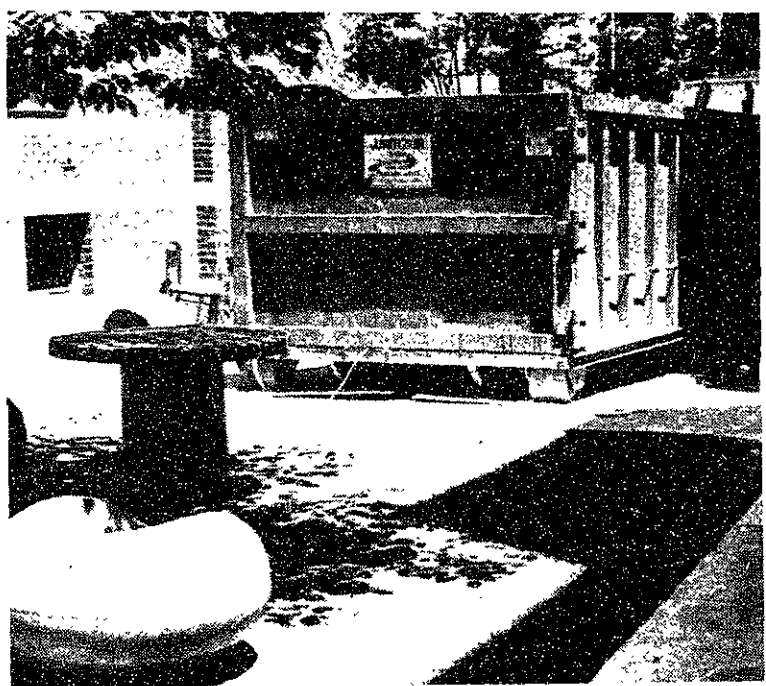




Tech photo by Ellen L. Spero

A trash dumpster blocks the front entrance to Bexley Hall, which is closed this summer for renovations.

EECS proposes IAP 6.001 Programming course wouldn't be taught in spring

By Andrew L. Fish

The MIT Department of Electrical Engineering and Computer Science has proposed to replace its spring term offering of 6.001 with an intensive version during Independent Activities Period (IAP).

The proposal, which is still in the planning stages, is intended to "create more intimate student-faculty contact" and "better serve students who have difficulty juggling conflicting demands on their time during the semester," according to a June 3 draft.

Professor Richard B. Adler '43, associate head of the Department for Electrical Science and Engineering, said "a whole lot of discussion is needed [on the proposal]." He indicated that such discussions were currently under-

way.

Adler said the proposal creates "whole kinds of problems." Some of the questions which have been brought up include how to make assignments, how grading should be done, and how to control registration, Adler explained.

Adler noted that it was possible that IAP demand could be higher than term enrollment, including "those who might not ordinarily take the course. . . . How do you avoid getting 800 people?" Adler asked.

The proposal could help the freshman year by freeing up more time, Adler said. He noted that most freshmen end up taking 6.001 during their spring term.

"It's a lot of material to learn in three and a half weeks," Adler conceded. He said the condensed version of 6.001 had been given to some faculty, "but they are not trying to pass exams."

"My own feeling is that there are too many things to settle to get the course ready for September," Adler said.

Dean of Undergraduate Education Margaret L. A. MacVicar '65 said there were "a lot of meritorious points" in the plan. "I hope that the concerns can be addressed so the program can be instituted," she said.

Proposals like this would "increase the kinds and character of

opportunities offered during IAP," MacVicar said.

MIT should "proceed with caution, without changing the character of IAP," MacVicar said. "It would be a tragedy if IAP lost its scope and freedom."

David S. Wiley '61, recently-named successor to retiring Associate Dean of Student Affairs Holliday C. Heine '67, said "it is important to be supportive of new pedagogical projects; however, many concerns have been raised [about the proposal]."

It is important to have student input, Wiley said. "We want to work out something that's best for the whole institution," he added.

Undergraduate Association (UA) President Bryan R. Moser '87 said the proposal, "is not a trivial change." Moser had concerns of the impact of the proposal on pace and pressure, IAP, and a student's introduction to Course VI.

The proposal must be "handled as an experiment" and "really well laid out," Moser said.

"As I see the proposal it has a coercive nature now," Moser said. "It has the potential of changing IAP in a very negative way."

"Until we have an opportunity to ask questions we won't make decisions," he said. Moser added that the UA is conducting a forum on the proposal on July 1.

Coop will move to Kendall

By Ronald E. Becker

The Harvard Cooperative Society (the Coop) will be opening a new store in the Kendall Square/Cambridge Center area, according to James A. Argeros, President of the Coop. The Coop signed a 20-year lease with Boston Properties and the City of Cambridge for property in the Kendall Square Area on June 2.

The Coop anticipates having the Kendall Square store in operation beginning April 1, 1987. This new store will have an expanded book section and will carry a wider selection of goods. Textbooks for MIT courses will still be sold. Book selection will be increased, and the textbook area will be convertible to other purposes during off-season.

Low growth potential and low visibility of the current student center store are the primary reasons for the move, Argeros said. The MIT branch of the Coop hasn't been showing the same kind of growth that the other Coop stores have shown, he said.

Kendall Square is a high-

growth area and Argeros indicated that The Coop was "lucky to be able to go there." He also predicted that if The Coop didn't make the move, that another, similar retailer would take the Kendall Square space and provide fierce competition to the Student Center store.

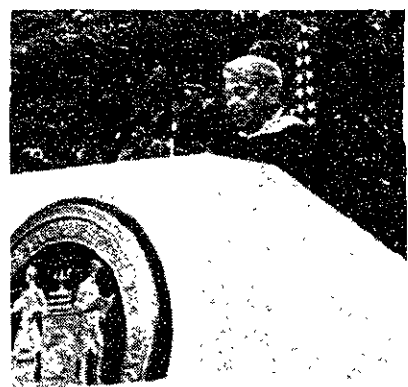
Another benefit of the move is that the new Tech Coop will be located right next to the Kendall/MIT T-stop. This offers better access to the Boston community,

Argeros said. The new store will also be adjacent to a planned "public plaza" and will offer a "food mall" service.

The current Student Center store is out of date — the fixtures and shelves are not up to contemporary standards. The new MIT Coop will have "a better environment in which to shop," Argeros said.

The new store will have 40,000 square feet of shopping space (50

(Please turn to page 2)



Tech photo by Ronald E. Becker
William R. Hewlett SM '36 addresses the graduates.

1769 graduate; McNair building named

By Andrew L. Fish

Amidst heavy rain, 1769 graduates received their degrees at MIT's 120th commencement on June 2. The graduation exercises were plagued by the worst weather since commencement was moved outside in 1979.

MIT President Paul E. Gray '54 used the opportunity to announce that the building housing the MIT Center for Space Research would be named for Ronald E. McNair PhD '76. McNair was one of the seven astronauts killed when the space shuttle Challenger exploded last January.

See text of Gray's remarks, page 2

In his charge to the graduates, Gray said "nothing could be more fitting than to have Ron's name and his spirit associated with that mission [exploring and understanding space] and this campus."

"The McNair Building will stand as a permanent reminder to future generations at MIT of the grace and significance of extraordinary achievement tempered by an uncommon wisdom and an abiding love of humankind," Gray continued.

Gray told the graduates that the "compression of time and space [through technological innovations] will require of you — more than any other generation — an ability to take the long view in your personal and professional decisions."

"This long view must be constantly before us . . . for we know that what we do today will affect not only our contemporaries near and far, but tomorrow's children as well," Gray said.

William R. Hewlett SM '36, co-founder of the Hewlett-Packard company, gave the commencement address. Hewlett told the graduates that industry is go-

ing to have to rely more on creativity to increase productivity.

See text of Hewlett's remarks, page 5

"Creativity will play a vital role in our increasingly high tech society," Hewlett said. "This is the time when the best and the most creative minds will be sought out and placed in positions of key responsibility," he explained.

Hewlett also placed responsibility on universities to "provide a theoretical base for quality and efficiency in the manufacturing process."

After Hewlett's address, Vivian Lee '86, president of the Class of 1986, presented the class gifts to Gray. The gifts consisted of a light sculpture to be placed in the Wiesner student art gallery and a scholarship fund. Lee spoke of the unity of the graduating class

in her address.

Rain and protests

Heavy showers poured throughout the ceremony, sending many inside to watch the exercises on television. Gray joked that a parent had remarked, "After the soaking I've taken from this place for the past four years what's a little rain?"

An alternate graduation site in the New Athletic Center had been set up, but the decision on whether to move indoors had to be made at 6:30 am, at which time it was not raining.

Some of the graduates and faculty participating in commencement wore red armbands in protest of MIT's holdings in companies doing business with South Africa. Also, about 10 people picketed against MIT's plans to develop the Simplex property in Cambridgeport.

Institute libraries install barcode lending system

By Suzanne J. Sandor

The MIT Libraries are phasing in a new automated circulation project to reduce checkout time and will eventually build an inter-library campus network. The initial planning for the system, named after MIT's founder William Barton Rogers, began in 1983, and borrowers started making use of the system last month.

Students must show a photo ID and a barcoded library card to check out books under the new system. Cards are available at the libraries.

"We are working towards an on-line catalogue system," said System Librarian Amira L. Aaron. The project will replace catalogue cards with computer terminals containing the pertinent information needed to locate material. MIT currently has 300,000 records on-line, but Aaron hopes to have the majority of the voi-

umes catalogued in the system as soon as possible.

Although the system stores information about each student including name, campus address and telephone number, the MIT Committee on Privacy has restricted the amount of data the system may contain in order to protect students' privacy.

"The committee has restricted us from storing such information as a student's home address, and they have also have prohibited students from gaining access to the system," Aaron said.

The Town of Wellesley has also begun to circulate books under an automated system known as CLSI. Unlike MIT, the Wellesley Free Library (WFL) is one of twenty libraries sharing the same system, the Minuteman Library Network. Each library can determine which towns have a specific book, the number of copies available of the book, and how many copies have been checked out.

"Books will come back faster and will be more available to patrons than they used to be," said Diane Baden, automated services librarian at the WFL.

(Please turn to page 2)

inside

Commencement photo
essay. Pages 6, 7.

Edwin Kuh

Edwin Kuh, professor of economics and finance died of cancer June 9 at age 61. Kuh was best known for his theories of the predictive value of econometric models. He served as director of MIT's Center for Computational Research in Economics and Management Science. He had also been a member of the President's Materials Policy Commission and the Economic Advisory Panel of the US Postal Service.

Kuh was first to find a relationship between the state of the business cycle and the productivity of the economy. He came to MIT in 1955 as an assistant professor and gained tenure in 1962.

Sloan School Dean Abraham J. Siegel called Kuh "one of the outstanding pioneers in econometric studies. . . . He was a most diligent and conscientious colleague and we shall all miss him."

Peter A. Diamond, head of the Department of economics, said, "In all facets of his life, Ed Kuh was a man who held his beliefs strongly and committed himself thoroughly on that basis."

Harvard economist John Kenneth Galbraith credited Kuh with helping establish affirmative action programs, calling him "one of the most innovative economists of his generation."

Kuh is survived by his wife Simoni; five children, Joanna, Elizabeth, Thomas, Sarah and Daniel; a granddaughter, Ariela; and a brother, Peter. A memorial service was held yesterday in the MIT chapel.

President Paul Gray's speech

(Editor's note: The following is the text of the charge to the graduates by President Paul E. Gray '54 at MIT's 120th Commencement Exercises.)

In the competitive sport of diving, the various dives are ranked according to degrees of difficulty. When the performances of different divers are equal, the diver who chooses the dive with the highest degree of difficulty wins. By that measure alone, you here today are winners. You have chosen and successfully negotiated a collegiate education having what may be the nation's highest degree of difficulty. I congratulate you. Your faculty congratulates

you.

Now your families and loved ones may not fully appreciate just how demanding your MIT education has been. But they do know its cost, and I am certain they would accord to that the highest possible degree of difficulty. You and MIT owe them a deep debt of gratitude. And so I would ask the graduates to please stand and face the audience, so that you can join with me and the faculty in applauding the families and friends whose sacrifices and loving support have made this day possible.

* * * *

I should note that this day of

celebration is part of a year-long commemoration of the 125th anniversary of MIT's founding in 1861. Much of our celebration this year has focused on past achievements and tradition — but always with an eye to the future. For better or worse, the Commencement Committee this year jumped right in to this spirit of innovation and tradition. As a result, we are all part of an experiment today — to shorten the commencement exercises by one hour while still giving each graduate his or her diploma individually, in what promises to be an extraordinary display of parallel processing. With all that time

(Please turn to page 5)

Coop will move to Kendall Square

(Continued from page 1) percent more than in the Student Center) on the first and lower levels of a six-level building. Also, there will be better access to loading facilities — a serious problem in the Student Center store, according to Argeros.

Plans for the Student Center

According to Stephen Immerman, Director of West Plaza Operations, a "feasibility analysis of the Coop space" has been conducted.

Immerman said that the question before the study was "Could we, through the introduction of a new set of retail goods and services, develop a cash flow which would allow us to substantially renovate the public areas of the Student Center in a way that would be cost-effective and at the same time meet the needs of the MIT community?" The initial study indicated that this was feasible, Immerman added.

A "client — user" group is being organized to help with the renovation. The group, which

will be "heavily student-oriented," will address esthetic concerns, how well specific goods and services will be received, and how the new food service management company will be integrated into the Student Center.

In addition, Immerman intends to hire marketing-management consultants to "come up with hard data on what the community needs."

Immerman also indicated a desire to "take care of some of the other problems as long as renovations are going to be made." These problems included the poor vertical access of the building, the elevator system in the building, and the loading dock facilities. Renovations will be primarily aimed at the basement, first, and second floors.

The operating expenses for the Student Center come "almost entirely from the tuition dollar, and we want to reduce that load," Immerman said. The money needed for the renovations will be borrowed from a special fund MIT has, he added.

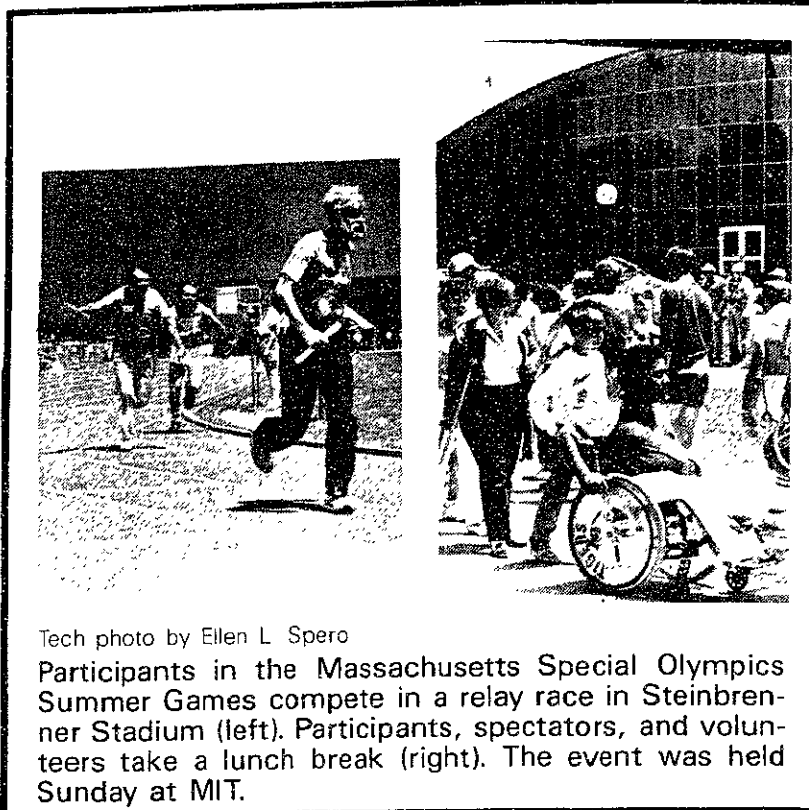
Immerman said that he hopes that "we achieve this renovation at no capital cost to MIT, and at the same time improve services available and thereby reduce the operating cost."

Bowling alley to close

The bowling/games area in the basement of the Student Center will close at the end of this month for a number of reasons, according to Immerman. The primary reason was that the area lost money consistently since it was opened twenty years ago. Reductions in staffing and hours failed to limit this loss — last fiscal year the area lost "on the order of \$30,000," Immerman said.

In addition, the alleys were in bad shape, requiring over \$6000 in repairs. The area is going to be completely renovated when the Coop leaves next year.

Immerman also indicated that the intramural bowling and bowling club leaders were consulted in this decision and had no objections.



Tech photo by Ellen L. Spero

Participants in the Massachusetts Special Olympics Summer Games compete in a relay race in Steinbrenner Stadium (left). Participants, spectators, and volunteers take a lunch break (right). The event was held Sunday at MIT.

Barcode lending system installed in libraries

(Continued from page 1)

WFL went on-line on March 18, 1986. "It's too early for patrons to realize the benefits of this system," Baden said, but soon they will see an improvement in our abilities to hold reserve books and retrieve books through interlibrary loans for them.

Although MIT has a backup system in case the main system crashes, the WFL does not. There is one system being made available which Baden hopes to have in six months. "It is a microcomputer that can record check-outs, check-ins, and renewals. When the system comes back up, you send the information over the phone line," she said.

The planning for Wellesley's system began in the fall of 1982.

"It was not until the technology advanced enough to lower the price and a general acceptance in the library community for automated standards was established that Wellesley would think about such a project seriously," Baden said.

Patrons at the Wellesley Free Library are assured privacy just as patrons are at MIT. "While a patron has a book checked out, if it is not overdue, we cannot look up a patron's record and see what book they have. There are a lot of privacy protections built into the system. Another part of this protection system is that once a book is returned, all record of the patron ever having taken out the material is gone," Baden said.

6.001 during IAP?

A proposal has been made to develop and teach a version of 6.001 during IAP for credit. Many questions must be answered in order to weigh the advantages and disadvantages of such a course. You can attend this forum for faculty and students to help ask and answer these questions.

Tuesday, July 1st, 5:30 — 6:30

Mezzanine Lounge, Student Center

If you cannot attend but would like to know and give input about this proposal, write a letter to or call Bryan Moser, W20-401, x3-2696.

UA Summer Planning

Meetings are being held on Wednesday nights from 6 to 9 in the UA Office, Student Center, rm 401 to plan for next year in student government. Come and help us plan to improve student life. Call ahead and tell us you're coming so that we can order pizza — or just stop by.



Course Evaluation Summer Work

The newly revived Course Evaluation Guide needs student workers this summer. We are looking for people to help out in a variety of jobs: comment reading & summarizing, subject review writing, typing, and advertising sales. No experience required, but good writing skills would be helpful. Pay is available and some work can be done at home.

To help, drop by the UA office (W20-401) during our work sessions on Wednesday from 4:00 to 9:00 or on Saturday from 2:00 to 6:00.

If you have any questions, contact:

Dean Dellinger

John Kuenzig

Nuran Cinlar

messages at

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The **UNDERGRADUATE ASSOCIATION**
student government at MIT fourth floor of the student center, rm 401, x3-2696

news roundup

from the associated press wire

World

South African state of emergency continues

A pro-government South African newspaper is reporting that the current state of emergency in that country may remain in force even after the expected signing of tough new security legislation. The white-controlled country has placed an extensive news blackout upon the country, but Church of England envoy Terry Waite returned from South Africa yesterday with a letter saying some of the people arrested under the government crackdown have started a hunger strike to protest the treatment they have received in jail. (AP)

Britain asks to speak with ANC leader

Oliver Tambo, head of the exiled African National Congress, says he is not sure about how he will respond to Great Britain's offer of negotiations. Until now the Thatcher government has refused to meet with the South African revolutionary group, accusing it of terrorism. (AP)

Nation

Striking AT&T workers turn down settlement

Talks between AT&T and the striking communications workers union continue, but the union turned down the phone company's latest offer Sunday night. A union official refused to go into details about the offer, which was turned down by two of the union's operating divisions. The nation's biggest strike in three years, affecting 155,000 workers, is now into its fourth week. (AP)

O'Neill refuses to allow Reagan to address House

Speaker Thomas "Tip" O'Neill has become the first person to turn down a presidential request to address a house of Congress. President Reagan yesterday asked O'Neill to allow him to address the House of Representatives on the upcoming vote for aid to Nicaraguan rebels. O'Neill replied that an address to the joint houses of Congress would be more appropriate. Presidential addresses to the House of Representatives alone are very rare, explained one administration official.

Gunman on Rodeo Drive

A gunman held five people hostage yesterday inside Van Cleef and Arpels on Rodeo Drive in Beverly Hills. The posh jewelry store was surrounded by police before the man was able to leave. Police have not released any information on the gunman's demands by press time, but reports indicate the man claimed the store sold him fake jewelry. (AP)

Local

Republicans may have no candidate for governor

Democrats are challenging the 2500 signatures filed by Republican gubernatorial candidate Gregory Hyatt. The State Ballot Law Commission is expected to rule on whether Hyatt, who is replacing former candidate Royall Switzler, will be removed from the ballot. If no decision is made by the end of the week, Hyatt will automatically be placed on the ballot. (AP)

Gray joins in statement against South Africa

MIT President Paul E. Gray '54 joined 15 other prominent American leaders in a personal statement urging South Africa to "change its course." The statement, issued June 18, condemned the renewed state of emergency in South Africa and the "assault on academic freedom." The statement urged South Africa to negotiate, rather than resorting to violence.

Burgers

McNapped!

Police are investigating the abduction of a seven-foot high Ronald McDonald statue from a Dover Township, New Jersey, McDonald's restaurant. They say the McNappers have sent a ransom note demanding about 8900 Chicken McNuggets — plus the sauce. (AP)

Burger resigns

US Supreme Court Chief Justice Warren E. Burger resigned last week, in favor of his work for the 200th anniversary celebration of the US Constitution in 1987. Burger, whose court was probably most famous for the 1974 Roe vs. Wade decision legalizing abortion, will step down on July 10, when the current court session ends. President Reagan has announced his selection of Associate Justice William H. Rehnquist to the court's top position. US Court of Appeals Judge Antonin Scalia was appointed to the open Supreme Court position. Both appointments are subject to approval by the Senate Judiciary Committee. (The Boston Globe)

Sports

World Cup

World Cup soccer will continue on Wednesday as France meets West Germany and Belgium plays Argentina. The winners will go on to the championship game next Sunday. (The Boston Globe)

Boris Becker

Defending Wimbledon champion Boris Becker easily defeated Eduardo Bengoechea of Argentina in straight sets yesterday. The only Wimbledon upset came at the hands of unseeded Eric Jelen, who defeated 11th seed Kevin Curren in five sets. Curren lost to Becker in last year's final match. Women's play starts today. (AP)

Weather

We will have some. . .

The Tech's usual weathermen were unavailable for this issue, so here goes. . .

Tuesday: Partially cloudy at times, breezy and warm, with highs in the upper 80's. Possible afternoon thunderstorms.

Tuesday night: Cooler, lows about 58.

Wednesday: Partially sunny, with highs in the 70's. Stray showers are possible.

Compiled by Michael J. Garrison

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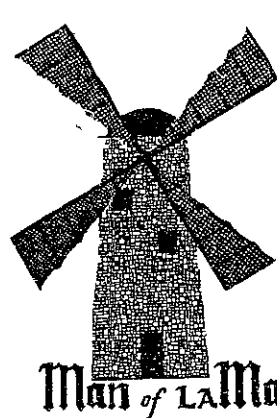
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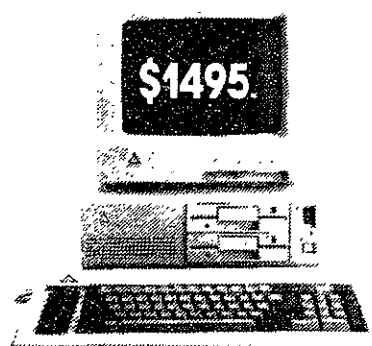
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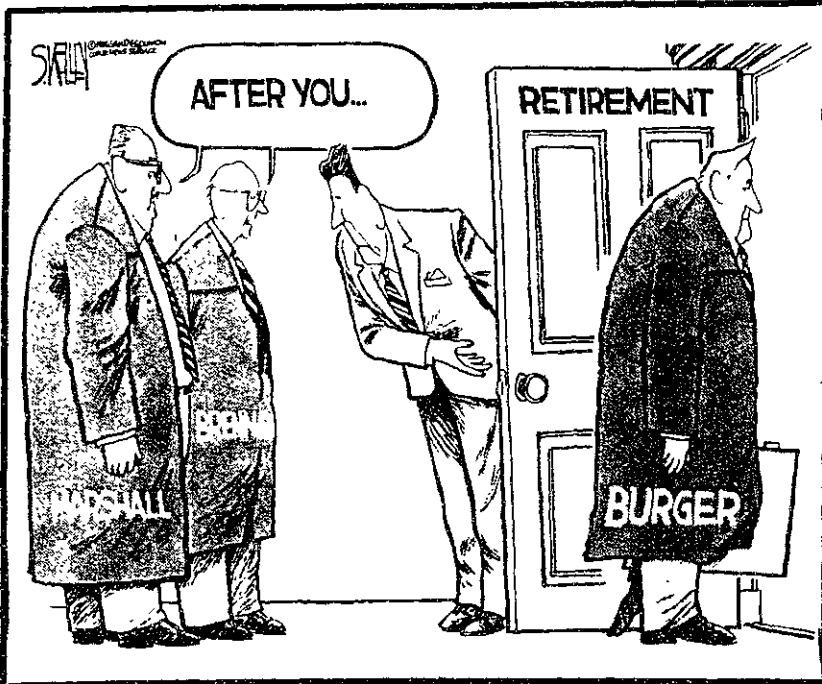
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The Tech

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Column/Andrew L. Fish

Commencement washed out

Commencement was a wash-out, both figuratively and literally. Pouring rains were likely to be the only memory graduates take away the ceremony, for the commencement address was far from memorable.

There is no excuse for holding the ceremony outdoors this year. Weather forecasts from the previous evening called for some precipitation that morning. MIT had to weigh the comfort of the graduates and their families against the logistical problem of moving inside. They were selfish in their decision.

This selfishness left graduates with stained clothing and stuffed noses. Families either were soaked or, if they were lucky, got to crowd around monitors to watch the "festivities."

Is this any way to treat people who have put a significant amount of time, effort, and money into their education? Is this any way to treat families who have traveled from around the world to see their children and share in their educational experience?

The answer is clearly no.

In the future I would hope that MIT would remember the charge to be "better safe than sorry." Moving commencement inside would have provided a much more enjoyable experience for all attending.

Inside or out, the audience still had to be content with the address of William R. Hewlett SM '36. This was unfortunate.

Hewlett's own title, "Random Thoughts on Creativity," was certainly appropriate. I had trouble following the speech, as it wandered aimlessly around, never reaching a firm conclusion.

The address also seemed to be a plug for Hewlett-Packard. Hewlett spoke almost exclusively about the various accomplishments of his engineers, praising their creativity. I half-expected him to tell of how his engineers came up with ideas in the shower and the desert. Only the background music was missing, otherwise, the commercial was complete.

The biggest complaint I have

against the speech, though, was its stereotyping of the MIT community. Hewlett treated the entire class as if they were engineers going into industry. The speech was not a broad message to the entire graduating class, rather a lesson on how to be a better engineer.

The speech probably meant little to the many graduates who are going on in the pure sciences, social sciences, humanities, and other professions not directly related to engineering — one biology major who will be going to medical school next year asked me, "What does R&D stand for anyway?"

I hope that this year's commencement was an anomaly. The next time rain is forecasted for commencement day, I assume the exercises will be moved inside.

I also urge the commencement committee to be more creative in their speaker selection. Graduates should be able to hear a speech with vision, and not another lecture, at the end of their long career.

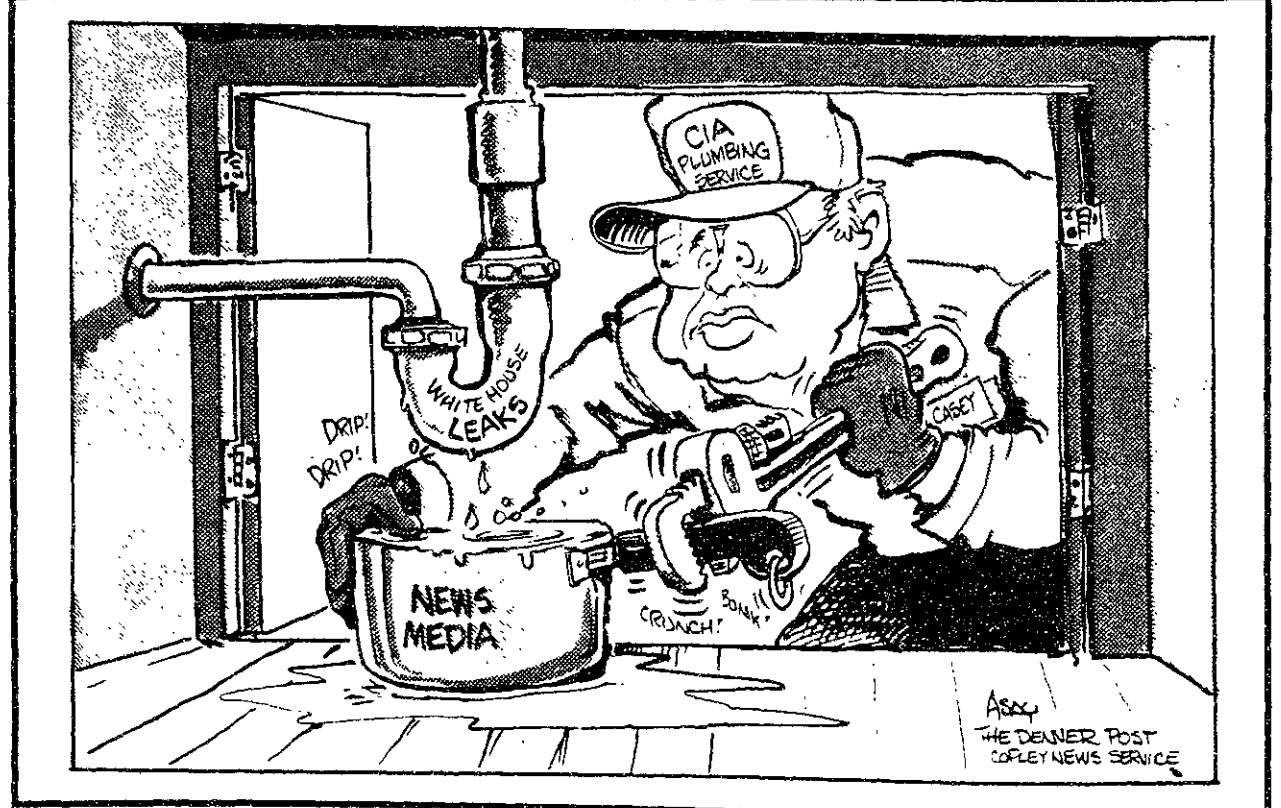
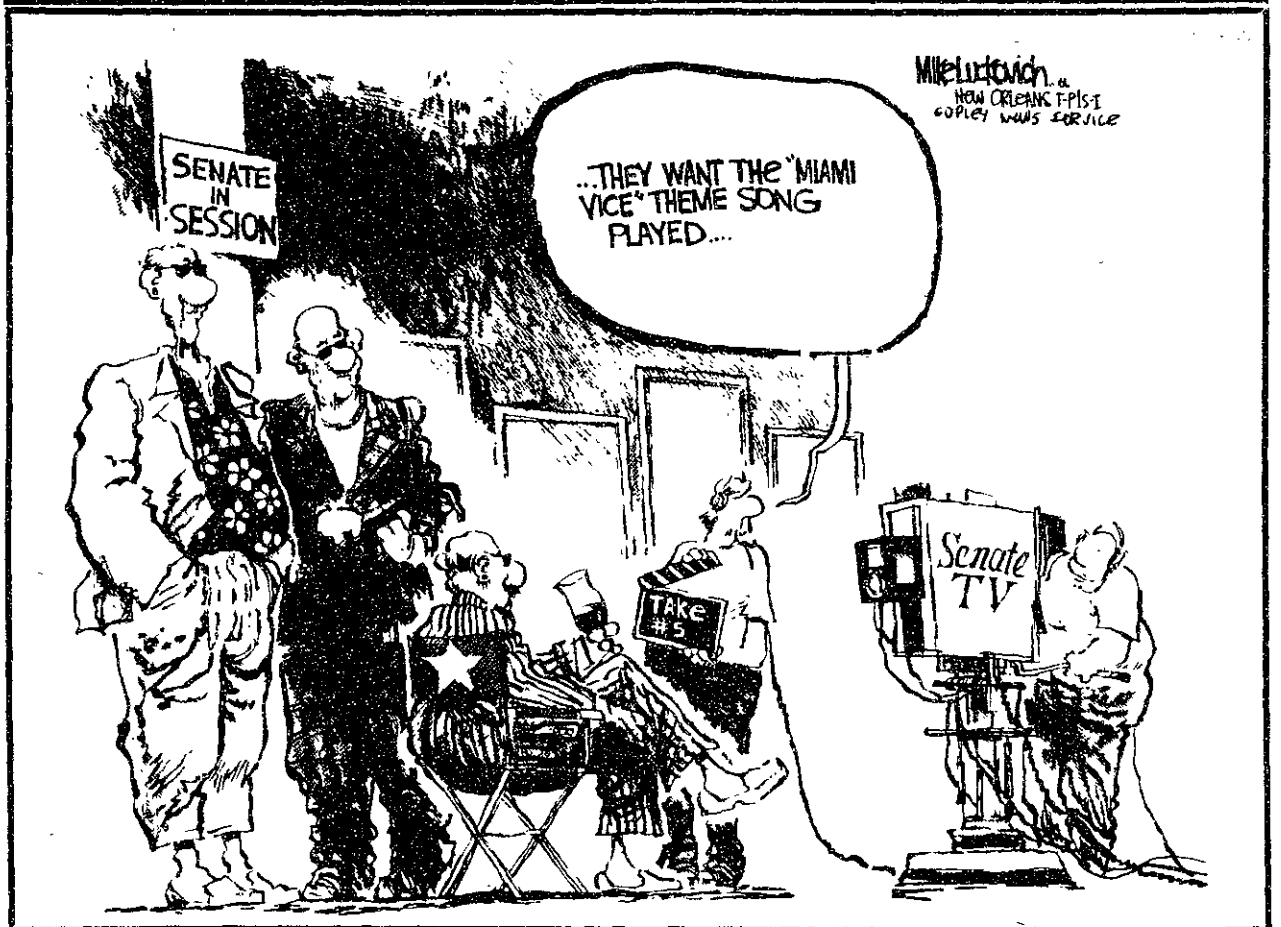
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Text of William Hewlett's commencement address

(Editor's note: The following is the text of the commencement speech delivered by William R. Hewlett SM '36 to MIT's 120th graduating class. The speech is entitled "Random Thoughts on Creativity.")

It's a very great pleasure to be with you this morning, particularly because it's been exactly 50 years since I walked across this stage and was given a piece of paper that said I was a master of science. In those 50 years, I have been intimately associated with the creative process that is so important to our modern, high-technology culture. I felt it might be appropriate, therefore, to share with you some random thoughts on creativity and its importance in today's society.

When I was preparing this address, I happened to ask Chuck House, who heads our engineering productivity program, what he thought about creativity. With a twinkle in his eye, Chuck said, "Creativity is what screws up my engineering program." Unfortunately, there is much truth in that statement.

Thomas Edison is alleged to have remarked about his laboratory, "There ain't no rules around here. We're trying to accomplish something."

I cite these two comments because they say a great deal about the creative process. It works best when it is not too structured, but it must, in the long run, be tamed, harnessed and hitched to the wagon of man's needs.

But first let me set a background for this country's renewed interest in innovation and creativity. By 1983, it was increasingly evident that we were losing the competitive edge that for so long had characterized the American Economy. To better understand this problem, President Reagan created a high level commission of distinguished business leaders and educators to "...review means of increasing the long-term competitiveness of United States industry at home and abroad, with particular emphasis on high technology."

After an in-depth study, the commission concluded that we are not meeting the competitive challenge well enough. It stated, "Our ability to compete in world markets is eroding. Growth in US productivity lags far behind that of our foreign competitors. Real hourly compensation of our work force is no longer improving. US leadership in world trade is declining. Finally, pre-tax rates of return on assets invested in manufacturing discourage investments in this vital core of our economy."

One of the commission's primary recommendations was to "Create, apply and protect technology. Innovation spurs new industries and revives mature ones. Technological advances lead to improved productivity, an essential ingredient for our standard of living."

In essence, this recommendation was two-fold — to create technology and improve productivity.

How do I define creativity? Nobel Prize winner Albert Szent-Gyorgyi provided a good working definition when he said, "Discovery consists of looking at the same thing as everyone else and thinking something different." I think that is a good enough summary to cover much of what I want to comment on.

The trouble is that creativity is really a poly-faceted discipline.

Trying to describe it in detail reminds me of the story of the three blind men who attempted to describe an elephant solely by their sense of feel. One explored the trunk. One discovered the tusks. The third explored the animal's enormous feet. But none really had a good picture of what the whole animal looked like. I would like to describe my "elephant" — creativity — as I have had a chance to observe it over these years.

First, let me make one general comment about creative people. Education is not a *sine qua non* for being creative.

A case in point is that of a most successful engineer who worked for Hewlett-Packard company for many years. Despite the fact that he had completed only one year of college, he was one of the most creative people I've known. You could present Larry with the most difficult problems and he'd come up with ingenious solutions. He had the ability to isolate the essence of the problem and attack it with vigor. It was such a pleasure to talk with him about his work — he just bubbled over with enthusiasm. Many of his ideas are still incorporated in a number of important products we manufacture.

It is very difficult to spot a creative individual just by looking at a resume. Psychologists can't even agree on how to measure this characteristic, let alone predict who will display it. Establishing an environment that fosters creativity and observing who flourishes is probably the best way of finding this elusive characteristic.

I'd like to distinguish between two kinds of creativity. One is spontaneous, in which an individual sees a complete and elegant solution to an interesting problem.

The other I call "creativity on demand," in which specific objectives are established and must be met, but with a great deal of flexibility in how the results are to be achieved.

Both types of successful innovators share many common traits. Creative people have an abiding curiosity and an insatiable

desire to learn how and why things work. They take nothing for granted. They are interested in things around them and tend to stow away bits and pieces of information in their minds for future use. And, they have a great ability to mobilize their thinking and experiences for use in solving a new problem.

Problems, however, are rarely solved on the spur of the moment. They must be organized and dissected, then key issues isolated and defined. A period of gestation then sets in, during which these issues are mulled over. You put them in your mind and consciously or unconsciously work at them at odd hours of the day or night — even at work. It is somewhat analogous to trying to place a name on the face of someone you've met before. Often the solution to a problem comes to you in much the same way you eventually recall the name.

There is a sub-class of creative individuals that not only has the ability to see things around them, but also to note that which differs from the norm.

A good example is Sir Arthur Fleming, who discovered penicillin. His story is familiar to many of you.

He first noted that when a mold had landed on a culture dish with colonies of Staphylococci, the colonies adjacent to the mold were killed. Many other scientists may have had this same problem but it was simply passed by. In fact, Fleming himself remembered such a previous occurrence, but this time became more interested and concluded that the mold must have secreted something that was toxic to the bacteria and, if so, that "something" might be beneficial in the treatment of human infection. Thus, the drug penicillin was born.

I have observed the same creative phenomenon and the same questioning mind a number of times. A few years ago, a young British engineer who was working for us was investigating the characteristics of a new semiconductor device. It performed basically as expected in all the tests, but Frank noted that there seemed to be an excess of "noise" in his measurements.

He completed his project, but was still curious. He decided to look into the source of this excess noise. With the aid of a newly developed measurement technique, he discovered that the "noise" was in fact a very high order harmonic train — in a sense, an electrical analog of a water hammer. This proved to be a very important discovery for certain nanosecond measurements. In fact, it made practical the very technology that was used to identify it.

Intellectual curiosity is a great source of creativity. An example of this is demonstrated by Nobel Prize winner Luis Alvarez, a long-time member of the Hewlett-Packard Board of Directors. While visiting Egypt, Luis became interested in the fact that no major burial chamber had been found in the pyramid of Khephren and began to muse about how one might determine if such a chamber did exist. Luis was familiar with cosmic rays and knew they might be suitable for X-raying the pyramid.

Careful investigation led him to conclude that if he had been asked to design a proper radiation source for this purpose, it would have been the Mu Meson, an important component of cosmic rays emitted by the sun. It exactly fitted the need.

An added bonus was the fact that under the pyramid was a chamber that extended the full length of the base, in which he could locate his "film," that is, a series of detectors that could measure the strength of the Mu Meson, as well as their direction of arrival.

With these thoughts in mind, he went to the chancellor of U.C. Berkeley who, on the basis of Luis's analyses, provided a small amount of money to carry out the experiment. I mention this because it is a good example of how a little effort can encourage a creative person. This study was not a normal function of a physics department, nor was financing it that easy. It was just a fascinating subject that the Chancellor thought might add to man's knowledge of the past.

Luis also received the enthusiastic support of the Egyptian government and the experiment, in due course, was carried out. No chamber was discovered, yet the experiment was successful because Luis was able to prove that there was no such chamber.

Another example is that of an HP scientist who was a specialist in designing quartz crystals used to generate extremely accurate time standards. The accuracy of such reference crystals is very sensitive to changes in temperature and mechanical force. Much of the existing technologies used to stabilize these crystals has to do with minimizing the effects of these two variables.

Don took the opposite view. He thought, why not use the intrinsic sensitivity to temperature as a way to provide a digital measure of temperature? Normally the frequency change was not a linear function of temperature, but Don devised a technique to linearize this relationship to about a tenth of a degree over a range from -40 to 200 degrees Celsius, and with a resolution of about ten thousandths of a degree.

A major advantage of this technique was that the sensing element could be located as far as 10,000 feet from this measuring instrument, with no loss in accuracy.

cy.

In similar fashion, he produced a quartz transducer that operated at pressures up to ten thousand pounds per square inch with an accuracy of about a twentieth of a PSI and a resolution of a thousandth of a PSI.

This device has been used extensively in oceanographic studies and for measuring differential pressures in oil fields to determine the best pumping strategy.

Basically, I've been talking about creativity applied to research-type situations. Let me now turn to the development phase, the "create on demand" type of creativity. Here, creativity's role is slightly different, as mentioned earlier. There is now a clearly defined objective and the job is to find a way to meet that goal.

This is the type of creativity about which much has been written, primarily because there are techniques to stimulate and enhance it. One book on the subject I greatly enjoyed was "Conceptual Blockbusting" by James L. Adams. His title suggests that we all suffer from mental blocks that stand in the way of solving the problem at hand. These might be emotional blocks such as fear of failure, frustration or too much or too little motivation. They may be perceptual blocks such as using incorrect information or the wrong method, or not using all your senses. Quite often, they are culture blocks which sometimes can be the hardest to overcome.

I think this is an area in which younger people have a tremendous advantage, since, as you well know, they have an endearing habit of always questioning past wisdom and authority.

They say to themselves that there must be a better way. Ninety-nine times out of a hundred, they discover that the existing, traditional way is the best. But it is that one percent that counts. That is how progress is made.

A wonderful example of the desire to break out of the rigid tradition of the past would be that of the French impressionist painters during the latter part of the last century. The most important works of these painters had been excluded from the salons, held in Paris nearly every year under the auspices of Les Academie Des Beaux-Arts. The salon juries refused their works because they did not follow the tradition of the Academy schools.

Finally, in 1874, the impressionists, many of them in their twenties and thirties, banded together to share the costs of exhibiting their own controversial works. A series of eight of these impressionist exhibits were held, and by 1886, the impressionist school was well established and recognized.

But to return now to the mundane world of R&D...

Projects do not always progress at a steady, uniform rate. Sometimes progress is stymied by a very difficult problem. The problem might be overcome by a clear, technical breakthrough, but more

Text of President Gray's address

(Continued from page 5)
saved, I was tempted to extend my remarks, but on this day I — like you — take my marching orders from the Commencement Committee. And so I will be brief and, if I may, a bit more serious in these final remarks to you.

While your horizons may seem limitless at the moment, the world you enter is, in many ways, much smaller than the world of your ancestors. In recent decades, time and space have become compressed — the result, in large measure, of scientific advances and technological innovation. I think particularly of the influence of electronics and physics on international security and communication. Today we are able to speak, hear, see, and reach across vast distances, even into space. We push time around in our travels. And the consequences of each act reach further and faster than ever before.

Contrast this with the state of the world at the time of this country's founding — just two centuries ago. In the spring of 1775, there was a battle involving fewer than two hundred men on Lexington Common in Massachusetts. Shortly after that, there was another battle in nearby Concord. Out of those battles began a war for independence that changed forever the nature of this continent, changed forever the nature of the relationship between the individual and the state, and changed forever the relationships among nations.

But it was more than two months before the House of Commons in London learned that anything had happened.

Now consider our circumstances today. In the spring of 1986, something occurs in Chernobyl, in Soweto, or in Libya and, if we don't see it happening live on television, we surely see it replayed and analyzed on that evening's news. This instantaneous quality of communication — about events, about ideas — is a product of technologically-driven change. At the same time, it is an engine of change — as people and governments act and react on a time scale that would have been impossible two hundred, even fifty years ago.

I was struck by a recent essay in *The New Yorker*. The author, commenting on the waves of fear generated by political clashes halfway around the globe, said:

often than not, it is bypassed with a compromise solution I like to call a "hot patch." If there are too many of these "hot patches," you'll probably wind up with a very cumbersome solution to the problem.

My company often employs retired engineers or scientists on a part-time consulting basis. One such was Harald Friis of Bell Labs. I'm sure some of the electrical engineers in this audience are familiar with his book on antenna design.

Harald and his wife would come to California during the winter months and spend time in Palo Alto. Harald enjoyed visiting with our engineers in the laboratories. Frankly, he didn't know beans about modern transistor circuitry, but he knew how to think about the development process and he loved to work with engineers who felt that they had reached a dead end on a project.

He could get them to step back and view their work as a whole. He would ask, "What are you really trying to do? Are you on the right track, but feel you have too many hot patches?" or, "are you really on the wrong track and need to make a fresh start?" This can be the toughest judgement call a development engineer may have to make. Harald was just wonderful in helping our engineers reach this critical decision. He had a way of making a person see things in perspective and the engineers just loved him.

We always try to encourage this kind of interaction in the labs between generations because experienced engineers can be very helpful in the developmental process. In this exchange of ideas, I have often seen younger researchers learn new ways to harness and use their creative instincts.

In practice, spontaneous creativity and the normal development process are often intertwined and may, in fact, seem to conflict. Witness Chuck House's comments, referred to earlier.

There is a time and place for creativity, but in the developmental process, timing sometimes outweighs technical innovations. It all comes back to the question of how often you can change course and still make forward progress. It is simply a matter of judgement.

I remember when we were trying to bring out our first scientific desktop calculator. Integrated circuits were just being introduced and we had to decide whether to delay the entry of the product so that we might use IC's or go ahead and introduce it with a primitive, but proven, read-only-memory device. We chose the latter. Timing was the dominant factor and not the "niceness" of the solution.

I've talked enough about the creative process in the R&D phase. Now, let's look at how creativity can help increase productivity and improve quality. This challenge clearly defined by the findings of the President's commission that I mentioned earlier. Modern technology must be used to improve productivity. We need the same creative effort in the production

process that we now lavish on the development phase. We must start by having productivity and quality as objective in the research and development process. Productivity must be designed into products — not added at a later date. Quality cannot be "inspected in."

There is already a great deal of technology readily available that can be used to improve quality and manufacturability of a product. In many cases, however, US industries are not taking advantage of this knowledge, although much of it originated in the US we need new ideas and new leadership in this quest. Here, the universities have a very real responsibility. I don't mean that they should go back to teaching forging, foundry, machine shop and drafting, subjects that I had to take as an engineering student.

But our universities do need to provide a theoretical base for quality and efficiency in the manufacturing process. I was delighted to learn that this trend is already under way at this institution. But, after all, what else would you expect?

I hope I've made it clear that creativity will play a vital and critical role in our increasingly high tech society. Our company's president, John Young, puts it this way: "Creativity is the only American competitive advantage left." Industry is going to have to make some drastic changes in how it views the importance of the research and development program and the necessity of increasing productivity. Changes are never easy to make. There is comfort and safety in tradition, but change must come, no matter how painful or expensive it may be.

From your standpoint, this situation is anything but bleak. Personal advancement in a static company or a static industry can be slow and difficult. Change, however, opens cracks in the most monolithic structures. It presents a period of great opportunity, for this is the time when the best and the most creative minds will be sought out and placed in positions of key responsibility.

In the high-tech field, top leadership is always looking for good minds, high energy levels and a willingness to accept responsibility. In fact, our company is so dependent on creativity that we are still emphasizing the recruitment of engineering graduates, even though a hiring freeze is in effect for the rest of the company.

It may well turn out that the present period will be looked back on as one of unprecedented opportunity for the scientifically minded. I hope so. I wish you success, happiness and great bursts of creativity in all of your endeavors.

"We know that a universal geography, discovered by modern physics, cancels out the human, earthly geography that has always given us our feeling of safety. In the scale of the new geography, in which distance is measured in light-years, and explosive power is measured in millions of tons of TNT, blue oceans lose their immensity, and the earth itself shrinks to the size of a pea. In the scale of that geography, which is the essential geography of our time, the boat that burns in the water... is no farther away from us than the television screen in our living room which shows us the scene."

This compression of time and space will require of you — more than any previous generation — an ability to take the long view in your personal and professional decisions: a perspective which embraces contrasting values and cultures, which unites an understanding of the contemporary scene with a sense of history, and which keeps faith with human potential. When space and time were virtually unlimited, there was, on the one hand, more time for thoughtful consideration of alternative courses of action, and on the other, less urgency for people to evaluate their acts in terms of distant countries or later generations. Now this perspective — this long view — must be constantly before us, must be part of us, for we know that what we do today will affect not only our contemporaries near and far, but tomorrow's children as well.

The right decisions will not always be obvious, will not always be easy. But the choices you make in your life will be sounder if you can bring them the sense that knowing *why* is as important as knowing *how*.

I hope that your years at MIT have given you some of this wisdom. I do not pretend that an MIT education — any college education — can give you more than you bring to it yourself. You are a great company of ambitious, intellectually curious, witty, even charming, high achievers — and you learn as much from each other as you do from your faculty. If we have been able to help you continue to learn and build on your God-given talents, and to expand the universe of your intellect and feelings, then we have done our job.

Perhaps the best way for me to explain

my hopes for you is to recall one of our graduates who was a shining example of the extraordinary quality we have come to expect of those who have been part of MIT. I speak of Ronald E. McNair — one of the Challenger astronauts, who received his doctorate in physics from MIT just nine years ago. Ron's life was one of stellar achievement, bright promise, and clear vision. Speaking of his view of the earth from space — and he, if anyone, had a long view — he said:

"Truly there is no more beautiful sight than to see the earth from space beyond. This planet is an exquisite oasis. Warmth emanates from the earth when you look at her from space... My wish is that we would allow this planet to be the beautiful oasis that she is, and allow ourselves to live more in the peace that she generates."

Ron gave much of himself to MIT and to the people of MIT, and he was a symbol to a whole generation of young people around the nation of the best qualities that I can hope for you. In February, the MIT family came together to remember and to honor him. I am pleased today to report another form of recognition which we are privileged to give. This morning, the governing board of the Institute voted to name the building that houses MIT's Center for Space Research after Ronald E. McNair.

The faculty, students, and staff in this Center are dedicated to exploring space and understanding the cosmos, and nothing could be more fitting than to have Ron's name — and his spirit — associated with that mission and this campus. The McNair Building will stand as a permanent reminder to future generations at MIT of the grace and significance of extraordinary achievement tempered by an uncommon wisdom and an abiding love of humankind.

I could wish no better model for you. As you undertake this next stage in your lives, I wish for you a life that is rich in opportunities to stretch your talents, your interests, your imagination, and your vision of this small planet as a beautiful oasis... generating peace.

And as you depart from this special place, I wish you good luck and God-speed.

commencement

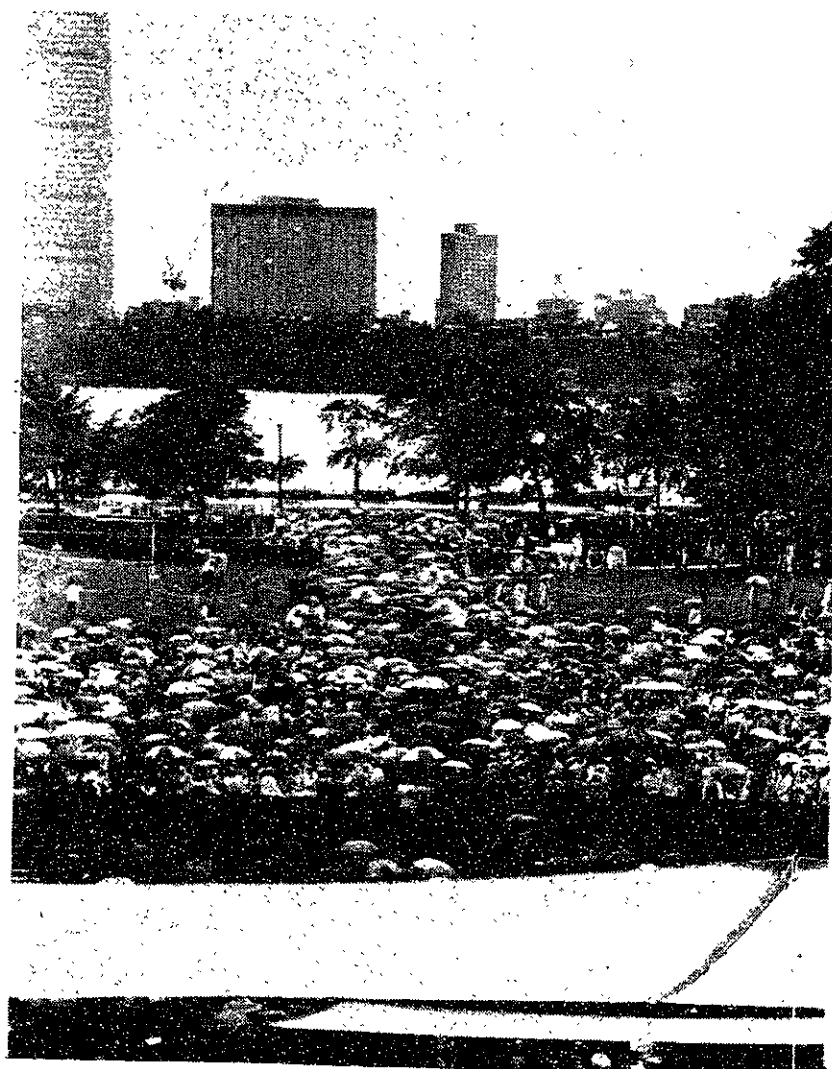
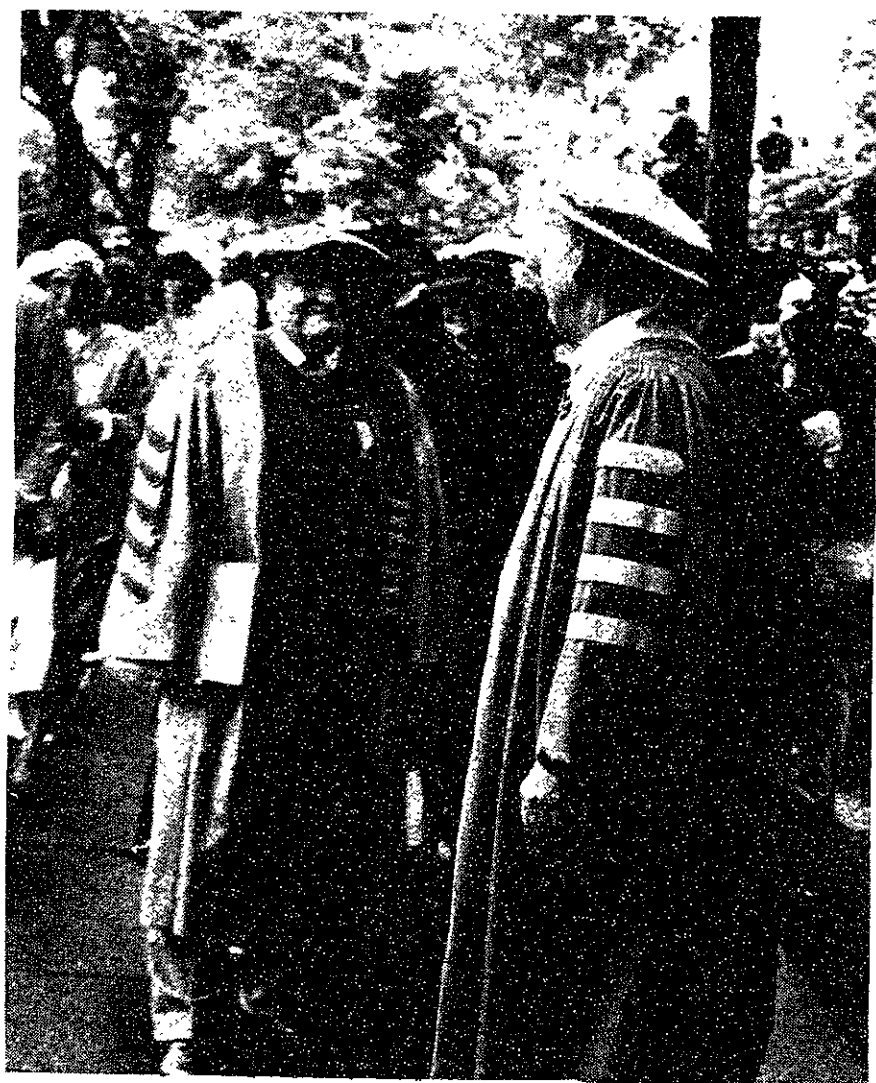
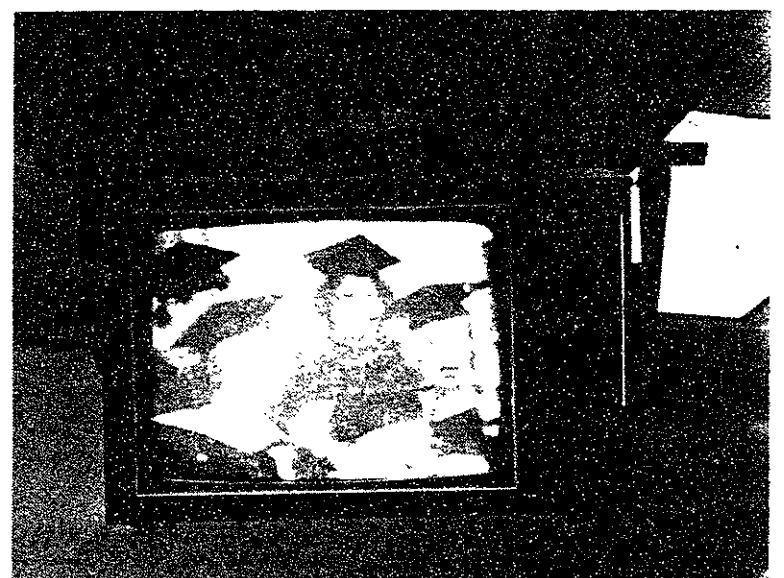
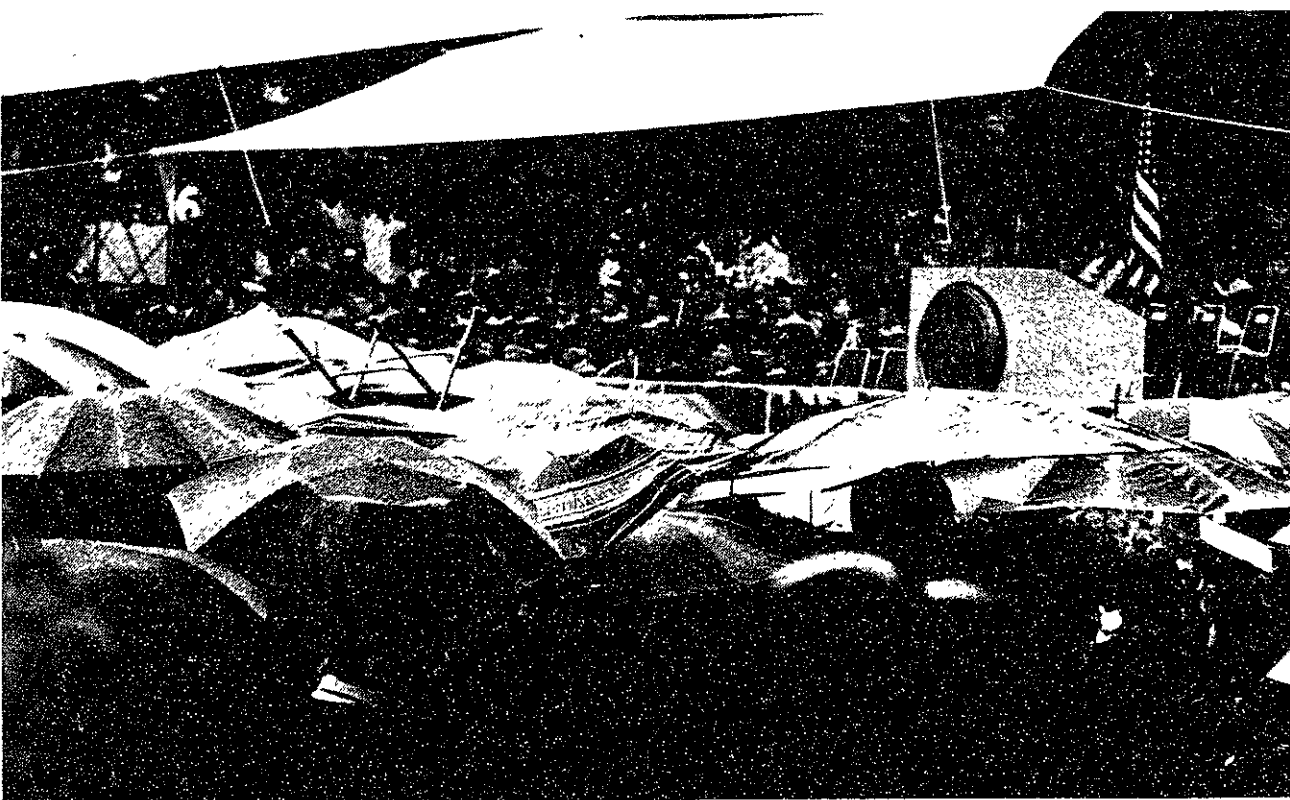
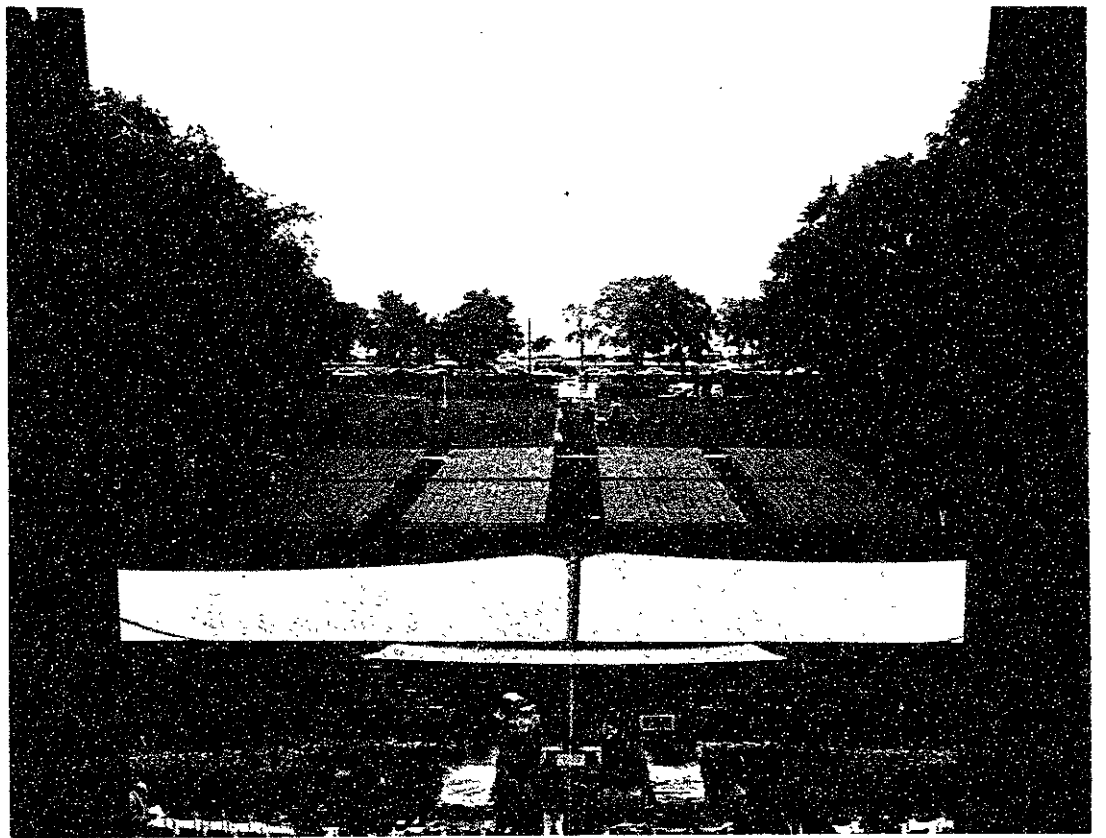
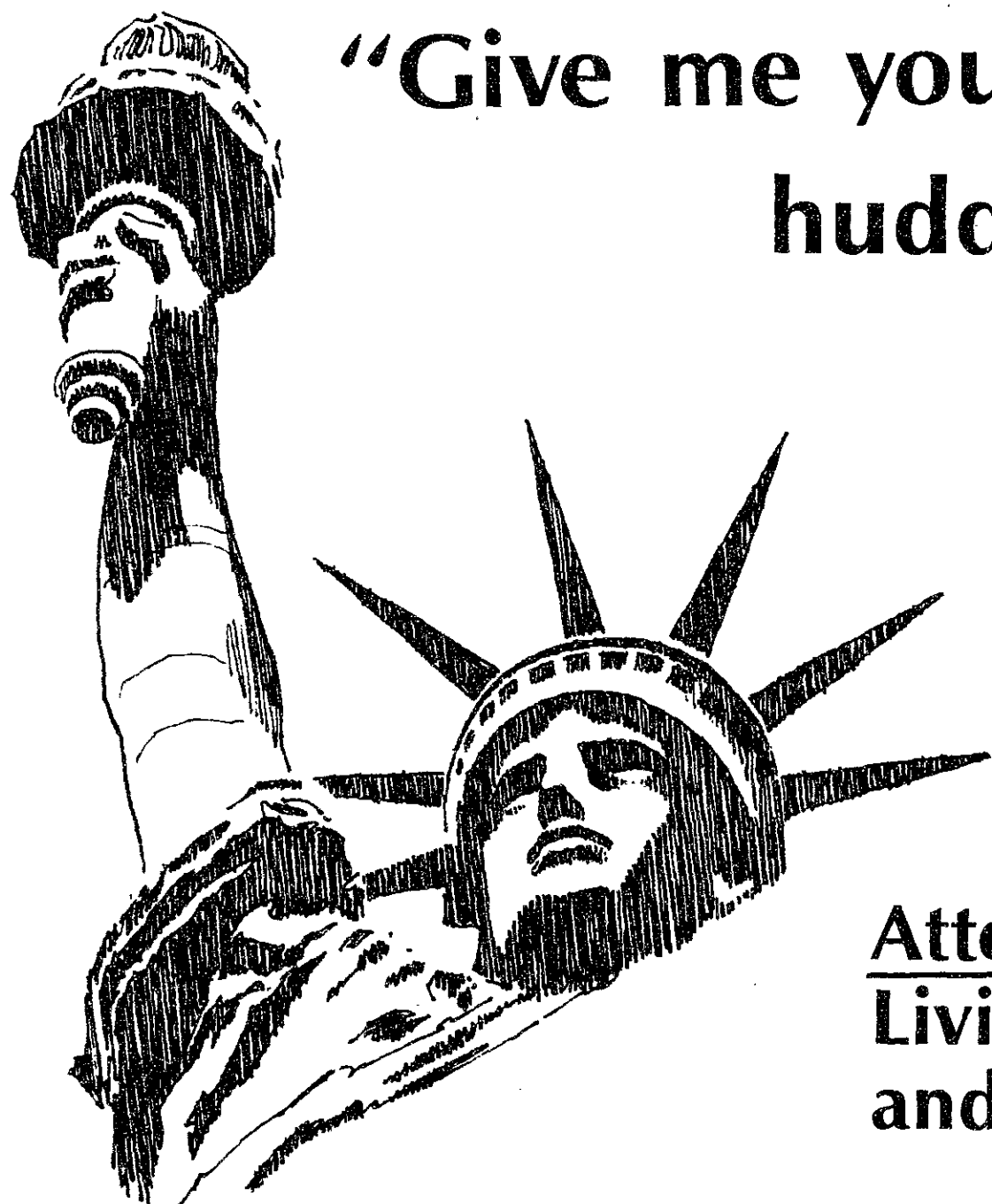


photo essay



Photos by: Steven Wheatman
and Ronald E. Becker



**"Give me your . . .
huddled masses . . ."**

**Attention:
Living Groups
and Student Activities**

TheTech

would like to take this opportunity to remind all living groups and student activities that MIT will be receiving some "immigrants" next fall. They will

come because of a dream — a promise of a better future. All they will bring with them is a satchel* with a week's supply of clothing and a copy of *The Tech*.

We are pleased to announce a special R/O Week advertising rate of \$2.90 per column-inch for MIT-recognized living groups, student activities, and athletic groups. This special rate represents a substantial savings over the usual rate for MIT student activities and is less than half the non-MIT rate. There is no better way to attract these new students to your activities than through *The Tech*, especially at a time when they're still reading everything they can get their hands on.

We can typeset your advertisement for an additional 20 percent, and our staff can help you design your ad for another small hourly fee. Color is also available for the July 15 and August 29 issues. Please contact our office if you have any questions, ask for Shari or Ronald. If no one is in, leave a message and we will get back to you.

* probably a graduation present from their grandparents.

**This rate is available only on the dates listed below,
and only to MIT-recognized activities, living groups,
and teams.**

Tuesday, July 15 Issue mailed to freshmen

R/O Week Publication Schedule:

Friday, August 29 Freshman Picnic

Tuesday, September 2 First housing assignments

Graduate student orientation begins

Friday, September 5 Final limbo assignments