

The MIT Faculty Newsletter

Vol. III No. 2

November, 1990

Nineties Hold Change and Opportunity Social/Political Realities Must Be Addressed

Charles M. Vest

The first few days of my tenure as MIT's president could not have been more pleasant. I also believe them to have been rather symbolic of the state of the institution. On the first day I was initiated into the world of MIT hacks, thanks to a group of MIT students who made my office disappear shortly before I reported for duty. On the third day great distinction was brought to the Institute by the awarding of the Nobel prize to our colleagues in Physics, Professors Friedman and Kendall. Later that same day the faculty confronted the issue of discrimination against homosexuals in the ROTC program with a unified spirit and a sense of informed responsibility.

These three events remind us all that MIT is blessed in abundance with the ingredients necessary for continued excellence as a university: bright and creative students; a faculty and environment that encourages - indeed demands - intellectual excellence of the highest order; and a community that can face difficult problems thoughtfully, responsibly, and forthrightly. We must foster all three of these essential elements if we are to maintain and enhance MIT's excellence in the coming decade, which will be marked, above all else, by change.

The decade ahead will see continued, rapid changes on the world stage, within the United States, and within the academic community - all of which will bear on MIT.

In the world political order, people and nations will be interconnected as never before - connected economically,

physically, intellectually, and socially. New infrastructures for communication, collaboration, and production will emerge.

Within the United States, the nineties will be a time of increasing social change. Our institutions will have to respond to the changing demographic profile of our populace, work force, and student bodies. As a nation we will have to find ways to stop the growing bifurcation of our society along racial and economic lines.

The decade ahead will be a time of great intellectual change and opportunity as we seek new ways of organizing knowledge and as we build new disciplinary and interdisciplinary structures to deal with increasingly complex issues. At minimum this will require new groupings of disciplinary

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Reflections

**The Francis Bitter National
Magnet Laboratory
Benjamin Lax**

The concept of a modern high field magnet laboratory originated at Lincoln Laboratory circa 1956. We were engaged in a series of solid state experiments in cyclotron resonance in semiconductors and magnetic resonance using pulsed magnetic fields. It became apparent that a wide variety of high field experiments, including plasma physics, would be better exploited using Bitter magnets. In 1958, shortly after Sputnik, three of us (Donald Stevenson, Henry Kolm, and myself) wrote a proposal outlining our plans and aspirations.

That summer, Carl Overhage of Lincoln Laboratory, Francis Bitter, John

**"The Francis Bitter National
Magnet Laboratory: Past, Present,
and Future" - See Page 11**

Slater, and Gordon Brown from the MIT campus, and Harvey Brooks of Harvard, joined me in Washington to present our proposal to General Holtzman at Andrews Air Force Base. I outlined the broad scope of scientific experiments and possibilities and Francis Bitter presented the technological

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Editorial**MIT and Contemporary Crises**

We are pleased to lead off this issue with comments from our new president, Chuck Vest. A thread common to his letter and this issue is the Institute's relationships to its changing external environment - international, national, state, and local. The articles and letters on the magnet lab, the gulf crisis, family and work, and the Albany Street Shelter all reflect this theme.

The Danger of War in the Middle East

The national environment is currently dominated by the tightening federal budget and the sharply increased danger of war in the Middle East. The two are intimately related; the ability to free-up funds for new investment in productivity enhancement, education, communications, transportation, health care, housing, and supporting R&D depend on the reduction of the military budget.

This budget has reached \$300 billion, over 50% of the total income tax dollars collected - more than \$4,000 per average Massachusetts household. Now, just as the crumbling of the Berlin Wall creates the conditions for the transfer of funds from unproductive military spending into productive civilian programs, the Bush administration has replaced the Cold War with a threatened hot war. This has pushed the S&L scandal, the education crises, and the falling standard of living off the front page. War in the Middle East will limit every other option for national investment in the years come.

At this time in the nation's history there is ambiguity about what ought to be our role in the Middle East. There is even greater ambiguity with respect to overall national priorities. The President's inability to articulate a clear

congressional delegation in order to impact the national debate. Let us not be silent as young men and women are sent off possibly to die in distant deserts while the economy is undermined for those that remain at home.

As scholars and citizens we should ensure that our institution is one in which policy options can be critically and publicly examined. We need to establish as quickly as possible a faculty forum for evaluating the Iraq situation, perhaps during IAP.

rationale for military adventurism in the Middle East is matched by the absence of clearly stated domestic priorities. Direct military intervention in the Gulf will cause enormous human damage in the already frail ecosystem there, while sharply setting back our real potential in harnessing education, science, engineering, and medicine to human needs.

As scholars and citizens we should ensure that our institution is one in which policy options can be critically and publicly examined. We need to establish as quickly as possible a faculty forum for evaluating the Iraq situation, perhaps during IAP. This issue of the *Newsletter* contains an initial contribution. Colleagues are invited to express their views in subsequent issues. We need also to communicate with our

The State of Massachusetts

At the state level the decline of the Massachusetts economy and the paralysis of political leadership does not bode well for us. Downsizing state government will bring with it a decline in the quality of services offered to us as residents; reduced service on the T; erosion of the quality of public education; increased difficulty finding adequate and affordable daycare; the closing of MDC pools and parks. Certainly we will need to find more effective means of relating to these problems and contributing to their solution, rather than ignoring them by claiming that our national and international missions preclude a local focus. MIT needs to be more actively and openly involved in the discussion and setting of state policy. At a minimum we need an office at

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MIT and Contemporary Crises

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the Institute that relates to state government, state agencies, and state initiatives, and can serve as a connection between interested faculty and state officials.

The Cambridge Community

The need for increased engagement is even sharper in considering our host community, Cambridge. We sit side by side with public housing projects and homeless shelters. Our graduate students, often tripled- or quadrupled-up in overpriced apartments, experience directly the affordable housing shortage. Our junior faculty and oftentimes senior faculty have trouble finding affordable housing. If we do not make some contributions toward helping the local community, we are not going to be able to ask the local community for help when we need it.

The establishment of the Public Service Office was one small step in this direction. A second small step would be to open lines of communication through the establishment of a community

lecture series in which MIT would share some of its intellectual resources with the surrounding community, and thus open a channel to heed more clearly some of its needs. Thirdly, the Institute should respond to the call from our students and extend the lease on the CASPAR shelter on Albany street, a small but significant service to the community.

Incorporating Diversity

Pervading all of the above concerns is the need for the Institute to represent the diversity of our larger society. If our faculty, students, and staff are not more equally represented from the population of women, African Americans, Asian-Americans, Hispanics, and other ethnic groups, we will be unable to properly engage and solve the problems that face all of us. Substantially increased Institute resources need to be put behind such efforts, despite tight budgets. If we invest in people now, we will be able to weather difficult times ahead. On the other hand, if we drive away the very people we

need, the Institute will be in danger of losing its ability to exercise intellectual and social leadership as the climate changes.

Editorial Committee

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Next Issue

Sometimes you get 'em coming and going.

In the next issue of the *MIT Faculty Newsletter* we'll have a piece by new provost Mark Wrighton and an article by outgoing provost John Deutch. We'll also have Part Two of our Magnet Lab histories/commentaries, in addition to other holiday features.

As always, we encourage submissions of all types and on all subjects of interest to the MIT faculty. Please send your offerings to: *MIT Faculty Newsletter*, 38-160, or to any member of the Editorial Board. **N.B.** - We now have an electronic mail address! You can find us at: FNL@ZEISS.MIT.EDU.

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FROM THE FACULTY CHAIR**Class Warfare at MIT**

Henry D. Jacoby

Just in case there are some faculty who did not follow last spring's calendar discussion, a reminder may be in order about revisions from last year to this. To alleviate the crowding of a growing number of final exams into too few days, the faculty voted several changes in schedule. The exam periods have been revised to provide five final exam days in both the fall and spring terms. For the fall term, one reading period day has been changed to an examination day. Reading period will start on December 14 this year and, under the faculty's "six-day rule" for courses with finals, December 7 is the last day for scheduling a test, or the handing-in of a homework set or other assignment. The number of class hours in the term is unchanged.

The revisions in the spring term are more substantial. Days have been added to allow four reading period days (previously there were three) and to increase the number of exam days from three to five. To preserve the current number of spring class hours, additional days have been picked up early in the term. IAP ends on a Wednesday as before. In the past, however, two vacation days and a weekend intervened between the end of IAP and registration the following Monday. This year registration will be on the day immediately following the end of IAP (Thursday, January 31), and the first spring-term class day will be Friday, February 1. Also, the Tuesday following the Presidents Day holiday (February 19) is now a class day. To make things come out even for M-W and T-T classes, the final day of the term (Monday, May 13) will follow a Tuesday schedule.

At the time these changes were voted it was understood they were a temporary and imperfect fix for only one of a larger set of troublesome calendar issues. Depending on the year, for example, the fall term has a number of class days that vary from 61 to 63, but never as many as the spring's 64. Our current schedule for the various vacations and holidays raises educational issues narrowly defined, and

broader questions about the role of R/O for incoming students, student work opportunities and travel costs, and the family life of faculty and staff. Concern about pace and pressure arises in most disputes, often taken as a point of argument by both sides.

In the midst of this menagerie of issues sits a 1000-pound elephant: Independent Activities Period. It is the most contentious component of our current schedule, and discussion of most calendar problems seems to evolve sooner or later into an IAP debate.

At the October 19 dinner for Paul and Priscilla Gray an autograph book was passed from table to table. Unfortunately, it did not make it all the way around before the end of the evening. If you missed it that night, or if you were unable to come to the party but would like to add a short note to the Grays, the book will be available for a few weeks in the office of Mary Morrissey (7-121).

Faculty tend to fall into one of three camps on this aspect of the calendar. The "long knives" want to do away with IAP, or at least perform substantial surgery on it. Driven mainly by concern for undergraduate education, they argue that IAP is not well used. They feel the time would be better spent extending the number of lecture periods in fall and spring subjects. A second, "gimme a break" group put more weight on the contribution the current IAP makes to the sanity of undergraduate students, and to the welfare of a faculty so deeply involved in research and the associated education of graduate students. They observe no slackening of faculty pace in January, but rather the utilization of a treasured opportunity to concentrate on grant writing and getting the work out.

A third group support the concept of a month-long IAP but wonder, "Where's

the beef?" They seek more faculty involvement in IAP activities, and more academic substance including an increase in the number of credit-bearing subjects. This position is ascendant at the moment as a result of a study in the last few years by Jim Mar's IAP Committee. To implement this change, direct departmental responsibility for IAP offerings is being increased, at the expense of the role of the IAP Office and its network of IAP coordinators. As with most everything else surrounding IAP, not everybody is happy with this shift in emphasis.

Debates about IAP, and last spring's kluge to fix the exam schedule, are just the most obvious stresses in a system that is showing its age after nearly 20 years in place. Our external environment has evolved over this period, as have our internal educational programs and our research life. Moreover, further changes in the Institute's programs likely are on the way, for example in the current rethinking of engineering education. It is time to take a comprehensive look at the calendar, and see if there might be a new arrangement that would better serve the Institute's programs as we see them unfolding over the next decade or two. Such a comprehensive study is now being organized.

It will not be an easy job. No one schedule can be best for every school's degree programs and research activities, or for the individual circumstances of faculty and students, graduate and undergraduate. Successful change, if significant revision is indicated, will require finding a new compromise, better than the current one for the Institute as a whole, which can draw a sufficient coalition of faculty support. Such a happy outcome is not likely unless all of us give thought to the topic early in any review process, debate it extensively among ourselves, and thereby develop a widespread understanding of the issues and options. Discussion here in the *Newsletter* will be a help to this end, and I hope the editors will join me in welcoming expressions of your views.

Parking: A Diminishing Resource

MIT Planning Office

One of the first rituals of the academic year for faculty, staff, and students at MIT is the annual allocation of parking permits. The question of parking is two tiered: first is the assignment of a permit and second is the assignment of a parking location. This article is intended to provide an overview of MIT's parking resources and the regulations which govern them, as well as a preview of the future changes MIT is likely to be facing.

Before the late 1950's, off-street parking was sufficient to accommodate the total parking demand of students and employees at MIT. However, as the MIT population continued to grow, and as new building projects absorbed land formerly available for parking, greater space restrictions resulted. Institute growth during the 1960's required a change from open lot parking to multilevel structure parking. Three major structures, each holding about 400 cars, were built during this period. By 1968, the MIT parking inventory totaled about 3,300 spaces.

Further increases in the residential capacity on campus as well as continued growth of population and building space during the 1970's created additional demand for parking. However, Environmental Protection Agency (EPA) regulations enacted in 1974 called for a reduction in overall parking resources. This legislation, coupled with increased competition for limited Institute funds, restricted MIT's ability to expand its parking resources. In response to parking demands the Institute added modestly to its inventory of spaces and increased the number of permits issued for employee and commuter student parking spaces. This approach effectively maximized the use of existing parking resources; but, by the end of the 1970's the MIT parking system was operating at capacity, and a higher ratio of permits to spaces was not feasible.

The parking resources serving MIT are composed of over 30 parking lots

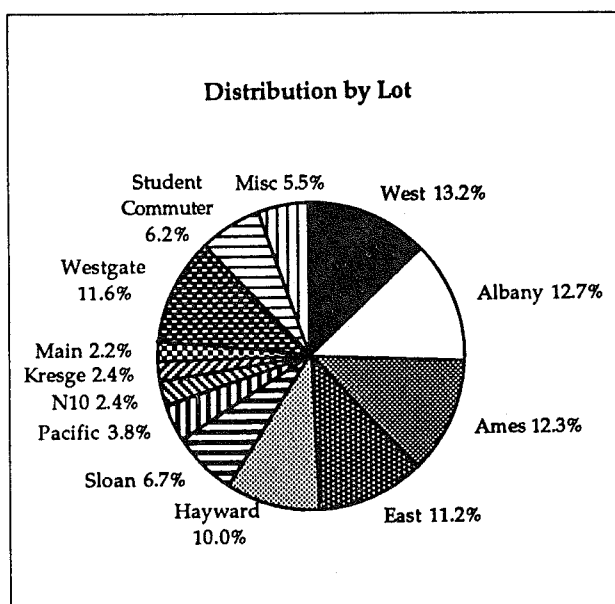
and garages provided by the Institute, on-street parking, and to a lesser degree, open lots and parking structures owned and operated by outside organizations. The current inventory totals almost 5,000 spaces. The population served by these spaces include about 8,300 permanent employees, 4,000 resident undergraduate and graduate students, 4,000 commuting undergraduate and graduate students, and varying numbers of temporary employees, visitors, and

The operational responsibilities for the administration of the Institute's parking resources are assigned to Campus Police with support from the Planning Office. However, the Institute has always relied upon the departmental units to be the final arbiter of each employee's relative need for a parking permit. In order to equitably distribute permits among the 150 or so departmental units, a formula is applied to the number of employees in each department. The formula is weighted by payroll category (Faculty, Staff, Support & Service), the distance from MIT of each employee's home residence, and the number of permits allocated to the department in the previous year. The formula does not provide for any undergraduate or graduate students, nor for individuals paid by voucher, through an outside agency, or on a consultant contract. Departments are given fewer permits for employees who live in the local area (Cambridge, Back Bay, etc.). Student and residential permits are issued by the Housing Office, the Dean for Student Affairs, or the Campus Police.

The location of permits are also allocated on a departmental basis.

The allocation among facilities is determined by the location of the department, the previous year's distribution, and any extenuating circumstances brought to the attention of the Campus Police and the Planning Office.

Despite continuing demand for parking, the number of spaces on campus or the number of permits are not likely to increase. Looming on the horizon is the possible implementation of a parking freeze by the City of Cambridge, which would further restrict any growth in the number of parking spaces. In addition, there may be consequences of the latest Federal Clean Air Act. And, finally, MIT's need to use space now designated as open parking lots for new construction may cause a reduction in the number of spaces now available.



contractors.

As mentioned earlier, the 1974 EPA Clean Air Act restricts the parking resources MIT may make available to its commuting employees and students. This restriction allows the Institute to provide parking to only 1 in 3 commuters. The Institute is able to accommodate more of its employees by over-allocating permits to its parking facilities on the basis that many of the faculty and staff do not commute by automobile onto campus daily. The over-allocation currently averages about 1.5 permits for each parking space available, but varies by facility.

The Transportation and Parking Committee, appointed by the president and chaired by a faculty member, is responsible for recommending parking policies to the Institute's administration.

Individualism or Community: The Struggle Continues

Frank S. Jones

In the summer of 1981, several members of the MIT faculty who are black, in addition to several black members of the administrative staff, went on a retreat. All present regarded the occasion as constructive.

Nevertheless, it was nine years before the next constructive meeting of members of the black faculty at MIT took place. Although the precipitating event was Chuck Vest's appointment as president and his endorsement of a more diverse faculty, the entrepreneur who facilitated the supper meeting was Dr.

themselves are barely inside. What is clearly called for is a community of strategists to frame and implement appropriate solutions. These strategists must be immersed in the problem and aided by imaginative colleagues such as Professor Emeritus Albert G. Hill, who successively fought to make MIT safe for Jewish and women faculty, became critically involved with an enlarging black community starting in September 1969, and whose extraordinary accomplishments at MIT and Draper Lab were recognized by the dedication

young black men, I saw and welcomed their interaction as "thesis" and "antithesis" which will one day lead to a "synthesis" - a stronger human (and black) community at MIT.

The bifurcated struggle of Drs. Loyd and Francis - to grapple with the wisdom of Gandhi and the brilliance of Einstein; to struggle with the teaching of Martin and Malcolm - is akin to mine; I have been enriched by their quest.

I have two heroines at MIT. They are Ms. Yvonne Gittens in the Financial Aid Office, and Ms. Jane Hamilton in Personnel. One is black, the other white, but they share the following: they are former administrative associates of mine who left for advanced training - one at Harvard, the other at SUNY, Buffalo, in spite of being tracked earlier toward the trash heap. They are competent, "uppity", and in the finest sense refuse to accept their "places."

The gatekeepers for the most part loathe secretaries who refuse to be controlled, even though the secretaries may be competent in all technical respects. Since I also don't accept "my place", Yvonne and Jane and I share a great deal of humor and friendship.

So, what about the struggle? It is within the black faculty; it is between the black and white faculty; it is for going beyond the gatekeepers to nurture a group - if not a community - of scholars and associates who are women and men; Jew and Gentile; black and white; gay and straight, where eventually these labels will be sublimated in the human uses of new and effective science and technology.

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Please note that to avoid Thanksgiving eve the November faculty meeting has been rescheduled from November 21 to November 28.

But this essay is not just about the limits of individualism. It is also a way of answering those questions frequently asked by students of color: "How do you deal with the constant assaults by the gatekeepers?" "Why do you stay?"

Bernard Loyd, former president of the Black Graduate Students Association (BGSA), Ph.D. in Aeronautics and Astronautics, M.S. in manufacturing at Sloan, and recently elected member of the MIT Corporation.

One means of thinking critically about these related events - and painful non-events - is to think about the continuum which extends from individualism to community. I do not know well all of the members of the faculty who are black, but I believe that those with whom I have talked have made it this far in large part because of individualistic skills. Individualistic skills, however, are not sufficient at MIT, where gatekeepers abound who - overwhelmingly but not exclusively white and male - would close the gates to outsiders who look like me, after they

of a building in his honor here in Cambridge.

But this essay is not just about the limits of individualism. It is also a way of answering those questions frequently asked by students of color: "How do you deal with the constant assaults by the gatekeepers?" "Why do you stay?" I stay because MIT draws young people who are bright, energetic, visionary, and courageous. Such a person is Bernard Loyd; also Ron Francis, who recently successfully defended his Ph.D. thesis in Physics and is a leader of the Coalition Against Apartheid (CAA).

Bernard and Ron have very different approaches to effecting change in the world. In far too brief terms, Bernard works from the inside out, and Ron from the outside in. In getting to know both of these able and complicated

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expertise and, more likely, the evolution of new modes of analysis and synthesis. At the same time, new developments in information technologies will change the ways people work, think, and interact. This will require of us increased wisdom in blending technology with human aspirations, capabilities, and purposes.

Surely the next ten years will be a

In facing all of these changes, we must, I believe, renew our national commitment to the development of human capital - people and ideas - through increased investment in and commitment to education and research. This must begin with a realization that the U.S. educational system is in deep trouble. We in higher education must assist in some

regulations, health care, environmental protection, and litigation. The list is seemingly endless.

At the same time, the revenue side of the picture is not encouraging. The growth rate in our income is slowing and we face declining societal support as the populace expresses understandable concern about tuition levels and student costs, as federal resources appear to level out, and, as I sometimes despair, we see a loss of national will to address the issue of educational needs.

There are only two possible responses to these budgetary forces: we can try to increase our revenues or we can try to increase our efficiency and do fewer things. I believe we must pursue both. We need to press ahead vigorously on the Campaign for the Future in order to increase our endowment, to focus the renowned entrepreneurship of MIT faculty on behalf of the Institute, to carefully foster our relations with the federal government, and to build new modes of interacting with both the private and the public sectors. All of these steps will help build a greater and stronger financial base.

But we must also increasingly focus on our fundamental missions and bring about change within this institution through a process of substitution and renewal as well as by growth. As we do so, I believe that it is essential that we retain some budgetary flexibility to serve as "venture capital," that is, to continue to support and encourage the faculty to delve into uncharted waters and undertake the daring and risky intellectual leaps that have so characterized MIT in the past. At all times we must also maintain a strong focus on the fundamental quality of the education we provide and the overall experience of the talented students we bring to this campus.

I look forward in the months ahead to engaging the Institute in an exploration of the macroscopic and long-range nature of MIT. In short, we must work together to define what we want MIT to be a decade hence and begin taking the actions necessary to realize that definition.

In facing all of these changes, we must, I believe, renew our national commitment to the development of human capital - people and ideas - through increased investment in and commitment to education and research. This must begin with a realization that the U.S. educational system is in deep trouble. We in higher education must assist in some appropriate way with the revitalization of primary and secondary education in this country.

time of unprecedented change in the basic sciences. We can expect continued, fundamental discoveries in molecular biology and genetic technology, in materials sciences, and in physics, chemistry, and earth sciences as new scales of dimension, time, and energy become accessible to us.

The nineties will be a time of changing roles for universities. In addition to maintaining our traditional mission of deep scholarship and education, we will become increasingly engaged with the world around us. Leading institutions will be called on to work cooperatively with other sectors of our society to analyze and help to solve many of the fundamental issues facing humankind - maintaining political and economic health in the new global society; coming to grips with the worldwide effects of human activity on the environment; sharing the fruits and responsibilities of our economy more broadly throughout society; curbing our increasing tendency to violence. MIT is perhaps uniquely positioned, by virtue of its tradition of working with industry and the government on tough problems, to play a leadership role in many of these areas.

appropriate way with the revitalization of primary and secondary education in this country.

In sum, we have before us a decade of rapid change and of great opportunity - an era in which the intellectual excellence of MIT can and must be maintained and enhanced.

These challenges and opportunities, however, must be placed in the context of budgetary reality. MIT, like higher education in general, finds itself in a situation in which the costs of doing what we expect of ourselves and what society expects and needs of us are rising much faster than our revenue.

The pressures to increase the budget are driven by such factors as: the need to maintain and renew our research and teaching facilities and resources; the increasing market competition for the best faculty and staff; the commitment to provide the necessary financial aid for our students; the imperative to undertake innovations in education and research; the need to develop benefits and other programs appropriate for a changing social structure; and the growing costs of government

Notes on the Gulf Crisis

Noam Chomsky

The greater part of the research effort at MIT is supported by taxpayers through the R&D component of the federal budget. With the changes in the international order, many expected a Peace Dividend to flow from reductions in the \$300 billion dollar military budget into previously underfunded civilian areas of research and education. In fact, the military sector of the budget has been largely maintained through the justification of the need for massive military intervention in the Middle East. Given the powerful industrial and political interests dependent on these funds, it is not surprising that a pretext for their maintenance quickly surfaced. Below I examine the premises underlying this massive U.S. military response in the Middle East.

The basic features of the Gulf crisis are clear and grim. Sanctions are unlikely to force Iraq to withdraw soon, and the U.S. cannot sustain a vast military force in the desert for long. With no steps towards a negotiated settlement, the U.S. will be faced with the choice of war or withdrawal, the latter highly unlikely given the rhetorical framework: defense of high principle and a New World Order. The basis is being laid for war, with consequences that might be catastrophic.

The terms of a possible diplomatic settlement have been recognized since August: Iraqi withdrawal in return for guaranteed access to the Gulf and a settlement of the dispute over the Rumaila oil field, 95% of which is in Iraq. Whether these possibilities are realistic, we cannot know unless they are explored. That path is barred by Washington, on grounds of high principle.

The principle allegedly at stake is that aggression cannot be rewarded. And the contours of the New World Order are to be seen in the "wondrous

sea change" at the U.N., which is "functioning as it was designed to do...for virtually the first time in its history" and thus offering "a bold pattern of peacekeeping for the post-Cold War world" (*New York Times*). The standard explanation is that with the U.S. victory in the Cold War, Soviet obstructionism and the "shrill, anti-Western rhetoric" of the Third World no longer render the U.N. ineffective.

These doctrines are considered self-evident truths, hence are presented without empirical support in the flood of articles with these themes. They are readily subjected to empirical test, which

illegal economic warfare against Nicaragua. And the U.S. once again voted against a resolution opposing the acquisition of territory by force, passed 151-3 (U.S., Israel, Dominica); in this case, a resolution calling for a political settlement of the Arab-Israel conflict, which the U.S. has blocked for 20 years, vetoing several Security Council resolutions.

The U.S. is far in the lead in the past 20 years in vetoing Security Council resolutions and voting against General Assembly resolutions (often alone, or with a few client states) on aggression, observance of international law,

The U.S. is far in the lead in the past 20 years in vetoing Security Council resolutions and voting against General Assembly resolutions (often alone, or with a few client states) on aggression, observance of international law, annexation, human rights abuses, terrorism, disarmament, etc.

shows that U.N. peacekeeping efforts have regularly been frustrated by the United States. Merely to take the very recent past, just prior to Iraq's invasion, the Security Council called for investigation of human rights abuses in the Israeli-occupied territories (14-1, U.S. veto as usual). In the last U.N. session (Winter 1989-90), the U.S. vetoed a series of Security Council resolutions condemning its invasion of Panama, its attack on the Nicaraguan embassy, and Israeli atrocities. Alone with Israel, the U.S. voted against two General Assembly resolutions calling for observance of international law, one condemning U.S. support for the contras, the other the

annexation, human rights abuses, terrorism, disarmament, etc. The USSR has generally voted with the overwhelming majority, and the "shrill, anti-Western rhetoric" of the Third World that elicits so much derision quite commonly turns out to be a call for observance of international law. There are exceptions, but this has been the dominant pattern.

As a matter of logic, principles cannot be selectively upheld. As a matter of fact, the "wondrous sea change" at the U.N. has nothing to do with the end of the Cold War, the improved behavior of the Russians, or the irrelevance of

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The Shelter Problem: An Open Letter to the Faculty

As graduate students living in the Boston/Cambridge/Somerville community many of us encounter daily the affordable housing shortage in this area. In order to begin to address this critical problem in a systematic way, some of us have gathered together as the MIT Homelessness Initiative. We are writing to you to share some of our concerns, and to set the conditions for further discourse.

Homelessness is an indictment of our society. The number of homeless persons in the United States is estimated to be between two and three million. In Massachusetts, homelessness is increasing by 20% each year. In Cambridge, 240 persons sleep in shelters each night, while an estimated 100 more must fend for themselves in our parks, streets, and doorways.

Among the most vulnerable in the homeless population are alcoholic homeless persons. The Cambridge and Somerville Program for Alcoholism Rehabilitation (CASPAR) runs a shelter at 240 Albany Street, on MIT property. This shelter is the only one in Cambridge that serves the alcoholic homeless, providing refuge and a chance for these individuals to rehabilitate themselves. The shelter has carried on this mission for eleven years at this site. Although the shelter consists only of three rapidly deteriorating trailers, as many as 80 people are fed each day, and 55 cots are crowded into all available space every night. In the winter, many must be turned away. The shelter workers, including many volunteers, provide the best care possible given these minimal circumstances, and the shelter has become a valuable service in the community.

However, the status of the shelter is uncertain. MIT has refused to renew the lease, and until a permanent site is found, there is no hope of improving shelter conditions. Last year, the state

awarded CASPAR a 2.5 million dollar grant for the purpose of building a permanent structure that would have afforded a more dignified environment for their guests. But because a permanent lease was not granted, the funds were lost at the fiscal year's end. Given that a five year search was required for CASPAR to secure the current site, it is highly unlikely that a new site could be found in the near future.

The MIT community has already demonstrated widespread support for permanent siting of the shelter on MIT property. Over 900 individuals, students, faculty, and staff, have signed a petition asking MIT to donate the less than half acre shelter site to CASPAR. In addition, supportive resolutions have been passed by the GSC and the UA.

As an institution that is largely funded through taxpayer contributions, MIT has a responsibility to the society that supports it. Education, research, and technology are perhaps the best tools for solving societal problems, and homelessness is one of the greatest problems facing our society today. Some have argued that MIT has done enough, that it is not MIT's responsibility to provide care for the homeless. We are not asking MIT to abandon education and research in favor of providing shelters for the homeless. We are asking that MIT put homelessness on its problem-solving agenda. There could be no better first step in this direction than for MIT to make an immediate contribution by supporting a shelter that has been serving homeless persons in the community for eleven years.

Signed

Mary Herndon

Chris Stipp

Biology Representatives to the Graduate Student Council

Members, MIT Homelessness Initiative

Who's In Charge Here?

Maintaining Our Physical Plant

Thomas W. Eagar

For those of us who sometimes feel that the level of Institutional support for custodial service, building maintenance and the like is inadequate, there are some simple facts that may prove enlightening.

With buildings valued at approximately \$1 billion, MIT has a maintenance and repair budget of \$1.5 million. A standard rule of thumb suggests 2 percent of building value as an annual maintenance budget. MIT spends roughly 0.1 percent. For an average homeowner in the Boston area, this is equivalent to an annual home maintenance budget of \$200. If you have ever wondered why our buildings seem to be deteriorating, one need not search too far.

One could argue that this is merely a result of tight fiscal policy, which it is; but one should remember that our research contract overhead pays for depreciation and building use expenses, including maintenance. With \$300 million in campus research volume, resulting in some \$100 million in overhead charges, surely the research contracts alone pay more than \$1.5 million per year in building maintenance fees.

In addition, one might expect that at least a small fraction of the \$150 million tuition income should be earmarked for building and maintenance. *Where* does this money go? And *who* is in charge here?

Who's In Charge Here? is reserved for short pieces reflecting the troublesome rules, regulations, general inconsistencies, and random anomalies that can seem to pervade the Institute. We encourage submissions on any and all topics, with the goal of encouraging some changes.

The Francis Bitter National Magnetic Laboratory: Past, Present, and Future

Robert G. Griffin

Introduction

The Francis Bitter National Magnet Laboratory (FBNML), established in 1960, was the world's first high field magnet laboratory, and continues to be the primary facility for high magnetic field research in the United States. It has provided scientists throughout the United States and the world with the highest continuous fields available, as well as unparalleled user-friendly service. Currently, the Laboratory operates more magnets running above 20 T than all other laboratories in Japan and Europe combined, and is considered the world's pre-eminent magnet laboratory.

For the past 30 years the FBNML has resided at its Albany Street site on the edge of the MIT campus. Nevertheless, there are many MIT faculty members who are unfamiliar with the origins and the research and educational contributions of the lab to MIT and to the country. The purpose of this article is to provide a brief description of the scientific origins of the FBNML, and the contributions of its staff and visitors to a number of areas of high field science and technology. In addition, we discuss the recent competition for the National High Magnetic Field Laboratory (NHMFL), the NSF decision to site the NHMFL at Florida State University (FSU), and the future for the FBNML.

Origin of the Laboratory

In the early 1950's, a solid state research group, led by Prof. Benjamin Lax of the recently established Lincoln Laboratory, began work related to the newly invented transistor and other solid state electronics components. By the late 1950's, their research had focused on cyclotron resonance and other resonances in semiconductors and magnetic materials, and they employed iron core electromagnets in their experiments. These magnets are not capable of producing fields much above 2-3 T, since iron saturates magnetically

at this level, and it was clear that higher fields would lead to interesting new science. As a consequence Lax and his colleagues initiated two efforts aimed at providing these fields.

First, two members of the group, Drs. Simon Foner and Henry Kolm,

In 1960, the National Magnet Laboratory was founded at MIT, with support from the Air Force Office of Scientific Research (AFOSR). [Benjamin] Lax was appointed director, a post he held for 21 years, while [Francis] Bitter chaired the committee responsible for constructing the facility. On Professor Bitter's death in 1967, the Laboratory was named in his honor.

developed a pulsed field system using energy stored in capacitor banks to produce fields up to 75 T in a 3/16" bore with a 120 5s half period. These magnets were used by Lax and coworkers in their semiconductor studies, and by Foner for magnetic resonance studies. However, the short duration and small volume of these fields rendered them unsuitable for many experimental situations. Consequently, Lax initiated a second approach to the production of higher fields through a collaborative program with Prof. Francis Bitter, who operated a high magnetic field laboratory on the MIT campus.

In the 1930's Bitter had developed a new type of magnet, now bearing his name, consisting of flat copper plates interleaved with insulation and stacked to form a water-cooled, conducting helix. A much larger current supply was necessary because no iron was used, but the field was limited only by the current which could be tolerated by the magnet. Bitter's design provided efficient cooling

and mechanical strength to produce a continuous field of 10 T in a one-inch bore with the power from a 1.7 MW motor generator set. The Lincoln group built new Bitter magnets, made improvements in the cooling system and buswork in Bitter's laboratory, and began regular use of the facility.

Requirements for yet higher fields quickly arose, and this stimulated Kolm to study the cooling requirements for Bitter magnets. He determined that the heat transfer rate could be raised considerably, allowing significantly higher fields to be produced if more DC power were available. These considerations - that higher continuous fields were needed, and that such fields could be achieved at reasonable cost - led Lax to propose the creation of a new high magnetic field facility to produce continuous fields up to 25 T using a 10 MW power supply.

In 1960, the National Magnet Laboratory was founded at MIT, with support from the Air Force Office of Scientific Research (AFOSR). Lax was appointed director, a post he held for 21 years, while Bitter chaired the committee responsible for constructing the facility. On Professor Bitter's death in 1967, the Laboratory was named in his honor. During the '60s, with the ample support of the AFOSR, the FBNML prospered both technically and scientifically, and became a model for the magnet labs which were subsequently built in Europe and in Japan. In 1971 the Mansfield amendment required that support for the Laboratory be transferred from AFOSR to the NSF, which is at present the primary sponsor, a point to which we will return below. In 1981 Lax retired as director and was replaced by Prof. Peter Wolff. The current Director is Prof. J. David Litster of the Physics Department who assumed the position in 1987.

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Notes on the Gulf Crisis

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Third World psychotics. What happened in August is that for once the U.S. happened to be opposed to criminal acts, as distinct from the Turkish invasion and virtual annexation of northern Cyprus, the Israeli invasion of Lebanon and annexation of the Syrian Golan Heights (U.N. sanctions vetoed by the U.S.), the Moroccan invasion of the Sahara, and much else. For decades, South Africa defied the U.N. and the World Court on Namibia, holding the territory illegally, robbing and terrorizing it, using it as a basis for terror and aggression against neighboring states. The U.S. advocated "quiet diplomacy" and "constructive engagement." The U.S. is upholding no high principle in the Gulf; nor is any other state.

Saddam Hussein is a murderous gangster, just as he was before August 2, when he was an amiable friend and favored trading partner. His invasion of Kuwait is another crime, comparable to others, nowhere near as awful as some; for example, the Indonesian invasion and annexation of East Timor, which reached near-genocidal levels thanks to U.S. material and diplomatic support. U.N. peacekeeping efforts were frustrated on State Department orders by Ambassador Daniel Moynihan, who takes pride for the achievement in his memoirs, and is now hailed as a long-time advocate of international law and the U.N., a proof that cynicism has no imaginable limits.

These facts are understood in the Third World, but not here. Subjected to no critical analysis at home, the current cynical posturing is trapping us into a war. The charges of ideological fanaticism commonly leveled against the Third World apply rather well much closer to home, a fact that merits some attention and concern.

Saddam Hussein became a monster because he violated a long-standing principle of U.S. foreign policy: no independent indigenous

doctrine.

Well before Iraq's aggression, the White House had informed Congress that "the growing technological sophistication" of the Third World and the need to deploy force in the Middle East and elsewhere would require a powerful high-tech military. The current conflict will be exploited to evade the "peace dividend," never realistic, given the domestic and international role of the Pentagon system.

Saddam Hussein became a monster because he violated a long-standing principle of U.S. foreign policy: no independent indigenous force may gain substantial influence over the world's major energy supplies, which are to be controlled by the U.S. and its clients. His transition from "moderate" to reincarnation of Genghis Khan when he interfered with U.S. interests also follows a familiar pattern from Mussolini to Trujillo to Noriega, among many others.

force may gain substantial influence over the world's major energy supplies, which are to be controlled by the U.S. and its clients. His transition from "moderate" to reincarnation of Genghis Khan when he interfered with U.S. interests also follows a familiar pattern from Mussolini to Trujillo to Noriega, among many others. The U.S. preference for force over diplomacy also has ample precedent - in the Middle East, Central America, Southeast Asia and elsewhere - and is easily understood, once we abandon self-serving

The New World Order does differ from the old. Soviet tyranny has collapsed. There is no longer a deterrent to the use of U.S. military force, for which the rivals/allies must be compelled to pay, with the erosion of the domestic economic base. This is what Deputy Secretary of State Lawrence Eagleburger called the "new invention in the practice of diplomacy" when outlining the New World Order to Congress. There is reason to expect this New Order to be much like the old for the usual victims, however the current crisis ends.

Response to Family and Work Committee Report**An Open Letter to President Vest**

Dear President Vest:

In June 1988 President Paul Gray and Bernard Frieden, then chair of the faculty, appointed the Ad Hoc Committee on Family and Work. In May 1990, after two years of hard work, the Committee distributed preliminary versions of its report to the MIT community for comments and corrections. A final version of the Committee's report is expected this fall. We are writing to express our support for the Committee's work thus far, and to urge the administration to lend its vigorous support in continuing and extending this initiative.

Although we write as members of the faculty, we are well aware that the problems of reconciling family life and working life are shared by students, post-docs, support staff, and administrative personnel. For all these groups, the structure of employment at MIT has long rested upon the unstated but powerful assumption that employees with family responsibilities enjoy a back-up system of domestic support provided by someone else.

The preliminary report amply documents the demographic and social changes that have rendered this assumption untenable. It also documents, both in statistics and in written comments, the painful conflicts between family life and work life experienced by many employed here. Finally, the report suggests that these conflicts will become even more acute in the immediate future. Because the Institute's policies and services have not been updated for some time, they are in danger of being left behind by social realities.

MIT needs to consider new, creative measures to help its employees reconcile working life and family life. One reason involves self-interest: family-oriented policies and benefits will be necessary if MIT is to remain competitive in attracting outstanding faculty and staff. More than self-interest is involved, however. In our society, universities enjoy a visibility and respect that enable them to have significant impact by adopting positions on social issues. We would like to see MIT assume a position of national leadership in the area of family policy.

The report of the Ad Hoc Committee presents a range of options that need to be discussed more thoroughly and, when appropriate, translated into Institute policy. The report suggests many ways in which MIT could help its employees arrange affordable child care. To a lesser extent, it suggests other policy options - ones that would let employees spend more time with their families, as opposed to helping employees purchase more child care.

We would like to see such alternative policy options explored more thoroughly. Doing so would mean raising broad issues of faculty culture and workloads that the Ad Hoc Committee consciously decided not to address. These issues do need to be considered, however, if we are to move beyond the prevailing attitude that children are acceptable for the faculty as long as the children do not interfere with our jobs.

We need a strong, permanent committee to address these problems, which are highly complex and which are evolving so rapidly. The Ad Hoc Committee has recommended that "a council be appointed which can track those needs [for dependent care], perform evaluations and make recommendations, about dependent care and other family and work areas, creating a coherent and evolving MIT program of activities on family and work" (Section 2.4, Preliminary Report). We urge you to act upon this recommendation by appointing an Institute-wide committee that has an inclusive charge and that reports to the highest levels of the administration. This committee should have strong, significant faculty representation. The faculty members - and, indeed, all members of the Committee - should be people who have demonstrated a strong concern regarding family and work issues. The faculty representatives, moreover, should reflect the wide diversity of interests and perspectives involved.

We look forward to working with the administration in shaping a forward-looking MIT policy to deal adequately with the new realities of family life as we approach the year 2000. No other initiative will be more important in shaping the future of the Institute.

Sincerely,

Rosalind Williams, Mary Boyce, Thomas R. Chastain, Katherine Freese, Lorna Gibson, Paul Hoffman, Paul Jaffe, John Hildebidle, Alan Lightman, Graham C. Walker, Heather Lechtman, Lisa Rofel, James Howe, Jean Jackson, Dorothy Hosler, Martin Diskin, Arthur Steinberg, Martha Gray, Barbara Liskov, James A. Fay, William K. Durfee, S. Shyam-Sunder,

Louis L. Bucciarelli Jr., Jacquelyn Ciel Yanch, Isabelle de Courtivron, Ruth Pery, Gilberte Furstenberg, Catherine V. Chvany, Bernd Widdig, Ellen W. Crocker, Ann W. Perkins, Edward Barton Turk, Cynthia Simmons, Elizabeth Garrels, Margery Resnick, Louis Kampf, Douglas Morgenstern, Graciela Perez-Trevisan, Sylvia Schmitz-Burgard, Monika Totten,

Tomoko Graham, Joshua Cohen, Sylvia Bromberger, Noam Chomsky, Michael O. Hardimon, James W. Harris, Irene Heim, James Higginbotham, Robert Stalnaker, Thomas S. Kuhn, Wayne O'Neill, James Rebitzer, Richard Valelly

To add your name, call Rosalind Williams (3-3060) or any other signatory.

The Francis Bitter National Magnetic Laboratory: Past, Present, and Future

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High Field Science and Magnet Technology

From its inception the Laboratory has maintained a program for improving the design and operation of Bitter magnets. Improved insulators and conducting plates, coupled with optimized housing designs and assembly techniques, have led to significant increases in reliability and maximum field. The radial cooling technique and monohelix configuration, both invented at the Laboratory, also constitute milestones in the continued development of water-cooled magnets.

Despite these advances, the maximum fields achievable with water-cooled magnets (24 T) are still limited by the available power, currently 10 MW. To attain yet higher fields, Bruce Montgomery of the FBNML staff introduced the concept of a "hybrid magnet" consisting of two or more concentric magnets - a superconducting outer section and inner water-cooled sections. The initial hybrid was completed in 1982 and achieved a field of 30 T. The Laboratory has since designed and built three additional hybrid magnets, and the highest man-made DC fields available have been attained with these magnets (33 T in 1988). A 35 T hybrid magnet is currently nearing completion, and a 45 T version was to be the keystone of the new NHMFL.

In addition, improvements have continued to be made in pulsed magnets. Most recently, the discovery and development of a new high strength conductor material, copper-niobium, led to the recent construction of a pulsed magnet giving 68.4 T with a 5.6 millisecond half period, a record field for this regime.

The FBNML has also been in the forefront of the development of superconducting magnets for nuclear magnetic resonance (NMR) research. Several superconducting magnetic resonance imaging (MRI) magnets have been designed and built, and actively-shielded gradient coils for MRI magnets were conceived and first used here. One of the world's first 12 T (500 MHz) NMR magnets was assembled and operated by FBNML for 14 years. This work is

continuing with construction of a compact 14 T (600 MHz) unit, and the next generation NMR magnet - a 750 MHz system - is currently being designed and fabricated.

The scientific research program at the FBNML has been supported by the NSF core contract, and by individual grants from the NSF, NIH, DOE, and other government and private agencies (currently amounting to \$5.8M annually). Although the FBNML is nominally associated with the Physics Department and condensed matter physics, the research at the laboratory involves physics, chemistry, biology, materials science, and several engineering disciplines concerned with applied magnetism. A few of the highlights of this program are:

The fractional Quantum Hall effect was discovered at the FBNML by a user group from Princeton University and Bell Telephone Laboratories; the 1984 Buckley prize in physics was awarded for this work. FBNML staff were first to measure the fractional Quantum Hall effect at temperatures below 0.3 K.

Pioneering advances in magneto-optical studies of solids include studies of infrared cyclotron resonance in semiconductors (III-V, II-V and diamond) using laser light sources, the invention of far infrared sources by nonlinear optical mixing using CO₂ lasers. The first measurements of the spin-spin exchange interaction between band electrons and magnetic ions in dilute magnetic semiconductors and the development of the appropriate theory, experimental and theoretical studies of magnetic polarons in dilute magnetic semiconductors, and the development of modulation spectroscopy techniques were accomplished.

Giant quantum oscillations were discovered in gallium using ultrasonic techniques.

Significant contributions were made to the understanding of critical phenomena in magnetic materials including the first observations of a Lifshitz point.

The concept of the high field tokamak,

which arose in the FBNML, led to the construction of the Alcator A and Alcator C fusion experiments and eventually to the creation of a new MIT interdepartmental laboratory, the Plasma Fusion Center, with an annual budget of ~\$25M.

Contributions to the technique of high gradient magnetic separation resulted in several patents, and commercial application in the clay industry.

FBNML staff provided new insights to the concept of the magnetically levitated vehicles, and built the first working model of a maglev vehicle employing superconducting magnets.

In the field of NMR, the FBNML opened the first regional high field NMR Laboratory in New England, operated the first 500 MHz NMR facility in the United States, and has been heavily involved in the development and applications of new NMR techniques. For example, several methods for measuring bond distances in solids have emerged (heteronuclear dipolar chemical shift spectroscopy and rotational resonance) which are now permitting structural determinations of membrane proteins.

The Laboratory was first to use a SQUID magnetometer to measure the magnetic field of the human brain and lung, an innovation that is generally credited with opening the now very active field of biomagnetism: the study of the weak magnetic fields of the human body. Magnetotactic bacteria were discovered and studied jointly with a group at the University of New Hampshire. A long series of studies of ferredoxin, nitrogenase the Mossbauer effect, yielded new information on these important molecules.

End Part One

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In Part Two of their invited companion pieces on the MIT Magnet Lab, Profs. Griffin and Lax bring their histories up to the present, including insights on the failure of the NSF to award the National High Magnetic Field Laboratory grant to MIT - next month, in the *MIT Faculty Newsletter*.

Reflections

The Francis Bitter National Magnet Laboratory

(Continued From Page 1)

capabilities of his magnets. With the help of the above academic leaders and George Valley, who was chief scientist of the Air Force, the proposal was sold on the spot. The Air Force decided to sponsor the creation of a magnet laboratory. In 1960 a sum of \$5.5 million was awarded to MIT to build the facility. In today's dollars this would be approximately \$50 million; the instrumentation and magnets accumulated in addition to the building, would run the value on the order of \$100 million for the total facility as it stands today. In 1963, when we opened the laboratory, the annual operating funds were \$2 million. Over the following thirty years we did not exceed \$5 million in operating funds, well below the inflation level.

The choice of locating the laboratory at either Lincoln, or in the hinterlands, or on the MIT campus was explored. It became clear that the sponsor and MIT wanted to locate on the campus, central to the universities surrounding Cambridge, and close to Logan Airport. The concept of a national facility that was centrally located in the heartland of academia was an important consideration (how times have changed!). MIT President Dr. Julius Stratton, an enthusiastic supporter, gambled on our enterprise by buying the Ward Baking Building on Albany Street for \$250,000. In the meantime, during the two years (1958-1960) while waiting for the funding to materialize, we joined with Francis Bitter and used his expertise and his existing laboratory to develop magnets that would be used later with the ten megawatts of the new laboratory.

We received the funding July 1960, and immediately began to renovate the old Bitter Lab in the basement of Building 6. Magnets which were built with Lincoln funds were installed and experimentation was begun. Two MIT students and two postdocs, one from Japan and another from Poland, began their research. Kolm, Simon Foner, Stevenson, and Montgomery from Lincoln Laboratory joined me as a nucleus at the old Armory in Cambridge as headquarters. With Francis Bitter as chairman of the design committee and me as director, the six of us (with the help of

Crawford Adams of Jackson and Moreland) began to plan the laboratory.

Our vision of the laboratory was a place to do innovative science in solid state, including cyclotron resonance, magneto-optics, magnetic resonance, transport phenomena, high field superconductors, low temperatures, and also to explore other as yet unidentified discoveries. Magnet technology and the related development of achieving the promised field of 250 kilogauss were also to be an important part of our research.

The laboratory was completed in the summer of 1963, a quarter million dollars below budget. With a budget of \$2 million, we began serious operation that fall. In 1964, Larry Rubin took charge of the facility, and it has operated smoothly ever since.

The sixties were a decade of great productivity under the Air Force Office of Scientific Research (AFOSR) sponsorship. Overhead was relatively small, we had money for students, postdocs, instrumentation, and, most of all, a laissez-faire trust by the sponsor and the academic administration.

Foner built a new pulse magnet facility, Montgomery was building the 250 kG magnet and instrumentation for a wide variety of experiments was begun. Foner built a sensitive vibrating magnetometer. We were relatively uninhibited in our choice of scientific projects. We undertook new enterprises in such fields as high field Mossbauer spectroscopy (led by Richard Frankel), we pioneered in high field resonance spectroscopy using far infrared lasers and Fourier transform spectrometers which Gebbie from England introduced to our laboratory. Together with Ken Burton, this became an international cooperative process.

One of my students, Yaacov Shapira, undertook to study metals in high fields using ultrasonic techniques. This led us to a whole new field of research - magnetism and super conductivity. Modulation magneto-spectroscopy using piezo techniques was introduced by Roshan Aggarwal. With Lincoln participation, magneto-optics of semiconductors and

semimetals, including the study of semiconducting lasers, was begun. Low temperature demagnetization and the study of superconductors in high fields were also started,

During this period, application of high fields was also begun. In addition to measuring the fundamental properties of high field superconductors, we conceived the idea of the hybrid magnet, i.e., a superconducting magnet to surround the Bitter magnet to obtain high fields. This possibility was anticipated early in the sixties and reminds me of an amusing incident. After we began building the Magnet Laboratory, I received an urgent call from General McCormack, the Vice President for Research at MIT. He relayed to me the opinion of Luis Alvarez (future Nobel Laureate) that our efforts were useless because cryogenic magnets and superconducting magnets would make our laboratory obsolete.

I was urged to meet with Alvarez to discuss the matter over lunch. After hearing his arguments, I convinced Alvarez that we would be measuring all the superconductors and that we would use them to boost the fields via a hybrid scheme. Subsequently, the cryogenic magnets were dismissed at a meeting in Washington with Dick Post of Lawrence Livermore Laboratory, who assured me that Alvarez was misinformed.

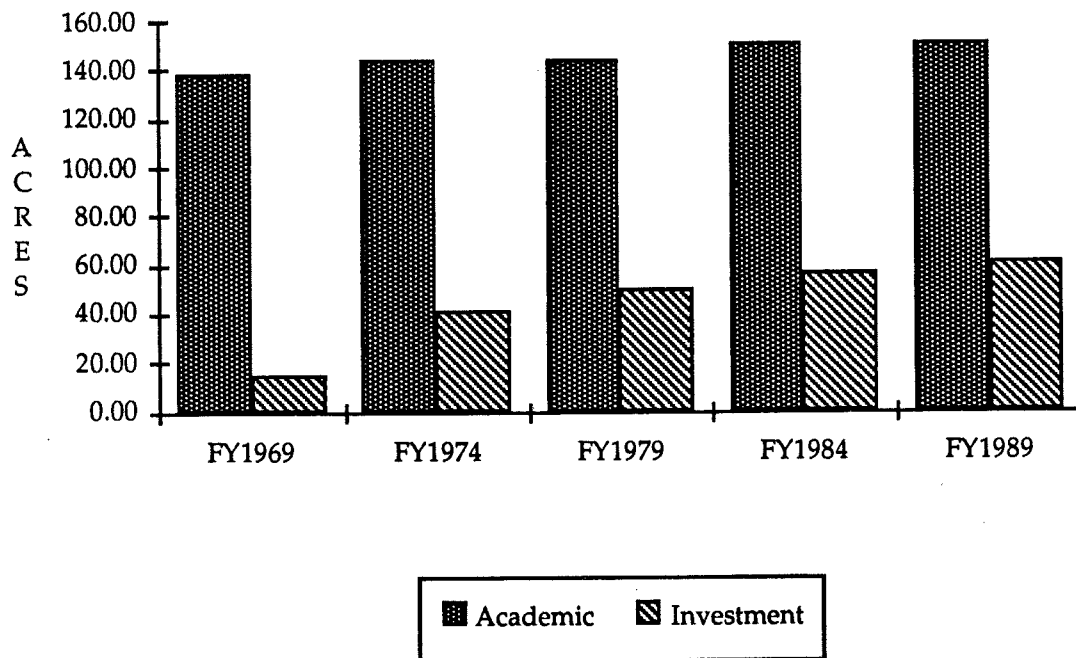
Applications of high fields was constantly advocated by Kolm and Montgomery. Two projects stand out as excellent examples of Kolm's contributions. One was that of magnetic separation, and the other (initiated with Thornton of the Electrical Engineering Department), was the magnetically levitated train. They actually had a model operate at 60 mph with a small superconducting vehicle gliding over an aluminum track. A third project led by Montgomery was the magnetically guided catheter, which was used to plug up aneurysms and deliver chemicals to inaccessible portions of the body. The culmination of this type of research was the magnetically guided inserts which were used to close the separated esophagus of babies born with this defect.

End Part One

M.I.T. Numbers

MIT Cambridge Land Area

	FY1969	FY1974	FY1979	FY1984	FY1989
Academic	138.80	143.90	144.20	150.10	150.70
Investment	14.50	41.30	50.10	56.90	60.90
TOTAL	153.30	185.20	194.30	207.00	211.60
MIT as % total Cambridge land area	3.77%	4.55%	4.78%	5.09%	5.20%



Note: The Institute made in-lieu-of tax payments of \$732,368 to the city in 1989 for the 150.7 acres of academic land. MIT investment properties generated \$2,199,450 in tax revenue for the City of Cambridge.
FY! For purposes of comparison, as of 1989 Harvard University held 179.87 acres of academic land in Cambridge, and 39.73 acres of investment land.

Source: MIT Factbook - Prepared by the Planning Office - June 1990