apply to MIT.

He entered the Institute, switched in his second year from chemical engineering to physics, and received SB and SM degrees in physics in 1894 and 1895.

He later received a degree in astrophysics from George Washington University and the University of Toronto awarded him an LLD.

Dr. Abbot went from MIT to the Smithsonian Institution staff in 1895. He became secretary (or chief executive officer) in 1928 and retired in 1944 at the age of 72, but he remained on the staff as a

research associate. In his 16 years in that post, he directed and organized many expeditions for the observations of eclipses.

Dr. Abbot's research in solar radiation brought him the Draper Gold Medal of the National Academy of Sciences and the Rumford Gold Medal of the American Academy of Arts and Sciences of Boston.

He was the author of popular and scientific works, including "The Sun and the Welfare of Man," "Great Inventions" and "The Earth and the Stars."

The Information Center, Room 7-111, will be closed from 6pm Dec. 24 until 9am Dec. 26, and from 6pm Dec. 31 until 9am Jan. 2.

New Copyright Proposal Heads Faculty Agenda

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an equity interest is utilized in a manner consistent with the public interest."

Those objectives, the proposal continues, "will best be obtained by defining the ownership and disposition of copyrightable material in terms of the following categories:

"A. Ownership of all copyrightable material which is developed in the course of or pursuant to a sponsored research or other agreement shall be determined in accordance with the terms of the sponsored research or other agreement, or in the absence of such terms, the material shall be

the property of the Institute.

"B. All copyrightable material which is developed with the significant use of funds, space or facilities, including but not limited to classes and laboratory facilities, administered by the Institute but without any MIT obligations to others in connection with such support shall be the property of the Institute.

"C. Copyrightable material not within the provisions of Categories A and B of this policy is wholly the property of the author."

The proposal goes on to say that textbooks developed through the use of classes are excluded from the provisions of the policy, unless the textbooks were also developed using Institute-administered funds paid specifically to support textbook development.

Also included in the proposal are provisions for sharing royalties.

Payroll Office Deadlines

The Comptroller's Accounting Office has issued the following schedule for Hourly, Student, Voucher, and Biweekly payrolls for the weeks of Christmas and New Year's. The consecutive four-day weekends make it imperative that each department or laboratory fulfill its responsibility in complying with this schedule. Cooperation is asked so that the Payroll Office may insure accurate and timely payments.

Payroll	Deadline	Comment
Wednesday, December 26, 1973		
Hourly and Student Payrolls	2pm	Time cards and distribution reports must be delivered to the Cashier's Office (10-180) by 11:30am for messenger pick-up service or hand-delivered to the Payroll Office (E19-515) no later than 2pm.
BiWeekly Payroll	3pm	Adjustment Reports and Distribution Reports must be delivered to the Cashier's Office (10-180) by 2:30pm for messenger pick-up service or hand-delivered to the Payroll Office (E19-515) no later than 3pm.
Voucher Payroll	11am	Vouchers must be hand-delivered to the Office of Personnel Relations (E19-284) no later than 11am.
Wednesday, January 2, 1974		
Hourly and Student Payrolls	2pm	Time cards and distribution reports must be delivered to the Cashier's Office (10-180) by 11:30am for messenger pick-up service or hand-delivered to the Payroll Office (E19-515) no later than 2pm.
Voucher Payroll	11am	Vouchers must be hand-delivered to the Office of Personnel Relations (E19-284) no later than 11am.

A Treasure House Of MIT History

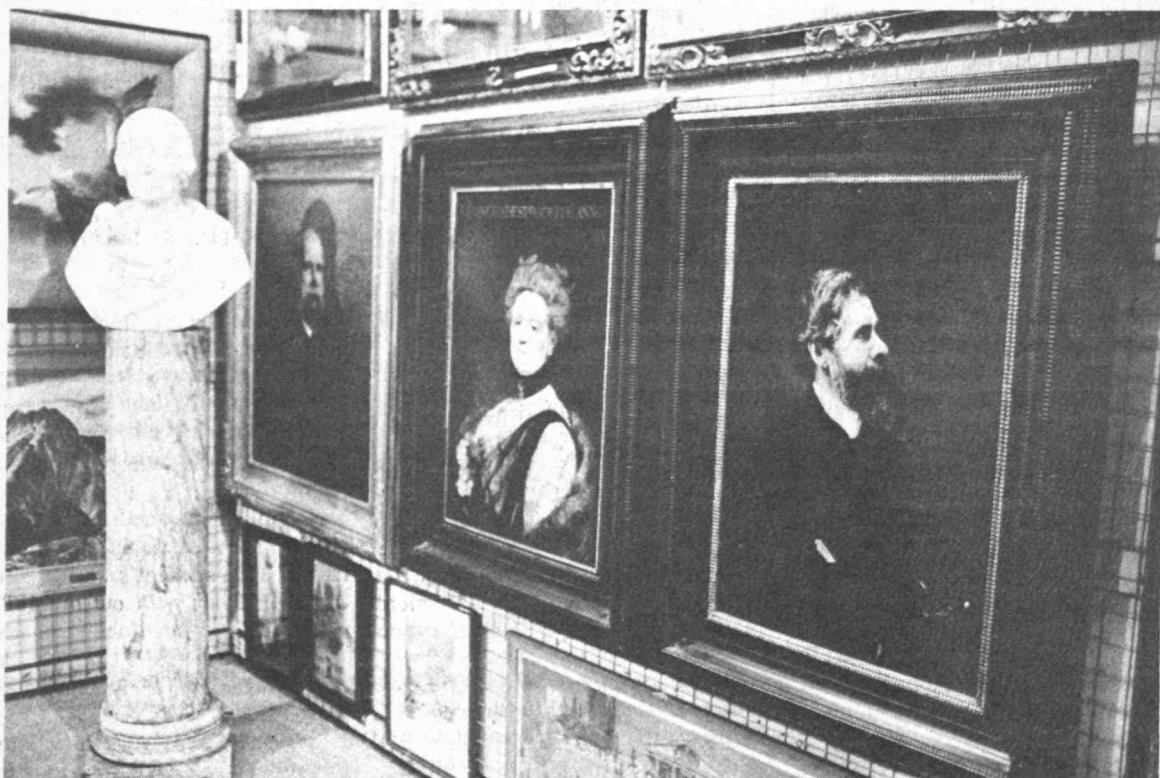
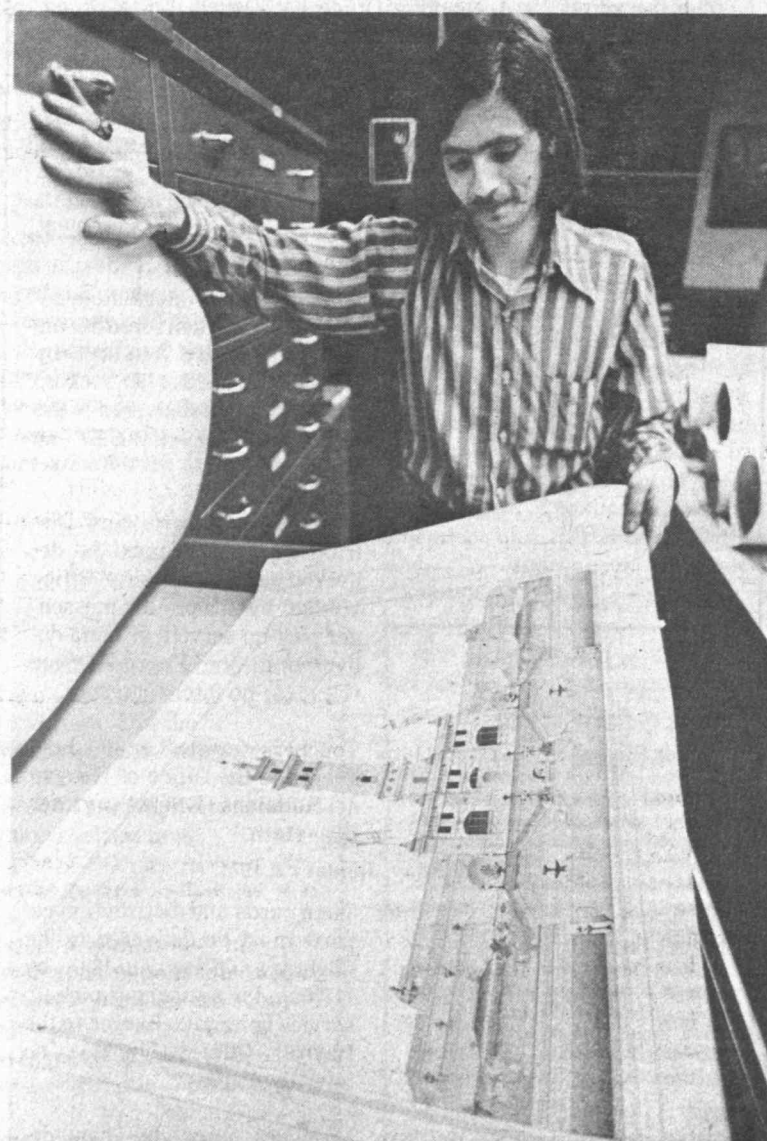
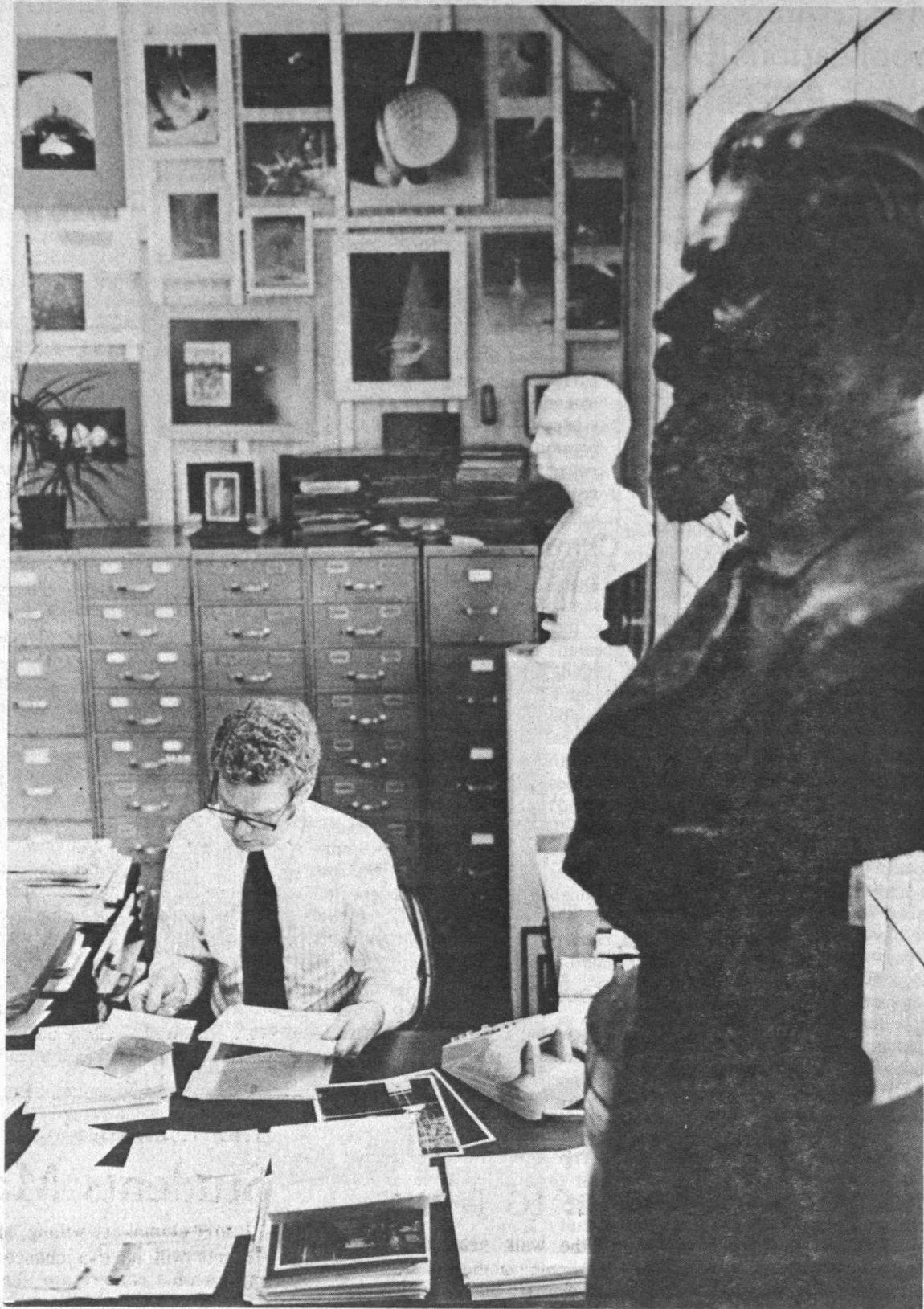
MIT has a rich treasure of artifacts illustrative of its history.

The MIT Historical Collections has brought together material of historic interest—in a museum-like setting—on the second floor of the former Epsco-General Radio building at 265 Massachusetts Avenue.

The collection is open to visitors and researchers. It includes an estimated 250,000 photographs, every thesis in architecture from 1873 to 1967, 120 portraits, other works of 19th century art, various art objects, parts of the differential analyzer that foreshadowed the digital computer, early telephones, electrical instruments and vacuum tubes, and materials of historic interest for research and biographical material.

And, it should be noted, all can be easily located under a system set up by the Historical Collections staff.

Among the art pieces are the Seeley Tapestry (below), which hung for many years on the balcony of the Rogers Lobby; a Chinese desk from Katharine Dexter McCormick's house and a bear from her extensive collection of animal figurines. At right, Warren A. Seamans, director of Historical Collections, works beneath the gaze of busts of Desire Despradelle, a faculty member in architecture from 1893 to 1912 (foreground), and Jacob Bigelow, vice president of MIT from 1863-1877 and a faculty member at Harvard Medical School. Behind him is a wall of strobe photographs from the Edgerton collection.



Above, in one of the Collections' galleries, is a bust of Henry D. Rogers, brother of MIT's founder William Barton Rogers, and portraits of James M. Crafts, MIT's fourth president, Leonore Despradelle and Professor Despradelle. Above right, the first model of the Western Electric dial telephone, one in MIT's extensive collection of telephones.

Above, John C. Astle, a Northeastern co-op student with the Historical Collections, displays the first architecture thesis done at MIT, a design for "Water Works, Engine House, Stand Pipe Tower, and Reservoir in a Public Park," by Henry A. Phillips in 1873.

Laser-Acoustic Device Designed to Detect Tiny Amounts of Gas

Since the passage of stringent air pollution laws in this country, scientists have begun grappling with the difficult proposition of quickly and precisely detecting infinitesimal quantities of many kinds of gases in the atmosphere.

Originally using chemical reactions to detect air pollutants, scientists are now exploring spectrometric techniques—which involve measuring the way a gas absorbs light, usually infrared, at certain specific wavelengths. By comparing this absorption with a reference light beam, which has not passed through a gas sample, scientists can determine the constituents of the gas and their concentrations.

The biggest problem with such absorption methods is that there are usually only minuscule amounts of the target gas in a sample, or else the length of the light's pathway through the sample is small. Both of these factors result in but a small difference between the detector light beam and the reference beam—often a difference too slight to be analyzed accurately.

Dr. C. Forbes Dewey, Jr., Associate Professor of Mechanical Engineering at MIT, is developing a method to amplify enormously the infrared absorption of a gas sample. His method will allow accurate measurement of air pollutants at levels of a few parts per billion, as opposed to the much higher concentrations accurately detectable by many other means.

Collaborating with Professor Dewey on the project is Roger D. Kamm, a graduate

student in mechanical engineering, who has performed much of the quantitative experimental and theoretical work during the last year. Dr. Colin Hackett, Research Associate in Fluid Mechanics, also participated in the program.

As a basis for his system, Professor Dewey uses a precisely tunable infrared laser aimed into a cylindrical sample chamber with a sensitive microphone attached (see diagram).

The laser is tuned to the frequency at which the pollutant to be detected absorbs strongly. As the pollutant molecules absorb the laser's energy in the functioning device, they raise the temperature of the chamber rapidly, producing a shock-wave-like pressure increase. This pressure wave travels outward to the walls of the cylinder, where it is detected by the microphone.

Professor Dewey found that he could amplify this wave by designing the sample chamber so that the reflection of pressure waves within it would set up standing waves within the chamber. By chopping the laser beam at a frequency coinciding with a natural resonant frequency of the chamber, the pressure waves resonate within the chamber, building up to easily detectable levels.

Thus, even tiny amounts of a pollutant will produce enormously enhanced pressure wave, which are directly proportional to the amount of pollutant present.

Professor Dewey's system is similar to one developed by Dr. Lloyd Kreuzer, formerly of Bell Laboratories. Dr. Kreuzer's system, however, involved measurement of the pressure wave after

only a single pass, without use of resonance features. A major problem in Dr. Kreuzer's system is the absorption of the laser radiation by the cell windows and walls, which causes pressure signals identical to those produced by the presence of the measured pollutant. According to Professor Dewey, resonating waves are clearly different from the waves due to absorption by the cell windows, and thus will not contribute substantially to the signal detected.

Roger Kamm is presently experimenting with methods to reflect the laser beam back and forth through the sample several times, to produce an even greater coupling of the absorbed radiation and the desired standing wave.

One important method now in use for measuring gaseous air pollutants involves reacting the sample with a molecule which will cause optical fluorescence in combination with the pollutant. The light given off by the combination is then measured, and because it is directly proportional to the quantity of pollutant present, the pollutant concentration is then known.

Though this method is reasonably accurate, it cannot be applied to all air pollutants because fluorescent reactions are known for only a few of the many kinds of pollutant molecules. Infrared spectrometry, however, can be applied to any molecule with dissimilar atoms. Not only do all such molecules absorb energy at infrared wavelengths, but finely-tuned laser beams can be used to home in precisely on the ideal wavelength to use in detecting each kind of pollutant.

"Our work so far has demonstrated that the theory of the system agrees well with the actual data, and the data obtained by Roger Kamm indicates that we can account very well for the system's behavior," said Professor Dewey.

"Our principal difficulties now are in developing a tunable laser with a beam intense enough to cause the necessary excitation of the molecules. We must also gain much more knowledge of the fine infrared spectra of the various substances we will encounter, and determine the best wavelengths for detecting those substances without interference from other kinds of molecules commonly found in the air."

Professor Dewey's research is supported by the Advanced Research Project Agency. The agency sees additional use in the technique as a method of detecting minute atmospheric absorption of powerful infrared laser beams used for communication or navigation. The atmospheric heating caused by absorption of such beams could cause lensing effects which would disperse the beam.

The sensitivity of Professor Dewey's system is evidenced by another application being considered by the Federal Law Enforcement Assistance Administration. The Administration requires a highly sensitive gas detector to "sniff out" explosives in packages and luggage at airports and other transportation terminals. Very expensive and perhaps less sensitive, German Shepherd dogs are now being used selectively to detect the minute amounts of vapor given off by explosives at such locations.

Storm-Iced Chapel Wall Sends Walkers into Moat

When Larry Pickard, manager of grounds at MIT, received word that—in the midst of Monday's heavy ice storm—people were splashing around in the Chapel moat, he was a bit incredulous. Nevertheless, he hurried to the moat.

"Just as I got there I saw somebody go off that low wall around the moat right into the water," he said. "I guess 30 people must have taken that fall one time or another."

The unexpected soakings occurred when walkers attempted to skirt a large puddle that covered

the walk near the Chapel by hopping on the moat wall. To their surprise, the top of the wall was slick with a coating of ice.

"We salted it right away," Mr. Pickard said.

In addition to the top of the moat wall a crew of 35 men under Mr. Pickard also salted the ramps and roofs of West, Albany and East parking garages. They also spread non-corrosive pellets on ice-coated stairs around the campus.

In another part of the Institute James Gardner, superintendent of mechanical operations for the Department of Physical Plant, was standing by with a special crew. His concern was the rising Charles River which crested at 5pm. Fortunately, no serious problems occurred.

Earlier in the day a steam main broke beneath Massachusetts Avenue at Vassar Street, creating a street-level scene that resembled Dante's Inferno, Mr. Gardner said. The break, probably not storm-related, was quickly isolated and a back-feed system was put into operation to continue feeding steam to the West Campus, Mr. Gardner said.

First term grade reports will be mailed to term addresses Wednesday, Jan. 9, 1974.

Freshman grade reports will be mailed Friday, Jan. 11.

Grade reports may be sent to students at other addresses if requests are made directly to the Registrar's Office no later than Jan. 2. Telephone requests for grades will not be granted.

Transcripts with first term grades included will be available beginning the week of Jan. 22.

Reading Subject To Be Taught By Psychologist

A reading course, entitled "Reading: Development of Comprehension and Speed," to be held during IAP is being organized by Robert K. Weatherall, director of career planning and placement.

There will be 17 meetings in the course, beginning Tuesday, Jan. 8, 1974 at 5pm in Room 10-250. The time was selected to be convenient for employees of the Institute as well as students.

Similar courses have met with success at a number of colleges and universities, and have been well received at MIT as well. This course will be taught by John Sloanaker, a clinical psychologist who has had experience with such programs at Harvard. There is a \$30 fee for the program, which includes the cost for materials.

A minimum of 103 participants are needed to make the course possible for MIT. Persons who wish to register for the developmental reading program are urged to sign up with Mr. Weatherall, Ext. 3-4733, as soon as possible.

IAP 'Sampler' Students May Share On-the-Job Careers

If MIT alumni are willing, MIT students will have a chance to explore what careers are like in day-to-day working experiences during the January Independent Activities Period (IAP).

"Being able to observe—and perhaps participate in—the worklife of professionals is very helpful for students who are faced with making career decisions," according to Robert K. Weatherall, director of career planning

AMITA Issues Call for Names

The Association of MIT Alumnae (AMITA) has issued its annual call for nominations for the AMITA Senior Academic Award.

The award will be given on the basis of academic excellence to one or more women students in the Class of 1974. The AMITA Award carries an honorarium of \$500-700 which is divided among the winners if there are more than one.

Criteria in judging include grade cum, depth and breadth in academic course work, special projects and/or thesis research. Nominations from research advisors and members of the Class of 1974 are especially welcome.

Nominations should be submitted to Dr. A. B. Buyrn, Room 26-411 by Feb. 4, 1974. The Award will be presented at the AMITA student dinner, March 20 at the Faculty Club.

Receive Awards

Dr. Charles C. Ladd, MIT professor of civil engineering, was a co-recipient of the J. James R. Croes Medal for a paper on "Initial Settlement of Structures on Clay," which he co-authored with Drs. Harry G. Poulos of the University of Sydney, and David J. D'Apollonia of Apollonia Consulting Engineers.

and placements.

"Career Sampling," (IAP No. 315E) aims to let students find out first hand what fields such as pediatrics, corporate law, systems analysis and process engineering are all about. The sampling will be done on an internship basis, matching a career interest of the student to a practicing alumnus in the field.

"We hope to have a flexible program," Mr. Weatherall said,

"which will give students an opportunity to spend anywhere from one day to the whole of IAP on an internship. Some students also may wish to have more than one internship."

Alumni participation for Career Sampling is being sought through an advertisement in the December issue of *Technology Review* and letters to black alumni and to approximately 1,000 alumni nationwide who serve as MIT's educational counsellors for high school students.

A similar IAP project was carried out last year under the auspices of MIT clubs around the country. Some 30 students completed one-day visits with alumni professionals in areas of their career interests, according to G. Peter Grant of the Alumni Association.

Students interested in participating in this year's Career Sampling should sign up in the Career Planning and Placement Office, Room 10-140.

Registrar's Notice: Degree Recipients

Post cards must be returned to Room E19-335 no later than Jan. 25, 1974, to indicate whether diplomas are to be mailed, called for in person, or if June attendance is planned.

Planet Surfaces Subject Planned

A subject in "Planetary Surfaces" will be taught during the spring term by Thomas B. McCord, associate professor of planetary physics.

The subject will cover the physical and chemical state of the surfaces of solar system objects. Included will be discussions of earth and spacecraft observations at ultraviolet, visible, infrared, and radio wavelengths, as well as radar studies. In addition, the subject will cover the physical state, composition, geology and landforms of solar system objects, as well as surface processes such as erosion, space-weathering, cratering, material transport, and volcanism. Analogs to earth processes will be used where possible.

The course, numbered 12.623, will meet Mondays and Wednesdays from 3:30 to 5pm in Room 24-407.

Work-Study Jobs Sought for IAP

On-campus work-study jobs during Independent Activities Period are being developed by the Student Employment Office for students whose financial aid package includes a "term-time earnings expectation."

Under the federal work-study program, employers pay only one-fifth of each student's wages, with the remainder paid out of MIT's work-study grant. Jobs thus provided are in addition to the employer's regular body of student jobs.

Potential employers interested in developing work-study jobs for IAP may call the Student Employment Office, Ext. 3-4973. Descriptions of already existing work-study opportunities for eligible students are on file in Room 5-119.

THE INSTITUTE CALENDAR

December 19
through
January 11

Seminars and Lectures

Wednesday, December 19

Rehabilitation Engineering Center Seminar* – Edmund Y. Chow, biomechanics, University of Minnesota; associate consultant, Mayo Clinic. 4pm, Rm 3-133.

Friday, December 21

Statistical Performance of Uncontrolled and Actively Controlled Flexible Skirt Air Cushion Vehicle Suspension* – Ashok B. Bognani, G. Mechanical Engineering Doctoral Thesis Seminar. 10am, Rm 3-343.

Monday, January 7

The Economics and Politics of World Oil – Morris A. Adelman, economics. Economics Lecture Series (77). 10:30am, E52-394.

Radio Tests of General Relativity – Irwin Shapiro, earth & planetary sciences. Earth & Planetary Sciences Lecture Series (74). 11am, Rm 54-425.

Viking: A Mission to the Surface of Mars* – Prof. Ronald A. Hites, chemical engineering. Chemical Engineering Seminar. 1pm, Rm 12-102.

Planetary Astronomy at MIT – Thomas B. McCord, earth & planetary sciences. Earth & Planetary Sciences Lecture (74). 3pm, Rm 54-425.

A Physicist's Look at a Biological Puzzle: How Can an Ion Get Through a Membrane? – H.E. Stanley, I.M. Asher, K. Rothschild, physics. Physics Potpourri (259). 3:30pm, Rm 37-212.

Tuesday, January 8

Educational Opportunities for Women and Minority Group Students at MIT in the Earth & Planetary Sciences – Frank Press, Robert R. Shrock Professor of Geophysics. Earth & Planetary Sciences Lecture Series. (74). 11am, Rm 54-425.

What is the Theory of Knowledge? – James Thomson, philosophy. Philosophy Lecture (241). 2pm, Rm 4-231.

Remote Sensing Mineralogy of Planetary Surfaces by Reflection Spectroscopy – Thomas B. McCord, earth & planetary sciences. Earth & Planetary Sciences Lecture (74). 3pm, Rm 54-425.

The Harvard-MIT Program in Health Sciences and Technology – Irving M. London, M.D., biology, director of Harvard-MIT Program in Health Sciences & Technology. Health Careers and Currents in Medicine Seminar (124). 3-4:30pm, Kresge Auditorium.

Canadian Energy Policy: The Northern Lights – Joseph Debanne, ocean engineering; Vincent Ferraro, MIT; Ted Greenwood & Glen Jenkins, Harvard. Political Science Seminar (261g). 3-5pm, Rm 1-190.

Methanol – A Practical Fuel for Present and Future Needs** – Thomas B. Reed, Lincoln Lab. Lincoln Lecture Series. 3:30pm, Lincoln Lab Cafeteria.

Looking at the Sun From Skylab, With Emphasis on Observations Using an X-Ray Telescope – Dr. Bruno B. Rossi, Institute Professor Emeritus, Professor Emeritus of Physics. Physics Potpourri (259). 3:30pm, Rm 37-212.

Studying, Teaching, Living in a Foreign Country: The United Kingdom – William N. Locke, foreign study advisor. Foreign Study Office Seminar (122). 4pm, Rm 10-280. Refreshments.

Ethics in the Classical Tradition – Dr. Stuart B. Martin, Boston College, will discuss "The Foundations of Western Ethics." Ethics: Sources and Applications Lecture (343a). 10:30am-12n, Rm 1-134.

Wednesday, January 9

A New Look at Rocks with the Electron Microscope – William F. Brace, earth & planetary sciences. Earth & Planetary Sciences Lecture (74). 11am, Rm 54-425.

Chemical Constituents and Reactions of Coal* – Prof. Jack B. Howard, chemical engineering. Chemical Engineering Seminar. 1pm, Rm 12-102.

Earthquake Prediction – Frank Press, Robert R. Shrock Professor of Geophysics. Earth & Planetary Sciences Lecture (74). 3pm, Rm 54-425.

Looking at the Sun From Skylab, With Emphasis on Observations Using an X-Ray Telescope – Dr. Bruno B. Rossi, Institute Professor Emeritus, Professor Emeritus of Physics. Physics Potpourri (259). 3:30pm, Rm 37-212.

Village Life in Iran – Hamid, a social anthropological perspective. Program on the Third World: Seminar on Foreign Students and Participation in Development (345). 7pm, Walker Memorial International Student Lg.

Thursday, January 10

Biochemical and Behavioral Effects of Amphetamines – Prof. L. Lytle, nuclear engineering. Nuclear Engineering Seminar (222). 9am-2pm, Rm 16-310.

The Contemporary Ethical Situation – Rev. Arnold Hogan, S.J., Adult Education Center, will discuss "Humanity Comes of Age." Ethics: Sources and Applications Lecture (343a). 10:30am-12n, Rm 1-134.

Prospective Thesis Topics in Structural Geology – William F. Brace, earth & planetary sciences. Earth & Planetary Sciences Lecture (74). 11am, Rm 54-425.

What is Ethics? – Judith Thomson, philosophy. Philosophy Lecture (241). 2pm, Rm 4-231.

Pattern Recognition Applied to Prediction of Earthquake Epicenters – Frank Press, Robert R. Shrock Professor of Geophysics. Earth & Planetary Sciences Lecture (74). 3pm, Rm 54-425.

Foreign Direct Investment in Canada: What's Good for GM of Canada is Not Necessarily Good for GM – Tom Horst, Allan Detsky. Political Science Seminar (261g). 3-5pm, Rm 1-190.

Immunology and Cancer – Herman N. Eisen, M.D., immunology, Center for Cancer Research. Health Careers and Currents in Medicine Seminar (124). 3-4:30pm, Kresge Auditorium.

The Sun and the Earth – Solar Wind, the Magnetosphere, and the Aurora – George Siscoe, visiting professor of physics; V.M. Vasyliunas, physics. Physics Potpourri (259). 3:30pm, Rm 37-212.

Friday, January 11

Ethics of Behavior Control – Stephan Chorover, psychology, will speak on psychosurgery and other methods of behavioral control. The film "Should Man Play God" may be shown. Innovations in Medicine (266). 10am-12n, Rm 16-134.

Radiometric Age – Dating in Planetology – Patrick M. Hurley, earth & planetary sciences. Earth & Planetary Sciences Lecture (74). 11am, Rm 54-425.

Monte Carlo and Clathrates* – Prof. Jefferson Tester, chemical engineering. Chemical Engineering Seminar. 1pm, Rm 12-102.

Evolution of the Moon and the Terrestrial Planets – Nafi M. Toksoz, earth & planetary sciences. Earth & Planetary Sciences Lecture (74). 3pm, Rm 54-425.

The Sun and the Earth – Solar Wind, the Magnetosphere, and the Aurora – George Siscoe, visiting professor of physics; V.M. Vasyliunas, physics. Physics Potpourri (259). 3:30pm, Rm 37-212.

Community Meetings

MIT Community Players* – Auditions for *Blithe Spirit*, by Noel Coward. Wed, Dec 19, 7-9pm, Rm 1-277. Information, 354-6103, after 6pm.

IAP Blood Drive* – Sponsored by TCA. Mon, Jan 7 & Tues, Jan 8, 9:45am-3:30pm, Sala. For appointment call x3-7911. Walk-in donations also welcome.

Open Forum on the Role of the Arts at MIT – Roy Lamson, chairman, Special Assistant to the President for the Arts. 2-4pm, Wed, Jan 9, Rm 14E-109.

Movies

The Law of Gravitation – Feynman Film Series, Physics (243a). Tues, Jan 8, 1pm, Rm 26-100.

Eno River Experience, Our Poisoned World, and One Spring Day – Earth Sciences Theater (63a). Tues, Jan 8, 4pm, 8pm, Rm 54-100.

Relation of Mathematics to Physics – Feynman Film Series, Physics (243a). Wed, Jan 9, 1pm, Rm 26-100.

Math Films – (163). 4pm, Rm 2-190.

The Grand Illusion – World War I: Film and History Series (143). Wed, Jan 9, 7-10pm, Rm 10-250.

Great Conservation Principles – Feynman Film Series, Physics (243a). Thurs, Jan 10, 1pm, Rm 26-100.

Geysers Valley and Heartbeat of a Volcano – Earth Sciences Theatre (63a). Thurs, Jan 10, 4pm, 8pm, Rm 54-100.

Energy: A Social Problem – Film Series on the Energy Crisis (153). Thurs, Jan 10, 5pm, Rm 10-400.

Energy: A Social Problem – Film Series on the Energy Crisis (153). Fri, Jan 11, 12n, Rm 10-400.

Symmetry and Physical Law – Feynman Film Series, Physics (243a). Thru Fri, Jan 11, 1pm, Rm 26-100.

Math Films – (163). 4pm, Rm 2-190.

Surtsey Volcano and Earthquakes: Lessons of a Disaster – Earth Sciences Theatre (63a). Fri, Jan 11, 4pm, 8pm, Rm 54-100.

Ipcress File – LSC. With *Lone Ranger Serial*. Fri, Jan 11, 7:30pm, 10pm, Rm 10-250. Admission 50 cents, ID required.

Exhibitions

The Stars, The Moon* – Black and white photography exhibition sponsored by the Committee on the Visual Arts. Comprised of photographs taken at the California Institute of Technology's Mount Palomar Observatory and by NASA's five lunar orbital satellites in 1966-67. Fri, Dec 14-Sat, Jan 12, Hayden Corridor Gallery.

Recent Paintings by Don Robertson* – Sponsored by Committee on the Visual Arts. Public preview Fri, Dec 14, 8-10pm. Exhibit Sat, Dec 15-Sat, Jan 12, Hayden Gallery. Hours: 10am-4pm Mon-Sat, closed Sun.

Photography Exhibition* – "8x10 Contact Prints" by Ron Rosenstock. Thru Tues, Jan 15, Creative Photography Gallery, 120 Mass Ave. Hours: Mon-Fri 9am-10pm, Sat, Sun, 12n-6pm, Free.

Hart Nautical Museum* – Permanent exhibit of rigged merchant and naval ship models, half models of yachts and engine models. Open daily in Bldg 5, 1st floor.

Music Library Exhibit – In honor of St. Cecilia, patron saint of music. Scores, books, pictures.

Religious Services and Activities

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

Hillel Courses* – There will be an organizational meeting for all levels of Hebrew classes Mon, Jan 7, 11:15am, Rm 4-149. **Workshop in Creative Services*** – Explore different possibilities and forms of prayer and communal living. Call Hillel, x3-2982 for information on this and other courses being offered during IAP.

Protestant Worship Service* – No services Sun, Dec 23 or Dec 30. Regular services resume Sun, Jan 6, 11am, Chapel.

Roman Catholic Holiday Mass Schedule* – Sun, Dec 23, 9:15am, 12:15pm, Chapel. Tues, Dec 25, 12m, 12:15pm, Chapel. Sun, Dec 30, 9:15am, 12:15pm, Chapel. Tues, Jan 1, 12:15pm, Chapel. Sun, Jan 6, 9:15am, 12:15pm, Chapel.

Announcements

ADP III – Application deadline is Fri, Dec 28. For information and application forms, contact Jan Morgan, x3-1676.

Unicef Greeting Cards – Also notes, datebooks, available at TCA Office, Stu Ctr Rm 450. Wide selection now, but they go very fast! Call x3-4885, stop by today.

February Degree Recipients – Post cards must be returned to E19-335 no later than Fri, Jan 25, 1974 to indicate whether diploma is to be mailed, picked up if June attendance is planned.

Dining

Wednesday, December 19 – Lunch: Hot turkey sandwich. Dinner: Manicotti w/Italian sauce. **Thursday, December 20** – Lunch: Canadian bacon. Dinner: Salisbury steak. **Friday, December 21** – Lunch: Shrimp chow mein over rice. Dinner: Pork steak. **Wednesday, December 26** – Lunch: Frankfurters & baked beans. Dinner: Roast lamb w/mint jelly.

Thursday, December 27 – Lunch: Pork chop suey over rice. Dinner: Lasagne. **Friday, December 28** – Lunch: Baked bluefish. Dinner: Sausage patties & applesauce. **Wednesday, January 2** – Lunch: Italian spaghetti & meatballs. Dinner: Hot roast beef sandwich. **Thursday, January 3** – Lunch: Salisbury steak. Dinner: Roast fresh ham. **Friday, January 4** – Lunch: French fried haddock bits. Dinner: Seafood souffle.

New IAP Listings

Jazz Arranging – Jaxon Stock, Berklee School of Music. Humanities Seminar on arranging for jazz band, no experience required. First meeting Mon, Jan 7, 2pm, Rm 4-260. Greg Olson, x3-6886.

Seeing and Planning – Carl Hewitt, electrical engineering, and Dr. David Marr, Artificial Intelligence Lab. First meeting Tues, Jan 8, 1pm, Rm NE43-8th floor lge. Information, x3-2082.

Additional IAP Information

The following are changes, corrections and additions to the information which appeared in the Final Guide to IAP. The bold numbers correspond to the numerical listings in the Guide.

"Hands-On" Portable and Small Studio TV Production and Editing (20a) – James B. Roberts, Rm 9-365, x3-7781. Meetings will be Mon, Wed, Fri, Jan 8-25, 11am-12:30pm, Rm 9-355.

Ragtime, Oldtime Jazz Jam Session (313a) – All musicians invited. There will be two more sessions, Fri, Jan 18 & 25, 8pm-12m, but in different rooms in Stu Ctr than the first meeting (Fri, Jan 11). Bring your own beverages. Information, Sam Benichasa, x8-3686 Draper, or 547-2520, evgs.

Analogue Music Synthesizers (138) – taught by Ralph Earls, will be offered Tuesdays and Thursdays from 1:30 to 3pm in room 26-068. Further information on the offering is available at Ext. 3-3210, rather than at the number listed in the IAP guide.

Micrographics (157a) – Meetings will be Tues., Jan. 15, 22, and 29; not Jan. 8.

Basic Research and Applied Technology with Magnets and Magnetism (214) – Mon., Jan. 7, from 12n. Guided tour and discussion of the facilities of the Francis Bitter National Magnet Laboratory; 10 megawatt generators, 250,000 gauss water-cooled magnet, 500,000 gauss pulsed magnets, and superconducting magnets.

Survey of Computer Advances: Software and Hardware (280) – Has not been cancelled. Taught by Prof. Stewart Madnick (x3-6671, room E53-330), separate seminars will focus on microprocessors, huge (e.g., trillion bit) memories, microprogramming and "high-level" computers, remote computing and computer networks, protection and security, generalized application packages, intelligent information management systems, and artificial intelligence. Meetings Mon Jan. 7, 14, and 21; 1-3pm, E52-160. Enrollment may be limited; please pre-register in E53-333.

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 January 9 through January 18 to the Calendar Editor, Room 5-111, Ext. 3-3279, before noon Friday, January 4.

13 Million US Households Termed 'Housing-Deprived'

(Continued from page 1)

report began arriving at the JCUS at 53 Church St., Cambridge, from federal, state, and local agencies, state and federal legislators, attorneys, construction industry firms, Wall Street brokerage houses, colleges, libraries, etc.

Participating in the press conference were Andrew Heiskell, chairman of the board of Time, Inc., and chairman of the JCUS visiting committee; Dr. Bernard J. Frieden, MIT professor of urban studies and director of the JCUS; Dr. David L. Birch, associate professor at the Harvard Business School and principal investigator for the housing needs study; and Arthur S. Newburg, director of research management and housing research in the Office of Policy Development and Research at the US Department of Housing and Urban Development. HUD provided part of the support for the study.

The conclusion that 23 million new housing units will be built in the 1970's stems from projections of household formation, migration, accidental losses and demolitions, second homes, and vacancy rates. The estimate of 13 million deprived households involves housing which is physically unsound, overcrowded, or excessively expensive relative to income.

Dr. Frieden cautioned against adding the two figures to arrive at a housing production.

"The projection of 23 million units and the estimate of 13 million housing-deprived households represent two very different concepts," he said. "Twenty-three million new units will provide living space for people who can pay their own way in the housing market. This volume of production is within the capacity of the nation's housing industry, if it continues to receive the indirect mortgage aids and tax treatment the federal government now provides. The 13 million figure is not a count of housing units that need to be replaced. It is our estimate of the number of low-and-moderate-income families who had a housing problem as of 1970.

"Some of these families—we do not know how many—will be able to improve their housing by moving into vacancies created by the construction of 23 million new units. Others are already living in good housing, but at too high a price. They need more income, or direct housing allowances, to solve their problems. Other families could be housed adequately if we had effective programs to make better use of existing housing and to keep up the quality of older neighborhoods. Some additional new housing will also be needed for the poor. The 13 million deprived households present a separate challenge to the nation—a challenge that can be met only in part by more production."

The best known and most comparable previous study of US housing was conducted during the Johnson Administration by the Kaiser Committee. It estimated the market requirement for 1968-1978 at 18 to 20 million units. In addition, it estimated a need to replace six to eight million substandard units. Lumped together, the two figures became a national "housing production goal" of 26 million. It was assumed that achieving this goal would discharge the mandate of the 1949 and 1968 Housing Acts: "A decent home and a suitable living environment for every American family."

Though focusing on the same mandate, the work of the JCUS departs from that of the Kaiser Committee in both strategy and methodology. Strategically, the



Dr. Birch

JCUS avoids the presumption that housing production is the only answer. Its data base is constructed to accept sociological as well as demographic input, and to reflect their interaction.

Expanding on this strategy, Dr. Frieden said, "Our report tries to broaden the discussion of housing needs by looking beyond national construction figures. Production is essential, but a production goal is not the same thing as a housing policy. Housing starts have reached record levels in the past few years, but there is growing concern over issues of cost, of quality, and of neighborhood conditions. As a result, we have begun to assemble information on several dimensions of housing quality as well as quantity. Also, we think it is misleading to study housing needs by generalizing for the nation as a whole. Instead we have analyzed the different sources of housing need in the many local housing markets of our metropolitan regions and rural areas."

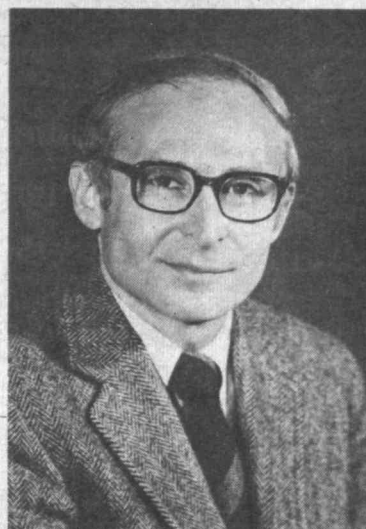
The JCUS approach differs from that of the Kaiser Committee in several important ways. The most salient is the process for developing national housing requirements. The Kaiser Committee worked entirely with national statistics and thus was unable to indicate regional and local differences. The JCUS approaches the problem from the opposite direction, accumulating statistics from hundreds of "standard metropolitan statistical areas" (SMSA's) and their rural counterparts.

The JCUS also was able to make use of extensive current data, including the 1970 Census, while the Kaiser Committee was restricted to 1960 Census data and limited subsequent surveys.

This "bottom-to-top" approach provides a mosaic in which deviations from the norm stand out clearly. Such information should be of significant value to planners in both the public and the private sectors.

Another key difference lies in the definition of housing problems. The Kaiser Committee, by focusing on the physical characteristics of housing rather than on the housing problems of families, failed to give a full account of several forms of housing deprivation. "Housing poor" families include not only those living in physically inadequate homes but also those forced to spend an excessive part of their income for rent or those living in overcrowded conditions. The JCUS found that little overlap exists among these families. However, what overlap there is was eliminated from the JCUS figures (a household living in a physically unsound house that is also overcrowded is counted once, not twice).

The study quantifies housing deprivation in the three general areas mentioned: physical inadequacy, overcrowding, and ex-



Dr. Frieden

cessive rent burden. Different standards of overcrowding and excessive rent burden were applied to different income and age groups to avoid obvious misclassifications; for example, a large wealthy household that lives in a small unit by choice does not constitute a social problem. JCUS researchers also used stricter measures of housing inadequacy than those generally employed by public agencies. For example, the measure of overcrowding was 1.5 or more persons per room, rather than the general norm of more than one.

"By these conservative standards, roughly 21 per cent of the 63.4 million US households are classified as deprived," Dr. Birch said.

Most of the deprivation (about seven million or 53 per cent of all deprived households) falls in the physically inadequate category. Households classified as overcrowded number approximately one million, or five per cent; about five million households (42 per cent of the housing-poor) suffer excessive rent burden. This represents a significant shift since 1960 when over 71 per cent of deprived households were living in physically inadequate units and only 24 per cent were burdened by excessive rent payments. Physically inadequate housing is concentrated in rural areas while families with high rent burden are predominantly urban dwellers.

The total number of deprived households declined slightly during the 1960-1970 period from 15.3 million to 13.1 million.

In explaining its conclusion that 23 million new housing units will be required to meet normal demand in the 1970's, the JCUS says that for every two units needed to make room for a new household, approximately one more will be needed for some other purpose related to growing affluence, mobility, or change in life style. Since World War II, total housing construction in each decade has, on the average, exceeded household increase by a ratio very close to 1.5 to 1. Despite the yearly ups and downs of housing starts, a comparable ratio should apply over this decade, according to the JCUS report. (The 23 million projection actually represents a ratio of 1.62 to 1.)

Of the 23 million new units that will be required by 1980, metropolitan areas will need 14.7 million units, or 63 per cent of the total, and non-metropolitan areas will require 8.6 million or 37 per cent.

Demographic increases and household changes will account for the greatest proportion of this requirement—about 14 million units and 61 per cent of the total. Other demands, including replacement of losses, the push for second homes, housing upgrading, and creation of higher vacancy rates to satisfy increased mobility will account for the other nine million units of 39 per cent of the total.

The JCUS study notes a growing trend toward new household formations. At one end of the age scale, an increasing number of young people are forming their own households. At the other end, older citizens are exercising more independence in choosing living arrangements and habitats.

Population growth per se accounts for the formation of nine million households and a "headship" ratio increase accounts for four million. "Headship" is the percentage of people in a given age group that are household heads. (The JCUS used an "intermediate" projection of ratio increase—continuing at the present rate of increase until 1975 and then leveling off. Exact figures for headship ratio increases are described as a major uncertainty in the analysis.) The additional one million households in the demographic section of the 23 million projection are immigrants from abroad.

The study forecast of 23 million units between 1970 and 1980 represents an average monthly construction of 194,500 units. Housing completions and mobile home shipments for the period between April, 1970, and March, 1973, amounted to a monthly average of 190,500 units, putting the Joint Center forecast slightly over target.

Dr. Frieden pointed out, however, that major structural changes could occur in the housing market and curtail construction in the longer term. He identified changes in land use regulations, labor and material shortages, energy restrictions, and prolonged shortages of mortgage capital as forces that could effect such structural change.

On the other hand, changes in consumer behavior could make the JCUS figures low. To test consumer attitudes, researchers conducted 900 in-depth interviews with households in Boston and Kansas City. Six hundred interviews were conducted during May and June of 1970 in Boston, and 300 in Kansas City during November and December of 1972.

According to Dr. Frieden, "If our findings from Boston and Kansas City are typical for the nation's metropolitan areas, then a very large percentage of middle income families who still live in older central-city areas, or in industrial satellite neighborhoods, are dissatisfied with their housing and especially its setting."

The study identifies the "middle class"—income between \$11,500 and \$16,500 and representing about 32.5 per cent of all American families—as the housing market's "center of disequilibrium." They are the most ready to act upon their dissatisfaction when personal prosperity permits or when their neighborhood starts to change.

Even if the forecast is correct, Dr. Frieden said, there will be times during the decade when actual construction dips below the projection. "Even now, high interest rates and shortage of mortgage funds are causing housing starts to taper off. Commerce Department figures for September show a revised, seasonally adjusted rate of 1,763,000 units for the year, or 146,900 per month. There will be peaks and valleys throughout the decade, but if normal forces prevail, the average will reflect our forecast."

Dr. Frieden cautioned against viewing the production of 23 million units as satisfying America's housing needs. "This volume of production," he noted, "will keep pace with the growth of new households and with the aspirations of people who have the

resources to move to better houses. But our study has shown that there is a large deficit of unmet social need, far larger than earlier studies have identified. And most of the people who suffer from housing deprivation are either poor or have only modest incomes."

"The policies of the past have succeeded in reducing the number of families who live in slum conditions. Now the challenge is to deal with the growing problems of the high cost of housing for the poor and the decay of whole neighborhoods. The private market, backed by government mortgage and tax policies, has been able to provide good housing for most Americans. But we must do more than build for those who are already well off. New policies and new private initiatives are needed to cope with the complex problems of housing deprivation. They should be designed to match the special circumstances of individual communities. To be effective, they should include a mix of some additional production, direct cash assistance, programs to conserve the housing we now have, and social action to make our neighborhoods into places where people can live with satisfaction."

Grade Reports

First term grade reports will be mailed to term addresses Wednesday, Jan. 9, 1974.

Freshman grade reports will be mailed Friday, Jan. 11.

Grade reports may be sent to students at other addresses if requests are made directly to the Registrar's Office no later than Jan. 2. Telephone requests for grades will not be granted.

Transcripts with first term grades included will be available beginning the week of Jan. 22.

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. Undergraduates are also urged to check with the UROP bulletin board in the main corridor of the Institute.

Department of Philosophy

Opportunity for a student to do research on 17th century theories of the origins of private property rights. The major part of the project will consist of extensive readings in English common law and in the continental writers on natural law. Preference will be given to a student who has a reading knowledge of Latin, but this is not an absolute requirement. Contact Prof. Brody at x3-4144 or 734-7345.

Charles Stark Draper Laboratory, Inc.

In the face of a soaring energy crisis, the Draper Laboratory is currently studying the feasibility of developing and supporting some form of alternative transportation. A number of ideas are under consideration, including not only car pools but also a mini-van service to supplement public transportation. The Laboratory is also exploring dynamically-scheduled, demand-responsive car pools. The Laboratory is interested in several students, beginning in December, to develop dynamic scheduling algorithms, along with some software (PLI or FORTRAN). This effort is expected to gather momentum during IAP and continue through the spring term. Interested students should contact E. H. Porter, Jr., or R. Warren at 182-82374.

A Better Chance (ABC)

A Better Chance provides quality secondary educational opportunities for economically disadvantaged minority youth. Students from low income families are placed in a residence in a suburban or rural community under the Public School Program format of ABC.

MIT undergraduates are needed to identify and "profile" a community in the Boston area, to develop mechanisms and procedures to be used as a prototype for ABC to gain access into other communities, and to compile information about the town and its residents.

Students would be involved in finding all the community resources possible which would lead to community advocates for the Public School Program idea.

IAP desirable to start. Transportation necessary. Contact UROP for further details.

Mineral Classes Are Identified In 40 Asteroids

By DENNIS L. MEREDITH

Studies of the spectrum of light reflected from asteroids have enabled two MIT astrophysicists to identify for the first time the precise classes of minerals that make up asteroids.

MIT graduate student Michael J. Gaffey and Thomas B. McCord, associate professor of planetary physics in the Department of Earth and Planetary Sciences, reported their studies of 40 of the brighter asteroids at the Fall meeting of the American Geophysical Union in San Francisco this week. They are currently analyzing data obtained from 80 of the several thousand known asteroids.

Comparing the reflectivity of the asteroids in the visible and near-infrared region of the spectrum with the reflectivity of over 150 meteorites, the astrophysicists were able to come up with the most detailed information to date on asteroid mineralogy. The way a surface reflects light of different colors is controlled by the composition of the surface material. Because meteorites are thought to be asteroidal in origin, the scientists theorized that meteoritic reflectivity could be extended to asteroids.

The scientists concluded that all the asteroids appeared to be consistent with known meteorite types or with unknown but reasonable mixtures of meteoritic materials.

Significantly, the scientists discovered that—though most meteoritic materials are present on asteroid surfaces—the relative proportions of the material types differ from that of known meteorites. Thus, they say, the meteorites which are found on earth are a very biased sample of asteroidal materials.

The scientists found evidence of many types of minerals on the asteroidal surfaces. Significantly they found evidence of minerals which required widely different conditions for formation, which lends credence to the theory that the asteroid belt—between the orbits of Mars and Jupiter—contains pieces from various layers of fragmented larger bodies.

The most commonly detected meteorite type is one called carbonaceous chondrite, a granular mud-like material which might be primitive material left over from the formation of the solar system. Other asteroids were found to contain enstatite, a magnesium-silicate which requires very high pressure and temperature to form and thus might be produced at the core of a large body. The scientists also found nickel-iron material and mixtures of these metals and silicates which are similar to several classes of meteorites.

Although most of the asteroids appear to be homogeneous on all sides, one asteroid—19 Fortuna—appears to possess a different composition on each of two sides. This might be an instance of an asteroid whose origin was at the boundary between two layers of a larger body.

"Through the use of this new technique, developed in our laboratory, we now know more about the composition of the surface of the asteroids than we do about the surface composition of Mars, despite the large number of spectacular photographs returned by recent Mariner spacecraft missions to Mars," Professor McCord said.

MIT Host for Industry-University Conference On Manufacturing Technology, Productivity

More than 150 senior executives of manufacturing companies throughout the country came to MIT Monday and Tuesday, Dec. 10, 11, for a National Conference on Manufacturing Technology and Productivity.

The company officials, together with faculty members from MIT and other technical universities, examined three major topics:

—The social and economic climate, present and future, for US

industry and particularly for discrete product manufacturing, as opposed to continuous or process flow manufacturing.

—Technological innovations that are expected to have significant impact upon manufacturing in the next two decades.

—The responsibilities of the technical university in preparing its graduates for industrial careers.

Robert T. Lund, senior research associate in the MIT Center for Policy Alternatives and chairman of the conference committee, said there is "strong evidence of a renewed concern by industry and government for the capability and the productivity of our manufacturing system."

"This concern spans not only the economic challenges of resource utilization and international competition, but also the social and po-

litical demands for the improved quality of life," he said.

"The claims upon the manufacturing industries are setting the stage for new approaches to product and process design, to production technology and to manufacturing management," he said. "Universities, particularly technical institutions, are becoming increasingly conscious of the role which they must play in training men and women for the complex industrial environment of the future."

The two-day conference provided for an exchange of information between the manufacturing executives and MIT faculty through talks and workshops.

Howard W. Johnson, chairman of the Corporation, welcomed the visitors, and Dr. Paul E. Gray, chancellor, was the luncheon speaker on the first day of the conference. Dr. Nathan H. Cook, professor in the Department of Mechanical Engineering, gave the introduction to the conference.

Other speakers and their topics included: Dr. David G. Wilson, professor in the MIT Department of Mechanical Engineering, "Design Priorities and External Costs;" Dr. J. Herbert Hollomon, professor and director of the Center for Policy Alternatives, "Productivity, Science and Technology;" Dr. Charles A. Myers, professor at the Sloan School of Management, "Human Factors in Manufacturing;" Dr. Jay W. Forrester, professor at the Sloan School of Management, "1980-2000, The Future for Manufacturing Industries;" and Dr. Jordan J. Baruch, lecturer at the Harvard Graduate School of Business Administration, "Technological Innovations in Manufacturing."

Also: Dr. Thomas B. Sheridan, professor in the Department of Mechanical Engineering, and James L. Nevins, division leader at the Charles Stark Draper Laboratory, "High Volume Manufacturing Technology;" Dr. Nam Suh, associate professor in the Department of Mechanical Engineering, "New Developments in Manufacturing Processes;" Dr. Frank E. Perkins, professor of civil engineering and special assistant to the Dean of Engineering for Education Programs, "Engineering Education and Industry;" Mr. Lund, "Automation for the Job Shop;" and Dr. John J. Allen III, associate professor of mechanical engineering at the University of Texas, "Computer-Aided Design."

The five major workshop topics were "Industrial Research and Development," "Public Policy and Manufacturing," "Productivity Improvement," "Education for Industrial Careers" and "Technology Abroad."

The major sponsors of the conference were the Center for Policy Alternatives, the Department of Mechanical Engineering, the Industrial Liaison Office, the Center for Advanced Engineering Study and the Charles Stark Draper Laboratory, Inc.

The members of the conference committee besides Mr. Lund were Dr. Cook; Mr. Nevins; Dr. Sheridan; Paul E. Brown, assistant director of the Center for Advanced Engineering Study; Jerome J. Schaufeld, director of MIT Associates, and Charles J. Sheehan, director of the Industrial Liaison Office.

Dr. John W. Kendrick, professor of economics, George Washington University, and former vice president, The Conference Board, set the stage for the conference in a talk entitled "Industrial Economics in the 70s."



More than 40 elderly persons from the Mattapan section of Boston visited the Institute recently at the invitation of the MIT Hillel Foundation. The activities of the day were held in the Bush Room and included a demonstration of a stroboscope, and lunch and discussion groups with students. Shown above

are Mr. Israel Ephross, an 86-year-old flutist, who accompanied the singing of Mrs. Lina Siegel, 68, during the entertainment segment of the day. Listening attentively is Jerry Kazin (checked shirt) of Linden, N.J., a sophomore in electrical engineering.

1974 Eloranta Fellowships To Be Awarded in Spring

A number of summer research fellowships for MIT undergraduates will be awarded next spring under the Eloranta Fellowship Program. Designed to increase opportunities for intellectually profitable use of the summer months, the fellowships have been made possible by a gift from Dr. Edwin H. Land as a memorial to the late Peter J. Eloranta, member of the Class of 1968.

Luria Receives 'Hope' Award

Dr. Salvador E. Luria, Institute professor and Sedgwick professor of biology at MIT, has received a research award from the City of Hope, a nonsectarian national medical center specializing in treatment, research and education in catastrophic diseases.

Dr. Luria, director of the MIT Center for Cancer Research—presently under construction—received one of the first two annual awards authorized last spring by the center's directors.

Winner of the 1969 Nobel Prize in physiology and medicine, which he shared with Max Delbruck and A.D. Hershey, Dr. Luria is a leading authority in virology and microbial genetics.

Medal to Rossi

Bruno B. Rossi, emeritus professor of physics has been awarded the Elliot Cresson Medal by the Franklin Institute. The award was voted Dr. Rossi "for his many important contributions to our understanding of cosmic rays and for his pioneering work in space physics and gamma-ray and X-ray astronomy."

All MIT undergraduates are eligible to apply for these fellowships, which provide for out-of-pocket project costs and a modest stipend. Seniors whose summer projects would actually occur after graduation are eligible. Students in the fifth year of a combined bachelor's-master's degree program are not eligible if their summer project would occur after the receipt of the master's degree.

The Fellowships support unique research or study projects, under the guidance of responsible agencies or individuals, in the United States or abroad. The proposed summer program may involve research or study experiences at a university or at an industrial or governmental laboratory.

To apply for one of these Fellowships, a student should submit a written proposal outlining plans for his summer project and indicating how he thinks the project will contribute to his overall educational objectives.

Applications for these fellowships for the summer of 1974 should be submitted before Feb. 25, 1974, to Mr. Leonard V. Gallagher, Associate Director of Financial Aid, Room 5-119. Interested students may secure an information sheet at the reception desk in Room 5-119.

Chorus and Pops

The Tanglewood Festival Chorus, conducted by John Oliver, director of the MIT Glee Club and Choral Society, will appear with the Boston Pops Orchestra in special Christmas concerts in Symphony Hall on Dec. 21 and 22.

Holley Medal Awarded to Two

Dr. Harold E. Edgerton, Institute Professor, emeritus, and Mr. Kenneth J. Germeshausen, MIT research affiliate in electrical engineering, were jointly awarded the Holley Medal of the American Society of Mechanical Engineers (ASME) for the development of new technologies and their application to stroboscopic photography.

The award was presented at the 49th annual winter meeting of ASME, Nov. 14, in Detroit, Michigan. It is the first time in the medal's history, 49 years, that it has been awarded jointly.

Also honored at the meeting was Dr. Eric Riessner who received the Timoshenko Medal in recognition of distinguished contributions to applied mechanics. Dr. Riessner was a member of the Department of Mathematics at MIT from 1938 to 1969. He is now professor of applied mechanics. Dr. Riessner was a member of the Department of Mathematics at MIT from 1938 to 1969. He is now professor of applied mechanics at the University of California, San Diego.

The Tech Elects Moore as Chairman

Barbara L. Moore, a sophomore in civil engineering from Dayton, Ohio, has been elected chairman of the board of The Tech, MIT's major student newspaper.

Also chosen in elections held Saturday, Dec. 8, were Storm Kauffman, a junior in mechanical engineering from New York City as editor-in-chief; Norman Sandler, a junior in political science from Des Moines, Iowa, as executive editor; and John Hanzel, a sophomore in electrical engineering.

Emergency Committee Maps Economy Steps

An Emergency Energy Committee formed by Governor Francis Sargent—and chaired by Professor Henry D. Jacoby of the Alfred P. Sloan School of Management at MIT—this week began widespread distribution of suggestions and hints that individuals can use to help save energy and money.

Entitled "Things You Can Do to Save Energy and Money at No Investment Cost," the committee's list of suggestions is being printed in this issue of *Tech Talk* as a guide for what people who live and work at MIT can do to help.

At the same time, Dr. James W. Meyer, project coordinator in the MIT Energy Laboratory and one of five MIT representatives on the governor's committee, this week offered a series of supplemental suggestions to augment the list as well as a table showing how much oil home furnaces can save when operated at improved efficiencies.

At home, Dr. Meyer said, people can increase their comfort despite lower temperatures in several ways:

Wear warm clothing while indoors.

Avoid drafts by keeping interior doors closed, draping open passages, keeping fireplace dampers closed when not in use, making sure automatic louvers on ventilation fans close properly.

Reduce interior cooling by radiation simply by keeping drapes closed over picture windows, particularly at night.

Maintain interior humidity with indoor plants and even by finish drying clothes from the washer inside the house.

Dr. Meyer said control of air infiltration and leakage into a house also can save important amounts of energy. Don't stand talking with friends or callers through open exterior doors. Limit the number of outside doors you use (but be careful not to secure unused doors permanently so they can't be used in an emergency.) Limit the use of exhaust fans. Installing a 4'x4' exterior vestibule around a main entrance prevents leakage better than a conventional storm door.

Losses prevented by storm windows and doors and by wall and ceiling insulation, Dr. Meyer said, can be augmented by insulating heating pipes and ducts, particularly those in basements or those exposed to outside air in such areas as crawl spaces.

Individuals can reduce the amount of heated space in a house by consolidating family activities, thus permitting the closing off of unused rooms, Dr. Meyer pointed out.

More energy can be saved, Dr. Meyer said, by lowering home hot water temperatures, by operating such appliances as dishwashers and clothes washers only with full loads, by keeping dryer lint filters and vent pipes clear, by drying clothes on a line outside or inside, if possible, to boost interior humidity—instead of in a dryer, by keeping refrigerators defrosted and the heat exchangers clear with an unblocked airflow, by keeping freezers full and avoiding frequent opening and closing, by using pressure cookers to reduce cooking time, and by cooking several items at once when using the oven.

Dr. Meyer also drew attention to smoke stack gas temperature as an indication of furnace efficiency.

"If the stack temperature of your furnace has been measured by your serviceman, there is

MIT Group Aids State

A group of MIT engineers and scientists are playing an important role in helping the state administration of Governor Francis W. Sargent map the Commonwealth's response to the energy crisis.

The five MIT people are serving on the 13-member Governor's Emergency Energy Committee which was established a month ago.

The committee is headed by Dr. Henry D. Jacoby, professor of management at MIT.

The committee's other MIT members are Dr. James A. Fay, professor of mechanical engineering and also chairman of the Massachusetts Port Authority; Dr. James J. MacKenzie, visiting scientist at the Institute and a member of the scientific staff of the Massachusetts Audubon Society; Dr. James W. Meyer, project coordinator with the MIT Energy Laboratory, and Dr. David C. White, Ford Professor of Electrical Engineering and director of the MIT Energy Laboratory.

"In setting up the committee," Dr. Jacoby said "the governor looked for people who knew about energy, who knew about the economy of Boston and of Massachusetts and for people who could call upon resources in their own organizations."

In addition, although Dr. Jacoby didn't mention it, committee members share another trait—the ability to attend meetings that begin at 7am.

"At first we met about twice a week," Dr. Jacoby said. "Now it's once a week, but we find it's still best to start at 7am."

"It's like nothing I've ever seen. Everybody is there every time there is a meeting," he added.

Dr. Jacoby said the committee's task is divided into four areas:

—Emergency preparedness, which includes development of contingency plans as well as what he called an "early warning system" that will tell state officials when to act to reduce demand.

—Voluntary conservation of energy. In this connection the committee has developed a pamphlet containing conservation hints for residents.

—Response to federal regulations. In this connection the committee, Dr. Jacoby said, is making inputs that will assist the governor's staff in determining how the state will react to federal energy regulations.

—Hardship cases. The committee has made some suggestions on how claims of hardship could be dealt with. This has to do with how the state would handle oil stocks put at its disposal under federal regulations.

idling while standing or to hop out for a short errand.

Don't warm up engine at idle, especially fast idle; start your car and drive off, but avoid excessive demands on the engine until it has warmed up.

probably a 1/4" hole in the pipe near the furnace smoke outlet—about 12 inches from boiler breeching," he said. "You can measure the stack temperatures by inserting a dial thermometer having a maximum range of about 700-800 degrees (F) after the furnace has been operating for about five minutes. A high stack temperature or one that has increased since your last adjustment means that too much heat is going up the chimney. Some stack temperatures have reached 900 degrees (F) which is not only inefficient but potentially hazardous."

It is also important to check furnace firing rates with a maintenance man, he said.

"Firing rates are sized to maintain a house in a 'comfort zone'—72-75 degrees (F)—in extremely cold and windy weather," he said. "If you now maintain your home at 65-68 degrees (F) it may be advisable to reduce the firing rate because most burners are more efficient when burning longer at a lower rate than for short periods at a higher rate."

Dr. Meyer said he has encountered many people since the energy crisis began who believe that turning lights on and off frequently actually wastes energy because of the electricity needed to start up a bulb.

"This just isn't true," he said. "There is a slight increase when the light comes on but it is nothing compared to the energy wasted when a light is left on in a room that is unoccupied," he said. "One 100-watt lamp needlessly left on all night—10 hours—consumes one kilowatt hour. You can do a load of dishes in your dishwasher for about half of that."

Dr. Meyer also offered a series of hints for automobile users:

Curtail car use. Ride in car pools, use a bike, walk. Plan auto trips to combine errands, etc.

Monitor your car's performance. Keep track of gas mileage and notice when it declines and get the car tuned when it does. Learn how to check the proper operation of your automobile choke. (When the engine is hot, the automatic choke should be fully open. A choke stuck partially open or unable to open fully burns extra gas because of an excessively rich mixture.

Watch your driving habits.

Reduce speed—wind resistance rises as the speed squared. Anticipate speed changes to avoid excessive acceleration and braking; drive as if there were an egg between your foot and the accelerator pedal. Avoid accelerator pumping. Maintain even speeds as allowed by traffic and road conditions.

Don't haul unnecessary weight (last summer's boating gear in the trunk.) Keep tires inflated to the high pressure side of the normal recommend range. (Radial tires will give improved gasoline mileage.) Don't leave the engine

Dollar Savings for Increased Efficiency for Every \$100 Spent on Fuel Following Oil Burner Tune-up

Efficiency Before Tune-up	Efficiency After Tune-up					
	55%	60%	65%	70%	75%	80%
50%	\$9.10	\$16.70	\$23.10	\$28.60	\$33.30	\$37.50
55%		\$ 8.30	\$15.40	\$21.50	\$26.70	\$31.20
60%			\$ 7.70	\$14.30	\$20.00	\$25.00
65%				\$ 7.10	\$13.30	\$18.80
70%					\$ 6.70	\$12.50
75%						\$ 6.30

You can save money when you save fuel. James W. Meyer, project coordinator at the MIT Energy Laboratory, worked out this table of oil burner efficiencies before and after tune-ups for average home furnaces.

Energy-Saving Measures Outlined by State Panel

LOWER YOUR THERMOSTAT

The six-degree reduction recommended by the President will save 18 percent of the fuel.

When retiring, an additional six degree reduction will save six percent more of the day's fuel. (Use an electric blanket if needed.)

When your house is unoccupied for more than a few hours, a 10-degree reduction will save five percent of the day's fuel each four hours.

KEEP YOUR HEATING SYSTEM EFFICIENT (10 percent more can be saved)

Have your furnace cleaned and adjusted regularly.

Clean filters in hot air systems.

Clean radiators.

USE HEAT EFFICIENTLY—ONLY WHERE NEEDED

Reduce heating and close doors to unused rooms.

(Fuel saving about five percent per room)

Do not block radiators or heat outlets in heated rooms.

In year-round, air-conditioned homes, reduce outside air intake.

USE HEAT CONTROLS TO ADJUST ROOM TEMPERATURES

Hot water system by water valves or radiator air flow dampers.

Hot air systems by dampers.

Electric heating by room thermostat.

(Any questions can be directed to your dealer.)

USE LESS HOT WATER

A one-third reduction will save over five percent of your annual fuel.

Run only full loads in washers.

Consider using cold water for clothes washing.

Take a quick shower instead of a bath or long shower.

Turn off electric hot water heaters when house unoccupied for long periods.

Repair hot water leaks.

USE YOUR FIREPLACE WISELY

Turn down thermostat while using fireplace.

Close damper when fire is out—a damper left open can cost 10 percent of your fuel.

OTHER DAY-TO-DAY ENERGY SAVINGS

Let direct sunlight in during the day.

Close shades and drapes at night and on the shady side of the house during the day.

Keep outside doors and windows closed as much as possible.

Turn off unnecessary lighting.

Minimize refrigerator openings.

Use major appliances (washers, dryers, etc.) during off-peak hours (use before 3pm or after 9pm).

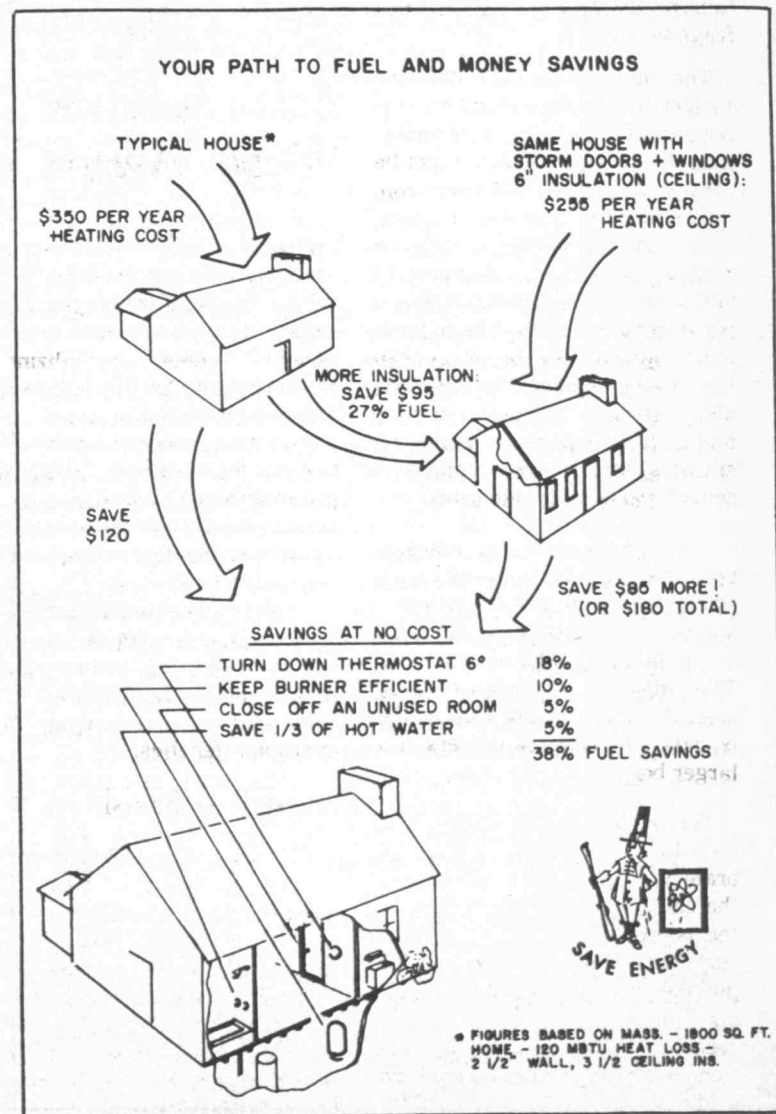
Minimize the use of all electrical heating devices.

THINGS YOU CAN DO WITH SOME INVESTMENT TO SAVE ENERGY NOW AND ENJOY FUTURE SAVINGS

Caulk and weather strip all doors and windows. Seal attic doors. Low cost do-it-yourself materials can save you four percent on heating.

Install storm windows and doors. Typical installation will pay for itself (at present fuel costs) in about nine years at savings of about 20 percent per year in fuel costs.

Increase ceiling insulation to six inches. If now 3 1/2 inches, this will save an additional five percent. It will pay for itself in about 12 years at present fuel prices and sooner at the prices to be expected.



FIGURES BASED ON MASS. - 1800 SQ. FT. HOME - 120 MBTU HEAT LOSS - 2 1/2" WALL, 3 1/2" CEILING INS.

MIT LIBRARIES - SCHEDULE FOR CHRISTMAS VACATION 1973/74

	Aero	Barker	Chemistry Reading Rm	Dewey	Humanities	Lindgren	MARIC	Von Hillep Materials Center Reading Rm	Music	Reserve Book Room	Rotch	Science	Space Center Reading Rm	Student Center
Thu. Dec. 20	9-5	9-9:45	9-4	8:30-9:45	8-9:45	8:30-5	9-5	9-5	9-5	8-5	9-5	8-9:45	9-5	24hours
Fri. Dec. 21	9-5	9-8	11-4	8:30-6	8-7:45	9-5	9-5	9-5	9-5	9-5	9-5	8-7:45	9-5	24hours
Sat. Dec. 22	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	24hours
Sun. Dec. 23	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed at 8pm
Mon. Dec. 24	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed
Tue. Dec. 25	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed
Wed. Dec. 26	9-5	9-9:45	11-4	8:30-9:45	8-9:45	9-5	9-5	9-5	9-5	9-5	9-5	8-9:45	9-5	open at 8am
Thu. Dec. 27	9-5	9-9:45	11-4	8:30-9:45	8-9:45	9-5	9-5	9-5	9-5	9-5	9-5	8-9:45	9-5	24 hours
Fri. Dec. 28	9-5	9-8	11-4	8:30-6	8-7:45	9-5	9-5	9-5	9-5	9-5	9-5	8-7:45	9-5	24 hours
Sat. Dec. 29	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	24 hours
Sun. Dec. 30	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	24 hours
Mon. Dec. 31	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed at 8pm
Tue. Jan. 1	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed	closed
Wed. Jan. 2	9-5	9-9:45	11-4	8:30-9:45	8-9:45	9-5	9-5	9-5	9-5	9-5	9-5	8-9:45	9-5	open at 8am
Thu. Jan. 3	9-5	9-9:45	11-4	8:30-9:45	8-9:45	9-5	9-5	9-5	9-5	9-5	9-5	8-9:45	9-5	24 hours
Fri. Jan. 4	9-5	9-8	11-4	8:30-6	8-7:45	9-5	9-5	9-5	9-5	9-5	9-5	8-7:45	9-5	24 hours
Sat. Jan. 5	closed	9-5	closed	9-5	9-4:45	closed	closed	closed	closed	9-5	10-6	9-4:45	closed	24 hours
Sun. Jan. 6	closed	1-5	closed	1-9	1-5	closed	closed	closed	closed	closed	1-5	1-5	closed	24 hours
Mon. Jan. 7														

All Libraries resume regular hours.

All Libraries resume regular hours.

Laser Opens Up Communication Potential Top \$90,000

(Continued from page 1) other dyes, which produce light in other regions of the visible spectrum, the researchers can construct a stable laser of any frequency, and with unprecedented precision.

The technical breakthrough achieved by Dr. Ezekiel and his colleagues is a method of "choosing" a precise single frequency out of the wide range available. The isolation of the desired frequency is done by a series of prisms and coupled short cavities. The selected single frequency can be smoothly tuned along the dye laser's range using an automatic feedback loop.

In addition, the scientists stabilized the laser beam by electronically locking the frequency onto a natural resonance observed in a beam of molecular iodine—which is a constant standard—thereby forcing the chosen laser frequency to remain constant. Dr.

Ezekiel has also used the unique method they developed to detect precisely the resonance of iodine, in a scheme to obtain ultra-high resolution spectroscopy using lasers.

Another major factor in stabilizing the MIT dye laser was the arrangement of lasing dye in the system. In most dye lasers, the dye solutions are contained within clear cells. Since dye lasers themselves are optically pumped—excited to produce laser light—by a powerful gas laser, this pumping laser often burns impurities onto the walls of the cell, increasing light losses and causing thermal fluctuations in the dye.

The MIT researchers used a free-flowing stream of the rhodamine 6G dye, which they excited with an argon laser. As the dye flows in a smooth sheet in front of the argon laser—like an optical flat—it can be excited to produce laser light without danger of inter-

ference from cell walls or burned-on impurities.

The fact that the laser system can be tuned smoothly and without any jitter in frequency means that lasers could be used as readily in communications as radio waves, said Professor Ezekiel.

Until now, the major difficulty in using laser beams in communications has been that they could not be modulated over a wide frequency range to carry information. And because only a few discrete frequencies of laser light were available, the full spectrum of laser light could not be employed for communications. The tunable dye laser sidesteps the problem of limited modulation by filling up a wide bandwidth with many laser beams of different frequency. By modulating each beam by a small amount, the entire visible spectrum can be filled with information-carrying capacity.

Laser beams are much shorter in wavelength than radio waves and much more information can be crammed into a single beam than into a radio beam. Communications scientists believe that a single laser beam, widely modulated, or many beams of different frequencies narrowly modulated, could carry as many as 100-million two-way conversations.

At Women's Seminar

Professors Vera Kistiakowsky of physics and Sheila Widnall of aeronautics and astronautics recently participated in a seminar at Brookline High School on careers for women in science and technology. The seminar was one of a number of actions the Brookline schools are taking to eliminate sex-role stereotyping.

No Paper

Tech Talk will not be published on Dec. 26, 1973, and Jan. 2, 1974 because of extended weekends over the year-end holidays. In addition to Christmas and New Year's Day, the Institute will be closed on Monday, Dec. 24, and on Monday, Dec. 31. Regular publication will resume on Jan. 9, 1974.

Forum Participant

Philip Morrison, professor of physics, will be co-chairman of a public forum on "Energy: Alternatives and Risks" to be held by the National Academy of Sciences in Washington, DC, Jan. 29 and 30.

Contributions to the United Way/United Black Appeal Campaign passed the \$90,000 mark at MIT as the seventh week of the drive ended last Friday, Dec. 14.

Lily T. Hosticka, campaign coordinator, said total contributions amounted to \$93,410.

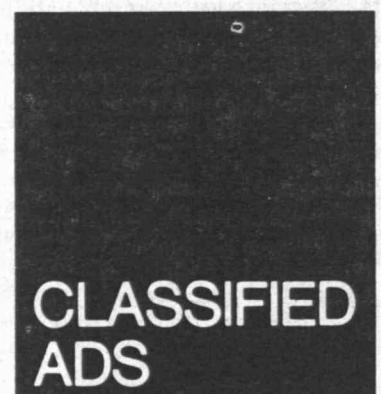
Of that amount, \$78,666 was contributed or pledged to the United Way and \$14,743 to the United Black Appeal.

Campaign workers at the Institute have distributed separate pledge cards for the United Way and the United Black Appeal campaigns, making it possible for members of the Institute community to contribute to either—or to both—of the campaigns.

Several people have made contributions to both campaigns.

The United Way helps support nearly 200 agencies providing a variety of social and health services in this area.

The United Black Appeal supports agencies whose specific aim is to provide services to the black community.



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 5-105. Please submit all ads before noon, Friday, January 4.

For Sale, Etc.

Moving: zig zag sew mach, \$60; stereo, \$30; bk shlf, \$10; dresser & mirror, \$10; box spr, \$5; red carpet, \$8; stool, \$5; lamps, \$5; end tbls, \$5 ea; crtns, \$3; elec brm, \$5 etc. Karin, x3-5821.

Making Holiday pix? Strobe w/ help. lk-nw Braun RL 515, rapid-fire, fast recycling, full/part settings, vert, horiz, bounce flash, w/case, cost \$125, ask \$100. Bob Di Iorio, x3-2701.

VW ski racks/locks, 2, nw, \$8.50 ea. Liz, x3-6162.

Girl ice skts, Hyde, sz 9, 1 seas, \$12; Bell & Howell 172, 8mm movie cam, w/3 lenses, asst filters, \$25; Keystone mdl K-109-D 8 mm proj, \$25. Ray Harlan, x3-1928..

Snow blower; bikes; numerous other items. x8-3360 Draper.

Sk boots, m, Henke bckl, sz 12½, w/tree, used once, nw \$75. Bob, x3-6631.

Mahog sgl bed frame, \$10. Al, x149 Linc.

Boots, vibram sole, b nw, sz 9½N, best. Todd, x3-3161, lve msg.

Gen Radio 2KVA Variac 0-280 & decade resistance box, Cornell-Dubilier decade capacitor, .0001-.01 and .01-.1 mfd, all for \$15; Leeds & Northrup repairable Wheatstone bridge free. Call 782-2372.

KLH 24 stereo compact, \$150. Pablo, 254-6716, evgs.

Firewood & wd burning stoves. Judy, x3-6101.

Dbl pedestal oak desk, \$25; typing tbl, \$3; Vivitar 200 mm f3.5 lens, \$70; 1893 Americanized Britannica, 10 vol, \$20. Jim, x3-3297.

Sears 27" liteweight bike, f, made Austria, used once, \$45; 2 Sears Highway spec 735x15 4 ply tires, less 1 K, \$25/pr. Joe, x3-5775.

Snow blower, 23", 2 stage, 4 hp, self-prop, \$98. Call, 484-9438.

Elec broiler, 2 moveable h elements, exc cond, \$10; m fig skts, sz 7-7½, \$6; Dunham Tyrolean hiking boots, old but usable, sz 7½-8, \$4. x3-7787.

Roper gas stove, cooks & heats, \$50. Mike, 354-7861.

Refrig, \$30; waterbed, 5x7, w/heater, fr, thermostat, \$75. x3-2270.

Range hood; elec knife; oil burnr; elec polisher; radiator; Rya rug; misc. Alan, x3-4284.

Used alum storm wndws, approx 3'x5'. Corry, x3-5783.

IBM selec typwrtrs, exc cond; metal desk. x3-2921.

Victorian hand carved oak buffet, old, w/pillars & mirror, \$100; Cooper goalie gloves, 1 seas, \$6; Hyde hcky skts, sz 13, b nw, \$15; Polaroid J-33 cam, \$5. Call, 926-1685, evgs.

Trundle bed, 30", w/foam matt, \$35. x7267 Linc.

Firewood, hd rock maple, 3 day delivery, \$90/cord. Russell, x9291 Dorm.

Calcinator incinerator, nat gas, 18"x24"x36" high, 6 yrs, exc cond. orig \$180, ask \$75. x3-5321.

CCM hcky sktrs, sz 10, yr old, sharpened, \$15. x0234 Dorm.

Tennis net, wire cable, gd cond, \$40. Alice, x3-4897.

Firewood, hard or soft, split or un, by stick, bundle, cord. Don, x3-1826.

Rossignol 100 skis, w/Salomon bndgs, yr old, Reiker sz 10½ boots & poles, best; Capro FL6 elec flash w/recharger. Lloyd, x9508 Dorm.

In order to stabilize the wavelength of an argon laser, Dr. Shaoul Ezekiel and his colleagues had to detect a resonance of iodine in the most precise way possible.

The technique they used is significant in itself, for it represents a method of obtaining atomic and molecular spectra better than any before achievable in the visible region. The spectrum of a molecule is the way in which the molecule absorbs or emits light over a certain range of wavelengths. Usually the spectrum of a molecule is a unique fingerprint, which scientists can use not only to identify the molecule but to tell how the molecular bonds vibrate in absorbing light energy.

Most high-resolution spectra are obtained by subjecting the molecules—made into a gas—to a scan of wavelengths of light within a cell. The results of this method are fuzzed, however, by collisions between the target molecules and doppler broadening within the cell.

Doppler broadening is the spread in wavelength of the light emitted or absorbed by atoms or molecules because of their motion toward or away from the detector. Each individual molecule emits light at a slightly different wavelength according to its motion, just as the frequency of sound changes according to the motion of a sound source (This doppler effect in sound is popularly illustrated by pointing out the change in frequency in a train whistle as a train approaches, passes, and then recedes from a stationary listener.)

Professor Ezekiel and his colleagues, however, use of molecular beam of the target substance, which they probe with a laser beam to obtain a spectrum.

With a molecular beam of iodine, probed by an argon laser producing light at a 5145-angstrom wavelength (and scanned over .05 angstroms) the MIT scientists have resolved the detected absorption peaks of iodine with a resolution of one part in ten billion.

This is ten thousand times better than that obtained with the best spectrometer, and 60 times better than that obtained with saturated absorption methods using gas cells in the visible region of the spectrum.

Because the molecules in the beams are all moving in the same direction in a high vacuum enclosure, they do not collide and their emission lines are not disturbed. And, because the molecules are not moving toward or away from the laser beam (because the beam is at right angles to the molecular stream) doppler broadening is reduced by a factor of 2000.

Stud snows, 2, 4 lug Mustang, & 2 nw reg tires, \$45. Gene, x1830 Middleton.

Used enlarger, b&w, 35 mm only, w/condenser & preset f4.5 lens, great for beginner, \$30 or best. x3-6124.

Bound 12x12 shag rug, bge, w/pad, exc cond, 4 mos, \$150. Charles Kazules, x7148 Linc.

Aria classical guitar, mdl 588, deluxe, w/case, b nw, list \$130, ask \$90. Call, 494-8353.

Solomon 404 bndgs, \$18; Hagen frbrglas skis, 180 cm, \$20; m Kastinger plastic boot shells, \$8m, \$20; all used a seas. Ed, x8-4459 Draper.

TEAC 3300-10 tape deck, b nw, orig pking, 10 1/2" reels, all solenoid operation, Scotch 207 tape, Advent mics, head de-mag, best. David, x3-4157.

Dyna preamp, exc cond. Roy, 484-3281.

Sofa-bed, \$30; couch, \$30; lamps, \$7; easy chr, \$5; 8x12 rug, \$20; desk & chr, \$75; calculator, \$20; nego. Henry, 354-1638.

Boys hcky skts, Bauer, lk nw, sz 13, \$6.50. Mrs Gundersen, x3-6085, pm.

Rims, 2, 13", Dodge or Valiant, \$5/pr. Frank, x3-6272.

Ice skts, f, sz 8, \$10; m sneakers, sz 8 1/2 & 10, \$3/ea; Regina fl polisher & rug shampooer, \$20; GE st & dry iron, \$4. x8-4095 Draper.

Stereo equip, KLH-18 tuner, \$60; pr KLH-5 spkr, \$100/ea; or best. x3-7624.

RCA port color TV, 18", '72; gold carpets, 12x24 & 12x12; flr lamp; '72 Ford Torino, gold, p st & br, ac r, nego. x186-52828 Harvard.

Hcky skts, b, sz 1 b nw unused; many other b hcky skts; b & g fig skts; child tricycle; wonder horse. Ed Friedman, 846-2578.

Dynaco PAT-4 pre-amp, \$50; 2 Dyna stereo 120, \$125 ea. Art, 247-7717, evgs.

Wd storm wndws, 4 panes: (4) 31x42, (2) 34x58, (2) 28x58, (1) 28x38. x8-4093 Draper, aft 4.

Trumpet, Yamaha YTR-232, B flat, brass, exc cond, w/case, orig \$195, \$150 or best. Steve Allen, x8-2687 Draper.

Boys 20" 3 spd bike, banana seat, exc shape, \$30. x3-4629.

Stud snows, Sears glasbelt G78-13, K, mtd, balanced, Opel rims, \$40 or best. Mike, x3-6122.

Wool rugs w/pads: pearl gray, \$175; lt blue, 9x12, \$100. Dr. Karten, x3-5780.

Sofa, used, overstuffed, dark red, \$12.50. Jane, x3-4804.

Fashion Tress wig, f, short strawberry blonde, nvr worn, \$45 nw, ask \$30. x3-1357.

DR set, Donia by Amer of Martinsville, wint, 3 leaf tbl opens to 8 1/2' w/pads, 2 arm & 4 side chrs, buffet, \$225; mod DR lite, 5 hanging globes, \$20. George Wallace, x3-6213.

Goalie skts, sz 9, used by 10 yr old, v gd cond, yr old, \$90 nw, now \$45. Susan, x3-4606.

Hard seas firewood, cut, split, delivered. Darlene, x3-6171.

Sew mach, beds, fan, curtains, draft equip, etc, Iving Bos 12/23. Call, 227-9535.

Vehicles

'64 Dodge sta wag, std, slant 6, fall stckr, nds master cyl & tune, v reliable, 1st \$100 drives away. Philip Mandel, x3-3161.

'64 Olds F85, V8, auto, \$100. Dave, x3-4980.

'67 Ford LTD, 76 K, 4 dr, amfm, p st & br, exc cond, \$375 firm. Robin, x8-4566 Draper.

'68 Pontiac Le Mans, p st & br, auto, ac, r, nw snows, gd body. Tom, x8-1276 Draper.

'68 Dodge 2 dr hdtp, 59 K, nw tires & snows, fac ac, \$300. Bert, x3-5726.

'69 Chevy Chevelle, 2 dr, conv, std, sm V8 eng, amfm, exc mileage, \$1,300. x3-4257.

'69 Ford Cortina, std, amfm, snows, fr cond, \$450. Ernie, x8-3679 Draper.

'70 Toyota Mark II, 36 K, auto, nw tires, exc cond, \$1,495. x3-1860.

'71 Vega, std, exc cond, 24 K, 25 mpg, ask \$1,600, call be Dec 22. David, 266-8133.

'72 Mustang conv, 4 spd, std, 18-20 mpg at 50 mph, \$2,495. Leon, x7792 Linc.

'73 Capri, V6, less 2.5 K, 3 mos, perf cond, wrnty, 24 mpg, nw \$3,700, sell \$3,300. Jan, x9451 Dorm.

'63 GMC Travel-All, fr cond, B6 truck eng, +300. Bill Pinson, x3-2819.

Housing

Allston, BR, block Comm Ave, nr T, avail now, v gd cond, \$150. x3-4996.

Bos, Beacon Hill, BR apt, 2 blocks from T, avail Jan, \$160. Call, 227-9535.

Bri, BR apt, crnr Bri & Comm Ave, 2nd fl, eat-in-K, prking, avail 1/1, \$200 + util. Lance, x5855 Linc.

Bklne, lg stu, full K, wk-in closet, nr T, lse, avail Feb 1, rent control \$129. Mary, x3-1943.

Camb, BR apt, Brattle St area, Jan-May, rent free in exch for help. Wilson, x3-5121.

Camb, 5 Centre St, comf apt, safe, gd for kids, 2 BR, LR, DR, K, nr shops, avail approx 1/10, \$275 incl h. Call, 547-4377, aft 7.

Dorchester, Sawyer Ave, apt or rm for rent. Bialocki, 696-5318.

Newtonville, 6 rm garrison col, 3 BR, LR, DR, K, gar, furn, 20m min MIT, nr T & schools, Feb-July or Aug, \$350. Phyllis, x3-2522.

Som, BR apt, eat-in-K w/pantry. lg rms, top fl solid old bldg, Bos skyline view. David, x3-1977.

V mod, lg 2 BR apt, 1st fl, d&d, ww, ac, balcony, walk-in closet, walk to shops, laundry facil, parking, avail 1/15, \$235 incl h. Call, 776-6742.

N Conway, Barlett, NH, wkly rental, chalet w/view, privacy lg frpl. Dave, x7821 Linc.

Middlebury Col, Vt: skiers! Wl energy crisis kp u from mnts? 1-1 exch, free rm & brd, for IAP. Info, For Stu office, 10-303, or Carol, 492-3629.

Animals

Beaut sheepdog, m, 10 mos, AKC, \$150. Don, x3-6211.

Rabbits, 6 wks old, wh, \$3. x3-2916.

Lost and Found

Wl exch lined London Fog raincoat for my London Fog unlined car coat, taken by mistake at 25 yr club dinner, Stu Ctr, Thurs, Dec 13. Charles Collins, x182-183-213 Bedford.

Lost: World Tiddlywinks Club Champ trophy, Stu Ctr Mezzanine Lge, 12/8, no questions. Dave, x3-4980.

Lost: Lhasa Apso puppy, Nov 20, 1 Mem Dr, after car accident, may be injured, wh face & paws, sandy/gray body, 8", 7-8 lbs, tail 7", \$200 reward for info leading to recovery. Michelle, x3-7530.

Lost: antibiotic capsules in unlabeled plastic container. Randy, x8564 Dorm.

Wanted

Carpool to Framingham, 5 days wk. x3-3959.

Wife of foreign stu, babysit 2 chldrn, ages 6 1/2 & 3 1/2, 11:30am-3pm (pref 'til 4pm), Mon-Fri, Waltham, own transp. x3-6697.

Apt or hse for visiting fac (Gunter Nitschke), easy reach MIT w/o car, 2/1-6/1, wl rent or trade for sm, quiet hse w/garden, Kyoto, Japan. Sivin, x3-3454.

People, 2-3, share lg Belmont hse, w/2 adults, 1 child, yd, parking, bus to H Sq, child welcome. Call, 484-3122.

F rrmate beg 1/1. Linda, x3-6923.

Ride to New Brunswick, NJ area, lve 12/19 pm or later, rtn 12/29-30. Juzer, x0248 Dorm.

Riders or carpool, MIT-Medford, Dan, x3-3190, kp try.

Nikromat FTN; VW convert, '67 or later. x5806 Linc.

Rmmate, 3 BR, Northgate, 335 Mass Ave No 6, convenient, furn, pking, \$93. Call, 354-1638.

Fl or pole lamps, nw or used. Fred, x3-3406.

Sleeping bag, Yuen, 492-0494, evgs.

Cat sitter for 2 siamese, declawed & spayed, 2-3 wks Jan, wl pay food, litter, xtra. Call, 547-8643, evgs.

Snows, 2, 6.50x13. Susan, x3-1960.

Rm, Tang Hall, 12/30-5/30, dates nego. Call, 876-6526, evgs.

Ride to Morristown, NJ, or environs, leaving sometime Dec 21. Sally, x3-2701.

Make \$1.60 fast, be subject in language experiment, 1/2 hr during exams or IAP. Sarah, x3-5763.

Riders to Baltimore between Dec 18 & 21. Jim, x9780 Dorm.

Positions Available

This list includes all non-academic jobs currently available on the MIT campus. Duplicate lists are posted each Tuesday preceding Tech Talk publication date on the Women's Kiosk in Building 7, outside the Office of Minority Affairs, 4-144, and in the Personnel Office E19-239, on the day of Tech Talk publication. Because transfer activity has been low in biweekly jobs Grades I-IV, Personnel interviewers will refer any qualified applicants on all biweekly jobs Grades I-IV as soon as possible after their receipt in Personnel. Employees at the Institute should continue to contact their Personnel Officers to apply for positions for which they feel they qualify.

Virginia Bishop 3-1591
Mike Parr 3-4266
Philip Knight 3-4267
(secretary - Joy Dukowitz)

Sally Hansen 3-4275
Jack Newcomb 3-4269
Evelyn Perez 3-2928
(secretary - Mary Ann Foti)

Dick Higham 3-4278
Pat Williams 3-1594
Claudia Liebny 3-1595
(secretary - Dixie Chin)

New applicants should call the Personnel Office on extension 3-4251.

The following positions have been filled since the last issue of Tech Talk and are no longer available:

73-1252-R Tech Asst - DSR Staff
73-1264-R Sr. Clerk III
73-1156-A Admin Staff
73-1193-R Sec IV
73-1191-R Sec IV
73-1247-A Admin Asst V
73-1269-R Sr Sec V or Adm Sec V
73-1230-R Sec IV
73-1199-R Academic Staff
73-821 Adm Staff Prog CXL
73-1284 Sec IV
73-1229-A Elec Tech B (Temp)
73-1212-R Sec III
73-1141-R Editorial Sec IV
73-845-R Systems Analyst
73-749-R Systems Analyst
73-1237-A Systems Analyst
73-1245-R Sec IV
73-1233-R DSR Staff
73-1067-R Sr. Clk III
73-1258-R Sec III

The following positions are on HOLD pending final decision:

73-1279-R Sec III-IV

Administrative Staff member will work in the area of resource development dealing with individual contributors. Develop strategies and programs, prepare reports, provide advice and counsel of a legal nature for resource development activity. Some travel required to represent MIT. Must have legal training and preferably some experience as a counselor in practice or a job situation utilizing legal training. Writing and organizational ability; motivation, enthusiasm required. 73-480 (5/30).

DSR Staff member will plan, manage and execute high-quality research projects having a strongly experimental orientation. Familiarity and experience with low-speed flight and wind tunnel testing methods and advanced piloting aviation type aircraft; Ph.D. in Aerodynamics and five years applicable research and development experience required. 73-488-A (6/20).

Biochemist - DSR Staff member will participate in lipoprotein studies, and will supervise the activities of several technicians in a clinical research setting. Ph.D. or M.D. in Biochemistry required, as well as experience with lipoprotein and supervising. 73-515-R.

Manager of Subsystem Development - Administrative Staff in the Programming Development Office will provide technical direction of the design, development, and maintenance of software subsystems under the OS/360, OS/VS2, and Multics Operating Systems. Minimum of 7 years professional experience, and 2 years experience in technical management. 73-912-R (9/12).

Environmental Engineer - Administrative Staff in Physical Plant will organize and direct an Institute-wide energy conservation program. Survey campus buildings to determine areas of possible energy economy; plan procedures; maintain the Institute's compliance with environmental requirements. BS in Electrical Engineering with a basic knowledge of building Mechanical systems for heating ventilating, and air conditioning. Experience in engineering design or operation of buildings. Experience in energy conservation helpful. 73-875-R (9/5).

DSR Staff in Metallurgy will perform scanning transmission electron microscopy and high spatial resolution electron probe microanalysis of biological specimens; prepare thin films to use a microanalysis standards; technical subjects. BS with experience in the performance of high spatial resolution and physical constants of thin film, or MS degree required. 73-1127-R (10/24).

Technical Librarian - Administrative Staff will design and implement procedures for organizing and maintaining and Industrial Administrative Information Systems. Process and document EDP reference manuals, technical journals, internally prepared documentation Aid in implementation, and thereafter maintain, formal methods of interfacing with vendor support personnel. Be directly involved in process of documenting material developed by technical support group, including editing and re-writing of such material. Will also edit and re-write material for a Programmer's User's Guide. Knowledge of methods for development and maintenance of a Special Library required; minimal knowledge of data processing concepts and terminology desired. 73-953-A (9/19).

Systems Programmer - Administrative Staff will provide technical expertise; develop and implement methods of improving computer performance. Minimum of two years S/360 or S/370 BAL (ALP) Assembler Language Programming experience. Knowledge of tele-processing, and COBOL or PL/1. 73-265-R (4/73).

Computer Operator IV will operate IBM Model 135 and all peripheral equipment associated with it, including disk drives, tape units, card reader/punch, printers. Must have a good knowledge of DOS job control, multi-programming experience and be capa-

ble of understanding operating instruction, midnight to 8:00am shift. 73-1221-R (11/21).

Senior Keypunch Operator III in the Office of Administration Information Systems will operate the IBM 029 keypunch machine. Punch into computer input cards formatted and unformatted documents. Minimum 2 years experience operating IBM 029 or comparable equipment. 73-1286-R (12/12).

DSR Staff in Earth and Planetary Science will interpret Mars picture data, and diffuse reflection spectral fractures arising from electronic transition; perform spectroscopy of lunar samples; coordinate research and projects in the Planetary Astronomy Laboratory; supervise undergraduate assistants; write reports, proposals and papers. Experience in the fields of planetary surfaces, observational astronomy, igneous petrology, optical properties of solids, lunar sample analysis and computer programming. Candidate should have an academic background in geology and principles and techniques of optical astronomy. 73-1218-A (11/21).

DSR Staff - Systems Programmer at Project MAC will perform system analysis and system programming on a research version of the Multics operating system. SM or EE degree required; 2-3 years programming experience in the Supervisor of some advanced operating system required. Ability to contribute to research and work with students important. 73-1234-A (10/24).

Project Manager - Administrative Staff in the Office of Administrative Information Systems will develop major systems; perform feasibility studies; prepare budgets; work with clients in the evolution of each new development project. Applicants should have a strong background in the management area of administrative data processing. 73-1327-A (12/19).

Administrative Staff - INSITE System Programmer in the Planning Office will provide maintenance for the space inventory systems (INSITE) for MIT and other institutions using the system. Develop the system and instruct consortium members in its use. Degree in a technical field (computer science, math); experience with IBM hardware, knowledge of FORTRAN, Assembly Language and Job Control Language is essential. Ability to instruct others and coordinate programming efforts is important. 73-1259-R (12/5).

Systems Analyst - Administrative Staff in the Office of Administrative Information System will develop, under direct supervision, solutions to business problems; prepare, design, and program specifications for new programs and for modifications to existing systems. Applicants should have business and administrative experience, analytical ability and familiarity with computers. 73-1315-R (12/19).

DSR Staff - Project Engineer (part-time-temporary) in Earth and Planetary Sciences will design and construct a prototype cooled slow-scan imaging device for use on telescopes. Knowledge of charge couple devices used at low temperature, slow-scan imaging devices; experience with digital circuit design; experience with analog and digital circuiting required. 20 hour work week; 8 month job. 73-1257-R (12/5).

Planner/Architect - Administrative Staff in Planning Office will concentrate on long-range planning for existing environmental conditions, define problems, develop plans and design concepts; degree in Architecture required; degree in Planning preferred. Minimum of 5 yrs experience and the ability to work independently important. 73-880-R (9/15).

Administrative Staff Planner will direct long-range physical planning for the various efforts of the planning team; develop budgets and schedule of government agencies and community groups. Must have a Masters degree in Planning and a minimum of 5 yrs experience. 73-535-R (6/13).

DSR Staff - Electronics Engineer in the Center for Space Research will design, test and check out scientific experiments for space satellites; assist in system design; test and integrate the developed experiment in the spacecraft and participate with prelaunch support. Emphasis is placed on low noise, low level analog circuitry but thorough familiarity with digital electronics and logic design of the experiment is required. BS degree in EE with experience in the design, development and testing of solid state low level analog systems; familiarity with modern semiconductor in space applications and modern signal detection theory and applications required. 73-1241-A (11/28).

DSR Staff in the Research Laboratory of Electronics will work on problems concerning interactions of atom with the radiation field. Individual should

(Continued on page 12)

DINING SERVICE HOURS DURING THE HOLIDAY SEASON

DEC. 22	TWENTY CHIMNEYS	8 AM TO 7 PM
DEC. 23	TWENTY CHIMNEYS	9 AM TO 7 PM
DEC. 24	CLOSED	
DEC. 25	CLOSED	
DEC. 26, 27, 28	LOBDELL BREAKFAST	7:30 AM TO 10 AM
	LUNCH	11 AM TO 2 PM
	DINNER	5 PM TO 7 PM
DEC. 29	TWENTY CHIMNEYS	8 AM TO 7 PM
DEC. 30	TWENTY CHIMNEYS	9 AM TO 7 PM
DEC. 31	TWENTY CHIMNEYS	8 AM TO 7 PM
JAN. 1	CLOSED	
JAN. 2, 3, 4	LOBDELL BREAKFAST	7:30 AM TO 10 AM
	LUNCH	11 AM TO 2 PM
	DINNER	5 PM TO 7 PM
JAN. 5	TWENTY CHIMNEYS	8 AM TO 7 PM
JAN. 6	TWENTY CHIMNEYS	9 AM TO 1 AM
JAN. 7	RESUME REGULAR SCHEDULE IN ALL FOOD SERVICE OPERATIONS	

WALKER MEMORIAL FOOD SERVICE WILL BE CLOSED FROM THE END OF SERVICE DEC. 21 TO BREAKFAST 7:30 AM JAN. 7, 1974.

PRITCHETT LOUNGE (WALKER) WILL BE OPEN NOON TO MIDNIGHT SUNDAY JAN. 6, 1974.

(Continued from page 11)
have a recent Ph.D. degree with strong background in atomic physics and laser techniques. 73-1243-R (11/28).

DSR Staff member will be responsible for the off-campus medical and major part of the industrial areas participating in the Undergraduate Research Opportunities Program. Solicit off campus contacts, coordinate the details of student placement; prepare reports; initiate and followup on the interactions between the program and offices of MIT; explain and promote the program to the outside community. Demonstrated creativity, writing and communication skills; self confidence required. 73-1283-R (12/12).

DSR Staff in the Center for Cancer Research will handle the culturing of cells, sterile passaging of cells, preparation of sterile media, preparation and purification of virus stocks Bachelor's degree in Chemistry or Biology required; experience with tissue culture desirable; work experience in Biology and Chemistry useful. 73-1331-A (12/19).

DSR Staff at the Center for Space Research will carry a major responsibility for the analysis of data from the MIT X-ray observatory on the Third Small Astronomy Satellite. The work will include the pre-launch, post-launch organization of operation and data management; development of the data system; analyze and publish results. Ph.D. in Physics required. Extensive experience with computer programming for data and analysis on a systems level. Knowledge of astronomy and astrophysics absolutely essential. 73-1310-R (12/19).

Nurse/Supervisor-Administrative Staff in the Clinical Research Center will assume responsibility for management of patients and personnel of the Center's Nursing Unit. Will also provide nursing care to all types of patients; perform various nursing duties; participate in research procedures by maintaining records of patient courses and research activities as requested by the physician investigators, the Program Director or Assistant Program Director. Candidate must be a registered nurse; previous supervisory experience preferred. 40 hour work week. 73-1282-R (12/12).

DSR Staff in the Center for Space Research will analyze and interpret plasma data from satellite-borne plasma experiments. Recent Ph.D. in space plasma physics or related area required. Candidate should have had direct experience with the analysis and interpretation of experimental results related to the interplanetary plasma. 73-1183-A 73-1184-A (11/14).

Senior Secretary V in the MIT Chairman's Office will organize busy office; handle many office routines and inquiries requiring independent disposition; maintain extensive filing system; monitor office accounts. Excellent typing, shorthand, and dictaphone skills required. Ability to maintain communications and smooth relations with top level offices of the Institute and with the Greater Boston Community essential. Willingness to assume responsibility, to work independently and under pressure important. 37 1/2 hour work week. 73-1335-R (12/19).

Senior Secretary V in the Arteriosclerosis Center will coordinate the office activities of the Director of a multifaceted medical research program. Schedule appointments, conferences, lectures, maintain student records and appointments and a variety of office files; periodically prepare reports; type manuscript reviews and other materials. Individual will have extensive telephone contact with other medical areas and patients. Good organizational skills; ability to establish priorities and supervise junior secretaries required. Knowledge of medical terminology and machine transcription helpful. 9:30-5:30. 73-1088-R (10/10).

Secretary IV in Academic department will type correspondence, proposals, DSR reports, manuscripts, theses (much of it technical); keep DSR account records; maintain small library; compose routine letters; assist professor with details of registration. Ability to work independently and to write letters important; accurate typing essential; knowledge of shorthand, technical typing and bookkeeping preferred. 73-578-R (6/27).

Secretary IV for Institute Secretary for Corporations will organize and run the office. Very accurate typing needed for some letter-perfect copy. Other typing duties require speed. Preliminary research on corporate prospects; gather backup information for visits; draft not-too-technical correspondence. Work closely with other Institute offices in obtaining pertinent data; receive visitors. Flexible, adaptable, good telephone presence. 73-1091-R (10/10).

Secretary IV to a Professor in Economics will handle all general secretarial duties; type correspondence, course material, technical manuscripts; perform editorial secretarial duties for *Econometrica*. Good typing and organizational skills required. 73-11700-R (11/7).

Secretary IV in Mechanical Engineering will handle bookkeeping for computerized accounts; maintain budget records; prepare materials for courses; type technical reports. Secretarial school background or previous experience preferred; knowledge of bookkeeping, keypunching, or other computer techniques helpful. Good typing and the ability to work for several people required. There is a lot of student contact in this job. 73-1194 (11/14).

Secretary IV in Metallurgy will perform general secretarial duties for two professors. Type class material, correspondence from machine records and files; coordinate busy office schedules; handle petty cash fund. Good typing and shorthand skills required; ability to set priorities; familiarity with technical terminology and computer helpful. 73-1220-R (11/21).

Secretary IV to three psychiatrists in the Medical department will handle all secretarial duties; transcribe patient case histories; maintain accurate records. Will also assist with other secretarial projects. Excellent typing skill, maturity, ability to deal with patients important. 37 1/2 hour work week. 73-1267-R (12/5).

Secretary IV in the Development Office will handle general office duties including a large amount of typing; will plan and layout typed material; maintain confidential files. Excellent typing skills needed for IBM Magnetic Card II typewriter. Ability to proofread important, editorial skills helpful. Maturity, tact, strong organizational skills required. 73-1253-R (12/5).

Secretary IV to Associate Director of the Alumni Fund will handle general secretarial duties for the office. Independently answer correspondence; type alumni Fund Bulletin, statistical reports, assist with the preparation of reports. Good typing and shorthand skills required; experience with MTST desirable; ability to work independently with details is essential. 73-1268-R (12/5).

Secretary IV will handle general secretarial duties for a small group involved with the Undergraduate Research Opportunities Program (URPOP). Excellent typing, dictaphone and organizational skills required. Ability to deal with students, academic and research staff important. 73-1265-R (12/5).

Secretary IV will handle secretarial duties for the associate director and group of associates of the Joint Center for Urban Studies. Transcribe from tapes; handle reception duties; maintain filing system for a study of a national housing allowance. Excellent typing needed for manuscripts and reports (some technical); previous secretarial training or experience preferred. Job will start 1/14/74. 73-1288-R (12/12).

Secretary IV in Biology will handle general secretarial duties for a laboratory group. Monitor research accounts; arrange travel; process requisitions and approve invoices. Excellent skills important; ability to work independently, previous experience desired. 73-1293-R (12/12).

Secretary IV for the Undergraduate Association, Dean for Student Affairs Office will type correspondence and minutes of meetings; maintain files and records; schedule booths for the lobby of Building 10; monitor checking account. Good skills and knowledge of office procedures preferred; ability to work with several people and the desire to help students important. This position is for 10 months per year; office not open during July and August. 73-1285 (12/12).

Secretary IV to two Biology professors will handle all general office duties; type technical material from dictaphone; process invoices independently perform office functions. Strong typing and dictaphone skills required; some accounting and organizational ability preferred. Previous experience essential. 73-1308-R (12/19).

Secretary IV in Aerospace Studies (Air Force ROTC) Department will perform general office duties including file maintenance and correspondence. Will administer and maintain specialized Air Force medical files. Good typing required, ability to meet people and answer telephone inquiries essential. 30-35 hour work week. 73-1213-R (12/19).

Secretary IV to a professor in Metallurgy will handle general office functions; take dictation for letters; type correspondence, class materials; assist in preparation of reports; assemble statements of expenditures. Excellent typing and shorthand skills required; previous experience preferred. 73-1316-R (12/19).

Secretary IV to several professors will handle general office duties; type class material, papers, proposals, correspondence, assist with typing overload. Good typing skills required; technical

typing skills preferred but will train good typist. Flexibility to work for several people important. 73-1306-R (12/19).

Secretary IV to the Director of Personnel Relations will handle general office duties; answer some correspondence; set up meetings, conferences. Type statistical material, setting up formats for charts; maintain office accounts. Excellent typing, including knowledge of format for statistical tables and charts. Basic bookkeeping skills helpful. Previous secretarial experience or training required. 73-1303-R (12/12).

Secretary III-IV to three professors in Chemical Engineering will type correspondence, course material, technical manuscripts; handle general office duties; assist in maintenance of student records. Excellent typing skills required (technical typing preferred); ability to work with students and for several people important. 73-1246-R (11/28).

Secretary III-IV for the Institute Secretary will handle general office duties organize appointment calendar and itineraries; maintain files. Good typing and dictaphone skills required; light shorthand skills helpful. 73-1326-R (12/19).

Secretary III-IV for a group of faculty members in Mathematics. Handle all general secretarial duties, maintain postdoctoral job opportunity files. Excellent typing skills needed for correspondence and mathematical papers. Previous technical typing experience helpful. Ability to work with minimal supervision important. 73-1254-R (12/5).

Secretary III (part-time) in the Dean for Student Affairs Office will assist with general secretarial and administrative duties necessary for the operation of Talbot House, Student Center/Kresge. Good secretarial skills; and the ability to act quickly important. 12 hour work week. 73-1198-R (11/21).

Secretary III to the Vice President of Administration and Personnel and the Administrative Assistant in that Office will handle heavy load of typing, transcribe from dictating equipment maintain active calendar, serve as office receptionist, maintain files and answer phones. Good language skills, ability to take accurate messages are essential. Knowledge of Institute policy and resources is desirable to provide assistance to a large number of callers and visitors. Will use IBM Executive typewriter. 73-1271-R (12/5).

Secretary III to three professors in Ocean Engineering will type correspondence, proposals, reports; maintain files and accounts; make travel arrangements and schedule appointments. Good technical typing skills required; some accounting knowledge helpful; previous experience preferred. 73-1333-R (12/19).

Secretary III will work for the Infrared Optical Laser Group, Physics Department. Handle general secretarial duties; type technical papers and correspondence; assist other secretaries as necessary. Good secretarial skills important; familiarity with equations required. 73-1324-A (12/19).

Secretary III to two staff members in the Alumni Association will type newsletter, general correspondence; assist in the maintenance of Biographic records and general office work. Good typing skills required; ability to establish priorities and good judgment important. 73-1328-R (12/19).

Secretary III in the Financial Aid Office will type correspondence tables, help organize application process for students; assist with reception and general office duties. Excellent typing skills required. 73-1318-R (12/19).

Secretary IV will handle general secretarial duties for the Special Assistant to the Dean of Engineering. Set up procedures and files for a new office; type correspondence and reports. Good typing and dictaphone skills; ability to deal effectively with students, faculty, administrators and visitors required. 73-1313-A (12/19).

Senior Clerk IV (Documentation) in the Center for Policy Alternatives will organize and maintain an extensive document collection of English and foreign language publications for a research group involved in the area of science, technology and public policy. Search current literature, order publications pertinent to the center; document and catalogue material; handle correspondence. Accurate typing required; knowledge of French and German or Russian desirable. Familiarity with MIT's library system preferred. 73-1248-R (11/28).

Account Representative V in the Office of Administrative Information Systems will coordinate client schedules, job setup; verify user input and output; maintain operating instructions and job control information; perform liaison functions between the client office and the computer operations facility. Knowledge of computer throughput procedures and job control throughput

procedures and job control functions required. Ability to communicate clearly is important. 8:30-5:00. 73-1336-R (12/19).

Jr. Programmer V in the Arteriosclerosis Center will assist in design, development, and evaluation of a Medical Data Management System. Candidate must have a sincere interest in working in a medical environment and have the ability to collaborate with medical personnel. Previous data management experience, knowledge of PL/I and familiarity with 360/370 OS desirable. 73-1182-A 11/14).

Technical Assistant IV in the Alumni Association will keypunch records; assist in the administration of the data processing controls, changes, updates, and maintenance of 80,000 records and subscription. Minimum 3 years keypunch and data processing experience with Alpha-numeric punching. Familiarity with 029 keypunch, 059 card verifier and 129 keypunch/verifier preferred. 73-1275-R (12/12).

Technical/Administrative Assistant in Nutrition and Food Science will search for references in the libraries; coordinate information concerning research connected with African nations. Excellent typing and dictaphone skills; fluency in French; knowledge of biological and/or chemical terminology required. College background preferred. 40 hour work week. 73-1239-A (12/12).

Senior Library Assistant IV in the Barker Engineering Library will be assistant in the Processing Office for Monographs and Catalog Maintenance. Verify catalog records; process incoming monographs; supervise various card catalog processes. Previous library experience in cataloguing/processing department, some library science courses in bibliography, experience is a necessity. Accurate typing required. 9-5 or 10-6. 73-1231-R (11/21).

Library General Assistant III in the Barker Engineering Library will type the library Bulletin, reference correspondence; handle billing for lost and overdue books; maintain files and assist with filing for card catalog. Strong typing needed; ability to work independently; flexibility and organizational skills important. 73-1329-R (12/19).

Library General Assistant III (part-time-temporary) in the Humanities Library will check the Institute catalog and national bibliographies for titles of new materials; assist in the processing of reserve books and other clerical assignments. Accurate typing needed for book orders; ability to organize work and capacity for detail is important. Library experience helpful. 18 hour work week; job ends 6/30/74. 73-1311-A (12/19).

Sr. Accounting Clerk IV will handle all accounts payable functions for Graphic Arts Service; perform other routine clerical duties, handle billing of jobs. Candidate must have a knowledge of basic arithmetic and an interest in working with figures and details. 73-1314-R (12/19).

Senior Clerk IV will assist the manager of Self Study Subject Distribution (Center for Advanced Engineering Study). Control and distribute video tapes of academic courses produced in the Center; create and maintain an inventory system; provide customer services of a technical and non-technical nature. Ability to work independently important. Candidate must be dependable and well-organized. 73-1325-A (12/19).

Senior Clerk IV (part-time) for the Harvard-MIT Program in Health Sciences and Technology will handle requisitions/purchase orders; reconcile accounts; assist in budget preparation and with special projects. Accurate typing, basic accounting skills necessary. Ability to work independently and with details important. Knowledge of MIT and accounting procedures helpful. 20 hour work week. 73-1332-A (12/19).

Senior Clerk III or IV in the Registrar's Office will work with Undergraduate student records. Transcribe grades, check computer input/output, update permanent records. Excellent typing required. Previous office experience helpful. Interest and ability in working with details essential. 73-1256-R (12/5).

Accounting Clerk III-IV in the Center for Space Research will be responsible for various payroll records; monitor travel expense vouchers; reconcile the monthly accounting statements; perform other general clerical duties. Familiarity with the Institute payroll procedures; accurate typing skills are desirable. 40 hour work week. 73-1255-R (12/5).

Accounting Clerk III in the Comptroller's Accounting Office will be responsible for maintenance of four cycles of accounts receivable billing. File material, prepare new accounts; post on NCR machine. Accurate typing required; ability to work with figures important. 73-1305-R (12/19).

Technical Typist III in the Chemical Engineering Department will type large volumes of reports, manuscripts, proposals from rough drafts using a magnetic tape typewriter. Excellent skills; ability to handle typing of equations and chemical symbols; good skills in punctuation and paragraphing required. Ability to work independently important. 73-1238-R (11/28).

Senior Clerk III or IV in the Registrar's Office will need excellent typing skills for work with graduate students' records. Post grades from computer output; update and verify files and records; answer questions from students. Ability to work with details and figures important; previous office experience helpful. 73-1290-R (12/12).

Senior Clerk III-IV will work with 1200 undergraduate records in the Registrar's Office. Will be responsible for data entry of grades; answer phone queries. Previous office experience helpful; accurate typing skills, ability to work with details important. 73-1287-R (12/12).

Senior Clerk III in the Student Financial Aid Office will perform reception duties; answer questions about scholarships, loans and term-time employment. Good typing skills needed for general typing; ability to deal intelligently with the public required. 73-1317-R (12/19).

Technical Typist III in the Research Lab of Electronics will type manuscripts and reports from rough data. Responsible for punctuation and paragraphing, may involve some editing for preparation for publishing. Excellent skills, minimum of one year experience. 73-1266-R (12/5).

Jr. Dietary Aide II in the Clinical Research Center will prepare meals for all in-patients; weigh formulas and additives given to out-patients on dietary studies; check to see that everything is labeled correctly. Candidate must be familiar with dietary aide procedures; previous experience preferred. Ability to work independently important. 40 hour work week. 73-1277-R (12/12).

General Cook at the Faculty Club must be able to read, understand and follow recipes for all types of food preparation. Make sauces, cook meats, vegetables, prepare salad ingredients. Prepare menu items for luncheons and some items for dinner. General knowledge of all types of food preparation; good experience in first class club or restaurant required. Ability to read and understand English important; will generally prepare American-type food 6am-2pm. 73-1228-R (11/21).

2nd Class Engineer must have a Mass second class Engineer's license or higher. Individual must be willing to work on any shift. 73-182-R (4/73).

Electrician for Physical Plant will install and maintain all types of electrical equipment and systems. Ability to work from blueprints, verbal instructions or sketches as necessary. Some electronic experience desirable. Must be able to work all shifts and on irregular schedule. Minimum of five years experience and Mass State license required. 73-1107-R (10/17).

Technician A (E and M) in the Radioactivity Center will maintain electron equipment associated with controlled low background facility, breath radon and thoron equipment; troubleshoot unclear pulse instrumentation; do construction and wiring. Individual must have a strong background in pulse and digital circuits; experience in use of oscilloscopes and other test instruments; ability to use shop machinery. Experience in repair of electronic instrumentation helpful. 73-1186-R (11/28).

Electronic Technician B in the Center for Space Research will assist with laboratory research; operate technical experimental apparatus. Breadboard and test linear and digital circuit systems for satellite experiments. Graduation from a two-year day technical school or its equivalent; ability to perform flight-quality soldering and cabling required. 40 hour work week. 73-1261-A (12/12).

Technician B in the Environmental Medical Service will perform general radiation protection technician duties at the MIT reactor. Repair and calibrate instruments conduct radiation surveys and sample preparation, decontamination and lab clean-up. Package radioactive waste and assist in construction of shields. Training and experience in electronics and radiation protection required. Afternoon shift. 40 hour work week. 73-1227-A (12/15).

Painter in Physical Plant must have minimum of 5 years experience in all phases of painting, including interior and exterior work, preparation and mixing paint materials and matching colors, thorough knowledge of the various materials, tools, equipment and rigging used in the trade. Must have a Painter rigger's License and be able to work effectively on staging and ladders. 40 hour work week. M-F. 73-1240-R (11/24).