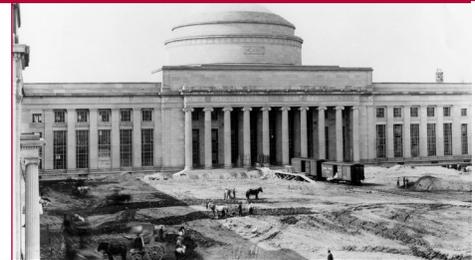


MIT Faculty Newsletter

<http://web.mit.edu/fnl>

this issue features an editorial on "Affirming Freedom of Expression at MIT" (page 3), the "Preliminary Position of the Faculty Policy Committee on Faculty Governance" (page 5), our Teach Talk feature (page 8), commentary on undergraduate education, with three articles beginning on page 10, a report on how faculty medical benefits change upon retirement (page 16), a piece on the Engineering Systems Division (page 18), our MIT Poetry feature (page 20), an article on academic computing (page 22) and Web accessibility (page 24), and an OpenCourseWare Update (page 25).



The Management of the MIT Endowment

Allan S. Bufferd

WE HAVE PREPARED THIS ARTICLE in response to a request for comments on the management of the MIT Endowment. With the increased importance of the Endowment in the financing of activities at the Institute, this is a wonderful opportunity to more completely describe the management of these assets to the faculty, a core constituency of the Institute. A better understanding of how these assets are managed and how distributions from the Endowment are determined is essential to the setting of realistic expectations of the potential distributions from these funds in the future, and to further an understanding of the underlying obligations of the Institute to these funds, which are the result of gifts from many generations of alumni and friends of MIT.

In setting out these comments, we have drawn from recent presentations to the Academic Council and various departments. We are available for more direct discussions with other departments and laboratories to further elaborate on the comments presented here, and look forward to the observations of the faculty on the management of these assets and the distribution policies described.

Welcome Aboard President-elect Hockfield!

WE ARE EXCITED AND HOPEFUL over the arrival of a new president at MIT. Your experience at other universities and your knowledge of the biomedical sciences bring new resources into the Institute's leadership. A new hand at the helm provides opportunities to make strategic and policy adjustments that may be needed. We hope you will view the faculty as your colleagues, allies, and advisors.

Opportunities for extensive discussions with faculty will be hard to find, but necessary. Our faculty represents an extraordinary body of experience, knowledge, and engagement in the relationship of the Institute to both teaching and research missions, to the internal community of students and staff, and to the larger external community of institutions, corporations, governments, and nations.

Continuing globalization of the economy and the international sharing of knowledge means our role as a national resource has to be adjusted towards our also being an international resource. Given the increasing polarization of the U.S. economy into *haves* and *have-nots*, MIT will have to work even harder to avoid serving and training only the children of the *haves*. We are looking forward to working with you to achieve this goal. ■

[Editor's note: President-elect Hockfield has agreed to address the faculty in the January/February *MIT Faculty Newsletter*.]

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Photo credits: Page 1, MIT Museum; Page 17, Calvin Campbell

Editorial

Affirming Freedom of Expression at MIT

THE EVENTS OF 9/11 and the environment generated in response to 9/11, in particular the passage of the Patriot Act and the expansion of Homeland Security apparatus, have generated new dangers to the maintenance of free inquiry, expression, and speech that is the lifeblood of great universities. In particular, the issue of freedom of expression has emerged dramatically as a result of events at MIT's graduation last spring, and we feel strongly that the right to freedom of expression at MIT needs to be affirmed quickly and decisively.

At the June 2004 MIT Commencement, the MIT campus police prevented four members of the MIT Social Justice collaborative – three undergraduates and one alumnus – from peacefully leafleting marchers at graduation. They were actively prevented from handing out leaflets, and one was arrested. We believe that these acts constitute a serious violation of the Constitutional rights of the students and alumnus involved. Their leaflets spoke to issues of campus, scientific, and national relevance, and civilian vs. military priorities in the budget of the National Institutes of Health. The leafleters accosted no one, nor did they interfere with the progress of the graduation ceremonies. The subsequent release of the arrested leafleter, with charges dropped, is not an exoneration of the police actions. Arrests are chilling, and arresting and then releasing and dropping charges is a classic mechanism of suppression of free speech when no law has been violated.

Freedom of expression, particularly political speech, is a cornerstone of modern democracy. The right of free

expression is of particular importance in the university, in part in support of the broader democratic goal, in part because of the necessity of the fullest freedom of

expression for optimal progress in the academic enterprise. For these reasons, the MIT faculty needs to insist that:

- 1) The suppression of freedom of expression at Commencement 2004 was unacceptable and needs to be condemned by the MIT administration, not excused.
- 2) The protection of the rights of expression of everyone – students, staff, and faculty – is a fundamental task of campus police, and that
- 3) University rules and regulations protecting freedom of expression be strengthened in the coming period.

Among the reforms that we feel deserve serious consideration:

- Establishment of a Faculty/Staff/Student Review Board, modeled after Civilian Review Boards, to oversee police actions on the campus.
- The expansion of the MIT Campus Police mission to explicitly include the protection of the rights of freedom of expression and assembly of students, staff, and faculty.

To give some historical context to the viewpoint we express above, we note that despite its role as a leading partner in military research and national defense policy,

MIT has a long history of sustaining dissent – from the nuclear disarmament movement led by physicists Vicki Weisskopf, Herman Feshbach, Phillip

Leafleting of those attending the graduation march has been a frequent activity during the past four decades. Why do we suddenly witness such constitutionally protected speech being suppressed?

Morrison, Aron Bernstein, and Henry Kendall, to the Scientists Strike for Peace during the Vietnam War, led by David Baltimore, Ethan Signer, and others, to the Middle East critiques by Noam Chomsky and associates, to the student critiques and actions against the Gulf War and the current war in Iraq.

There have always been attempts to limit expression on such controversial issues, not only with respect to national policy debates, but also with respect to MIT policies. This faculty newsletter was founded because faculty members realized they had no independent means of publicly addressing each other or collectively criticizing the administration. The *Newsletter's* survival in its early years depended critically on an active struggle by faculty supporters.

Thus we are particularly sensitive to the issue of freedom of expression at MIT. Leafleting of those attending the graduation march has been a frequent activity during the past four decades. Why do we suddenly witness such constitutionally protected speech being suppressed? The most likely explanation is the changing political climate and the

continued on next page

Affirming Freedom of Expression at MIT
continued from preceding page

current federal administration's promotion of the Patriot Act and related initiatives, the chilling effect of which is to encourage self-censorship and inhibit many forms of political expression and assembly. We see this in the corralling of demonstrators at the Democratic and Republican National Conventions, and in the treatment of four young people on our campus.

Those of us old enough to have experienced the McCarthy period or the Civil Rights struggle are familiar with the use of a supposed internal enemy to justify suppression. In this coming period, MIT and other colleges and universities have an added responsibility to defend freedom of expression and assembly as granted in the Bill of Rights, and to ensure that the truth is not a major casualty of the war on terrorism.

We need to take the first steps in our own backyard, and guarantee that sup-

pression of dissent does not become accepted campus policy. There is some danger that the actions needed on this issue will fall between the old and new administration, with neither taking responsibility. We feel that the faculty must ensure that these deep issues are dealt with seriously and effectively. Our failure to do so will abrogate our responsibility to maintain the atmosphere of free inquiry, expression, and speech that is the lifeblood of great universities. ■

Editorial Sub-Committee

Teaching this fall? You should know ...

the faculty regulates examinations and assignments for all subjects.

Check the Web at <http://web.mit.edu/faculty/termregs>.
Questions: Contact Faculty Chair Rafael Bras at x3-2117 or rlbras@mit.edu.

First and Third Week of the Term

By the end of the **first week** of classes, you must provide a clear and complete description of:

- required work, including the number and kinds of assignments;
- an approximate schedule of tests and due dates for major projects;
- whether or not there will be a final examination; and
- grading criteria.

By the end of the **third week**, you must provide a precise schedule of tests and major assignments.

Tests Outside Scheduled Class Times:

- may begin no earlier than 7:30 P.M., when held in the evening;
- may not be held on Monday evenings;
- may not exceed two hours in length; and
- must be scheduled through the Schedules Office.

No required classes, examinations, exercises, or assignments of any kind may be scheduled after the last regularly scheduled class in a subject, except for final examinations scheduled through the Schedules Office.

No Testing During the Last Week of Classes

Tests after Friday, December 3 must be scheduled in the Finals Period.

From The Faculty Chair

Preliminary Position of the Faculty Policy Committee on Faculty Governance

Rafael L. Bras

LAST SPRING THE Faculty Policy Committee (FPC) started to codify some concrete ideas to improve faculty governance. Nobody considers the system as broken, but the Committee feels that improvements are possible, and indeed necessary, to facilitate two-way communications between the faculty and our administrative leaders; to strengthen the input of the faculty as a whole on important policy and strategic decisions; to render the committee structure more streamlined and efficient; to make faculty meetings more relevant and better attended; and to provide the officers with the tools to represent the faculty appropriately. FPC's discussions are guided by a series of principles, to be respected as ideas for changes emerge. These principles are:

1. Preserve the concept of a unified faculty;
2. Minimize bureaucracy;
3. Maintain and enhance the close working relationship with colleagues in the administration;
4. Keep MIT's governance above petty politics.

The following concepts have remained as possible propositions for experimentation or implementation. Faculty governance is discussed in terms of three elements: the officers of the faculty, the faculty meetings, and the committee structure.

The Faculty Policy Committee wants your input and suggestions. The FPC is also requesting the comments of President Vest and President-elect Hockfield, as well as other colleagues in administration. Once all comments are received, we hope to formulate a proposal

that will be discussed with Academic Council and then in a faculty meeting. Hopefully this process will lead to improvements in governance to be implemented in the near future.

Officers of the Faculty

The Officers of the Faculty should work as a team. Each should have well defined roles, yet it should be recognized that their most important activity is to be stewards of the policies, regulations, environment, and processes that make the faculty the ultimate body directing the educational and research enterprise of the Institute. The officers, and particularly the Chair of the Faculty because of her/his participation in key committees, have the responsibility to represent the interests of the faculty.

Office of the Chair of the Faculty

The Officers of the Faculty should have a permanent and visible locale well known to the MIT Community, particularly the faculty. This area should:

1. Have meeting space,
2. House a full-time administrator and assistant,
3. Be the repository of files and archives, and
4. House the *Faculty Newsletter* activities. It is understood that the *Faculty Newsletter* is an independent outlet for faculty communications and is operated by an editorial board on which the Chair of the Faculty is just another member.

The "administrator" should be a full-time individual responding to the Officers and with the Chair as direct supervisor.

The role of the administrator should include:

1. Assisting the Chair, Associate Chair, and the Secretary in their duties,
2. Arranging logistical set-up of faculty meetings,
3. Writing the first draft of minutes of faculty meetings to be completed by the Secretary,
4. Maintaining a list of outstanding current issues,
5. Dealing with all day-to-day operations of the office,
6. Staffing the Faculty Policy Committee,
7. Staffing some of the other standing committees. Some committees, like the Committee on Undergraduate Programs (CUP), Committee on Curricula (CoC), and Committee on Academic Performance, (CAP) are naturally best served by staff from corresponding administrative officers, as they are now.
8. Serving as a communication link to all standing committees and their staffs,
9. Promoting and facilitate communication with the Office,
10. Serving as the spokesperson of the Office in ways to be defined by the Chair.

The Office of the Chair of the Faculty should have an annual budget for operations, with the Chair as the responsible supervisor of its use. It is important to note that FPC is *not* suggesting that the Chair of the Faculty be physically at the Office of the Chair of the Faculty. In fact, the opinion is that the Chair should physically remain at their normal office location.

continued on next page

Preliminary Position of the FPC

Bras, from preceding page

Duties of the Officers

Chair of the Faculty

The term of the Chair of the Faculty should be three years; it is currently two years. Any changes in term will not apply to the current Officers of the Faculty.

Duties should include:

- Setting the agenda of faculty meetings
- Chairing the faculty meetings in the absence of the President
- Chairing the Faculty Policy Committee
- Working with the Nominations Committee in appointing Chairs of standing committees
- Working with the President and other MIT officers on appointment of ad hoc committees or task forces
- Convening the Chairs of standing committees twice a year
- Sitting on Academic Council (including the Deans and promotions sub-groups)
- Participating *ex officio* on key committees (those dealing with issues that could result in major policy implications)
- Addressing faculty grievances
- Leading the faculty at graduation
- Attending meetings of the MIT Corporation
- Appointing faculty committees on presidential searches, in collaboration with the other officers of the faculty
- Hosting receptions and events
- Recognizing faculty and their service
- Introducing the Killian lecturer
- Managing the election of Institute professors
- Promoting communication via frequent formal and informal meetings with key individuals at MIT
- Overseeing the adherence to term regulations
- Overseeing the regular review of the *Rules and Regulations of the Faculty* and helping Academic Council maintain the currency of policies and procedures
- Communicating and controlling communication with the faculty-at-large.

Associate Chair

The Associate Chair should serve the same term as the Chair. Duties should include:

- Setting the agenda of the faculty meetings
- Assisting the Chair and representing the Chair in her/his absence
- Serving as a member of the Faculty Policy Committee
- Serving as an *ex officio* member and liaison to the Committee on Undergraduate Programs
- Addressing faculty grievances
- Working closely with the Chair in all her/his duties, as needed.

Chair-Elect

The Chair-Elect should be a full-fledged member of the Faculty Officers and participate in their work during the year-in-transition. The Chair-Elect should become a guest of the Faculty Policy Committee.

Secretary

The Secretary should serve the same term as the other officers. Roles should include:

- Setting the agenda for faculty meetings
- Sending out calls to faculty meetings
- Overseeing and monitoring written presentations of motions and other material for presentation to the faculty
- Writing and distributing minutes of the faculty meetings
- Addressing faculty grievances
- Coordinating on-going records of standing committees for the Officers
- Overseeing archiving of all records
- Coordinating memorial tributes to faculty members
- Authorizing the Registrar's list of degree candidates
- Serving as a member of the Faculty Policy Committee
- Serving as an *ex officio* member of the Committee on Graduate Student Policies.

Faculty Meeting

The Faculty Policy Committee sees the faculty meeting as an instrument to promote debate, influence policy, and

provide the faculty with ownership of major decisions affecting the educational and/or research enterprise of the Institute. Historically, faculty meetings are poorly attended, except on rare occasions. There are several (negative) reasons for the poor attendance. First, there are issues of form and structure that discourage attendance and do not promote a sense of ownership and open discussion by the faculty. Second, there is a feeling that all decisions are already made and the meeting is a "rubber stamping" exercise. Third, there is a sense that the issues brought to the meeting are at best unimportant. A fourth (and positive) explanation for the lack of attendance and participation, is that the faculty trusts the committee structure and the administration to make the right decisions.

FPC has compiled the following list of possible changes. Several of these can be implemented as experiments without changes to the *Rules and Regulations of the Faculty*. For example, under present regulations, it is possible for the President to cede the chairing of the meeting to the Chair of the Faculty. As stated earlier, many of the suggested changes are only structural.

1. Some faculty meetings to be led by the Chair of the Faculty. Both the Chair and the President should continue to be present at all meetings.
2. Request that each department appoint three representatives to attend faculty meeting, for staggered two-year cycles. These individuals, generally senior faculty, will have the responsibility of reporting to their units. Note that the meeting will continue to be open to all faculty members and all faculty in attendance will have a vote.
3. Change the time of meetings not to conflict with classes. A possibility is to alternate times.
4. Have separate business and informational meetings. Develop a set of agenda items for general debate.
5. Introduce evening dinner meetings, maybe at the beginning of each term, in order to define issues.

6. Publish position statements on issues that come up to the faculty, (faculty committees to present succinct arguments for and against).
7. Standing committees should report to the faculty at least annually.
8. Have the ability to have at least some faculty meetings closed to the public. Dinner meetings could serve that role.
9. Develop a Web-based voting procedure for some of the most routine, but necessary, votes.

Committee Structure

The committees of the faculty are the key to good governance.

Overall the committee structure works well. Improvement is needed in:

1. Communication of the Faculty Policy Committee with other committees,
2. Communication between committees,
3. Overlap with other faculty committees, and
4. Charge of committees.

In thinking of the committee structure, it is important to keep in mind that, in our system, the faculty meeting is a committee of the whole.

Definition of Committees

The standing committees are: Academic Performance, Curricula, Discipline, Faculty Administration, Graduate School Programs, Library, Nominations, Outside Professional Activities, Student Life, Undergraduate Admissions and Financial Aid, and Undergraduate Programs. In addition, there is a Communications Requirement Subcommittee of the Committee on Undergraduate Programs, Edgerton Faculty Achievement Selection Committee, and the Killian Award Selection Committee.

Most committees work well and have full agendas. Nevertheless, it is necessary to review the charge of all committees, their relevance and composition relative to their tasks. At least two committees – Outside Professional Activities and Faculty Administration – are currently defined in ways that limit their potential.

Some Thoughts

As a way to improve communications, all standing committees should have a representative from the Faculty Policy Committee. All committees should report to the Faculty Policy Committee on an annual basis, via short written or oral reports, as necessary. In some cases, reports to the faculty at large may be necessary (as is already the case with the Committee on Discipline). Committee chairs should meet with the Faculty Policy Committee and the Faculty Officers twice a year. All meetings of committees should be recorded in minutes and they should all be archived. The minutes should be shared with the Faculty Officers.

The mandate of the Committee on Administration should be clarified and the membership redefined; the same applies to the Committee on Outside Professional Activities. An outcome may be that the existing functions of these committees could be folded into other existing or new standing committees.

The Committee on Graduate School Programs should parallel the CUP/CoC, possibly splitting into two functions, policy and curricula, and include a faculty member as chair, with the Dean of Graduate Students as an *ex officio* member, as is the case with undergraduate committees.

The outgoing Chair of the Faculty should name the membership of the Nominations Committee. Nominations to committees and to the Chair of the Faculty should be requested from the faculty. The Chair should appoint the Associate Chair of the Faculty and the Secretary.

The membership of the Faculty Policy Committee should increase to include more faculty members. The Secretary of the Faculty should be a voting member.

A clear process should be in place for periodic review of standing committees, and a process to add or eliminate committees. Monitoring the “health” of committees could be a role for the Chair-Elect during her/his year-in-training, so a review would occur at least every three years.

All ad hoc committees of the President, Provost, or Chancellor should be discussed with the Faculty Policy Committee to make sure that the role of standing committees is considered and membership discussed.

New standing committees may be necessary on:

1. International engagements,
2. Graduate program policy,
3. Graduate programs curricula and degrees, and
4. Faculty regulations and policies and procedures.

Concluding Remarks

MIT operates better than most other academic institutions. Its system of governance allows for a speedy decision-making process; it aims to be conclusive; it is not caught in political intrigues; and most importantly, has avoided the “them versus us” syndrome between the administration and the faculty. After all, the academic administration is composed of faculty. All of the above are characteristics that we must preserve. Nevertheless, the system must evolve and adjust to the times. If the faculty is to retain the responsibility of the academic well being of the Institute, then it must become more involved and the system of governance should encourage and facilitate that involvement (see “Improving our System of Faculty Governance,” *MIT Faculty Newsletter*, Vol. XVI No. 4, February/March 2004).

The suggestions made in this document are made in the spirit of the above paragraph, and evolve from discussions in the Faculty Policy Committee. MIT is never afraid of change and always ready to improve. FPC is eager to experiment in the search for improvement in governance. Please share your opinion with us. You can write to rlbras@mit.edu or participate in discussion through <http://web.mit.edu/faculty/>. ■

Rafael L. Bras is a Professor, Civil and Environmental Engineering and Earth, Atmospheric and Planetary Sciences; Faculty Chair (rlbras@mit.edu).

Teach Talk

Developing Musical Structures: A Reflective Practicum

Jeanne S. Bamberger

[These comments are excerpted from the paper, “The Development of Intuitive Musical Understanding: A Natural Experiment.” *Psychology of Music*: January, 2003. <http://www.sempr.org.uk/journal.html>]

OVER THE YEARS I have taught the music fundamentals course subscribing to the usual rule-based music theory practice. But recently, out of a sense of dissatisfaction, I redesigned the course, most simply to make it work better – more appropriate to students’ largely untutored but none-the-less well-developed musical intuitions, and more responsive to students’ active and self-motivating ways of learning.

As I saw it, there was a major problem with previous approaches to the fundamentals course: we have been asking students to begin with what we believed were the simplest kinds of elements, but we were actually confusing smallest elements with simplest elements. We focused on these small, isolated, decontextualized pitch and duration elements partly because they are the easiest to define, and thus also the easiest to assess with respect to whether students have learned them or not. More important, the symbols that represent these elements are the tools of the trade for seasoned musicians – they are what we depend on for communicating with one another, for saying what we heard and for telling others what they should hear and play. But in doing so, we are not distinguishing between, on one hand, our own most familiar units of description, the notes shown in a score and our analytic

categories, and on the other, our intuitive, contextual units of perception – those which we all, in fact, attend to in listening and making sense of the music all around us.

From everything I have learned so far, these “units of perception” are highly aggregated, contextually and functionally meaningful entities such as motives and phrases, their boundaries marking the landmarks, the goals of motion, as we follow the continuously unfolding performance of a composition. We don’t listen to “notes” anymore than we listen to letters or even phonemes in following the unfolding of ideas in a lecture or a play.

It is not surprising, then, that students, often those who are best at improvising and playing by ear (as well as those who are best at improvising when making and fixing mechanical gadgets), are sometimes baffled and discouraged when we ask them to start out by listening for, looking at, and identifying the smallest, isolated objects. For in stressing isolated, decontextualized objects to which our units of description refer – to measure and name objects in spite of where they happen and their changing structural function – we are asking students to put aside their most intimate ways of knowing.

The new course, called “Developing Musical Structures” (21M.113) perhaps surprisingly shows certain similarities with the innovations implemented by TEAL in physics (Belcher, *MIT Faculty Newsletter*, Vol. XVI No. 2, October/November 2003) and the comments of Warren Seering in mechanical engineering (Seering, *MIT Faculty Newsletter*, Vol.

XVI No. 1, September 2003). For example, instead of starting with exercises drawn from canonical music theory, students begin by actually making music through composition projects aided by the computer music environment, *Impromptu*.

Design Principles

Two very basic principles have guided the design of the course and *Impromptu*. First, computers should be used only to do things we can’t do better in some other way. Second (borrowed from Hal Abelson), an educational computer environment is valuable to the degree it causes its developers to re-think the structure of the relevant domain. Thus instead of saying, “Here is this computer with all these neat possibilities, what can I do with it?” I said, “Here are some things that beginning music students can do already, how can I use this intuitive know-how to help them learn to do what they can’t yet do in a more musically relevant, intuitive, and accessible way?”

Impromptu evolved in answer to these questions coupled with related issues of representation. Music notations represent music at the “note” level and I wanted to give beginning students more aggregated and perceptually meaningful elements. But “notes” are necessary to make them. So, I was drawn to the potential of the computer as an interactive medium because I could create programmable, clickable icons that would immediately play just such already aggregated melodic motives. These playable icons would function for beginning students in their initial composing projects as both units of perception and units of work. We called them tuneblocks.

The Working Environment

In the screen shot below, the icons on the right, when clicked, play meaningful structural entities (motives); in this example, they include the motives with which to reconstruct the melody, “Ode to Joy.” To build the melody, students drag tuneblocks into the Playroom and arrange them in order so that they play the whole melody.

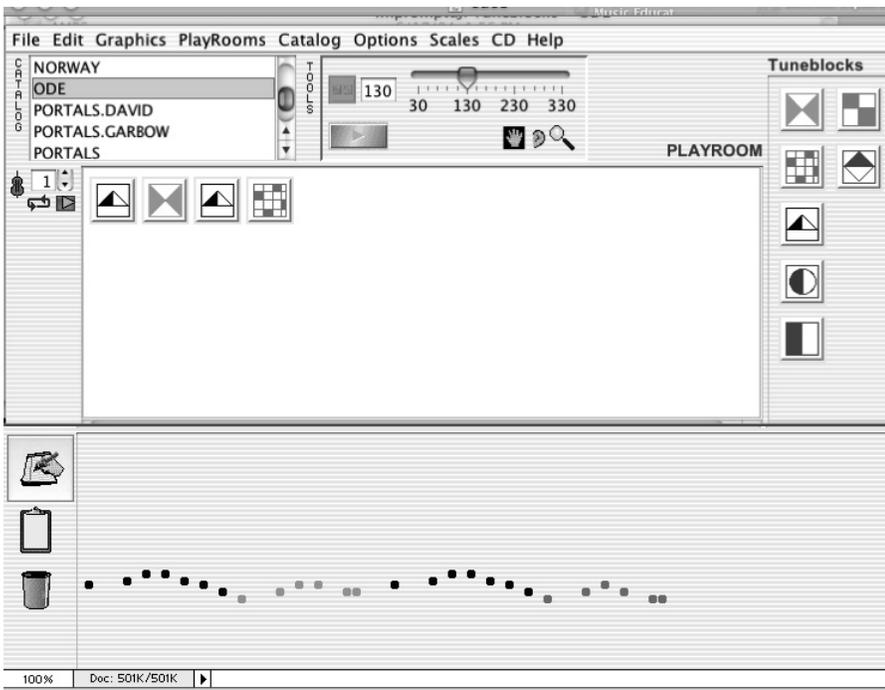
Blocks 3-1-3-2, the opening two phrases, are shown in the Playroom. Notice that as students build up a melody, they are actually involved in “constructive

“that you like and that makes sense” by listening, arranging, and rearranging blocks in the Playroom window and also modifying the “contents” (pitch and rhythm) by “opening up” the blocks using the edit window. It turns out that almost everybody can do that. However, in any one class of 10 or so, given the same materials, no two students come in with the same tune. [To listen to the blocks and to hear some student melodies, please see the online version of this article on the *Faculty Newsletter* Website, <http://web.mit.edu/fnl>.]

and insights rather than on collecting notes drawn from the instructor’s knowledge and information. Instead, as instructor, I am interrogating, probing, questioning – in order, collaboratively with the students, to make sense of and build on their sense-making.

The text, *Developing Musical Intuitions* (Bamberger, 2000) and recorded examples on an accompanying CD, illustrate how composers have used and extended some of the structural principles that are emergent in the students’ own work. In addition to the conventions of notation and other vocabulary, the basics of music fundamentals are couched in terms of generalizable principles, thus informing encounters students have had in composing, listening critically to one another’s work and to the recorded examples.

One of the gratifying results of the class is that instead of my devising questions to test what the students have learned, it is their continuing investigations into their own and one another’s musical understanding that becomes the generative base for developing new knowledge. Searching for answers to questions that they have put to themselves, students begin to build a developing theory of musical coherence. At the same time they are developing hearings and appreciations of music that go beyond what they know how to do already, to knowing about and knowing why. And in that process, they are also learning to hear and to notice aspects of music that previously passed them by, thus helping to broaden their musical taste and their listening preferences. Rather than giving up their intuitions, they learn in the service of better understanding them. ■



Impromptu Window

Units of Work: Multiple Representations

analysis” – i.e., they are reconstructing the larger structure of the melody as embodied by the sequence of icons/motives. The graphics window at the bottom of the screen shows a more fine-grained representation of the sounding blocks – “pitch contour” graphics.

The most interesting work develops when students are given what they called “strange” blocks borrowed from unfamiliar pre-tonal or post-tonal styles. Students are asked to make a melody

Most important, students are asked to reflect on their process of composition as an integral part of the process, itself. As they work, students keep a log commenting on their decisions, and how this informs their emergent “model of a sensible tune.” Students’ papers, together with the performance of their compositions, become the center of our class discussions. Of course, students are often surprised, even confused, that the focus in class discussions is on their puzzlements

Jeanne S. Bamberger is a Professor of Music and Theater Arts (jbamb@mit.edu).

Work of the Committee on the Undergraduate Program, 2003 – 2004

J. Mark Schuster

THE COMMITTEE ON THE Undergraduate Program (CUP) oversees the undergraduate academic program, particularly the freshman year and inter-departmental programs. CUP pays particular attention to long-term initiatives and policies. It is responsible for encouraging experimental innovation in undergraduate educational policy and has the authority to approve and supervise limited educational experiments. This authority extends to granting exceptions to the *Rules and Regulations of the Faculty* in order to facilitate such experiments.

CUP works closely with the Committee on Curricula (CoC) and the Faculty Policy Committee (FPC), and together these three committees make up the core skeleton of the faculty governance structure. The work of these committees is not often visible to the full faculty, but the decisions that they make impact us all. That is why I am taking this opportunity to give the faculty an update on the work undertaken by CUP during the 2003-2004 academic year.

Last year's CUP agenda focused on four main topics: reviewing two CUP-licensed experiments that were reaching the end of their trial period; considering proposals from two new undergraduate programs that have requested temporary devices to restrict enrollment; monitoring the implementation of various changes in the undergraduate program; and working with the Committee on Student Life (CSL) to articulate new guidelines for the advising and mentoring of upper-class students.

Review of CUP-Licensed Experiments

When CUP authorizes an educational experiment, it does so for a limited length of time and the experiment is subjected to periodic reviews by the Committee as to its promise and success. In 2003-2004, two educational initiatives came to the end of their experimental periods: the Special

Freshman Program in Media Arts and Sciences and III-C, the experimental undergraduate major in Archaeology and Materials.

The Special Freshman Program in Media Arts and Sciences

The Special Freshman Program in Media Arts and Sciences (MAS) was designed to offer freshmen a hands-on experience inside the Media Lab, which does not offer an undergraduate major. This program had been run, since it was established in 1998, as an experimental alternative freshman program endorsed by CUP. During the 2003-2004 academic year, CUP took a close look at the track record of the program to determine whether the committee would endorse permanent status.

CUP discussed the MAS program over the course of several meetings, during which reservations were expressed concerning the coherence of the student experience in the program and the lack of available data about and from participants. Members of CUP had some lingering concerns over the quality of the experience offered by the program, and there was a feeling that the program had not done enough to ensure its separate identity as an alternative freshman program. MAS was asked to address these concerns through a clearer articulation of the goals and objectives of the program, development of a more coherent fall academic program for participants, and an outline of how its success will be monitored. MAS has since presented a plan to CUP, which includes improved use of Freshman Advisory Seminars, greater visibility for MAS.110 (the core fall subject, which is now approved as a communication-intensive HASS subject [CI-H] and a HASS elective), and clearer articulation of the role of UROP placements in this program.

As a result, CUP has endorsed permanent status for the program, but it also believes that the MAS Freshman Program should be reviewed in the context of all the alternative freshman programs. Thus, CUP has recommended to the Task Force on the Undergraduate Educational Commons that it articulate criteria and guidelines for alternative freshman programs as part of its deliberations. Once such criteria are articulated, CUP would then review the MAS Freshman Program and all other alternative freshman programs accordingly.

S. B. Degree in Archaeology and Materials

On rare occasions, CUP has taken the responsibility for authorizing experimental majors; the undergraduate programs in Comparative Media Studies and in Archaeology and Materials are the most recent examples. In 2003-2004, CUP undertook a review of the experimental undergraduate major in Archaeology and Materials (III-C) – the first to be informed by the Guidelines for the Approval of New Undergraduate Programs endorsed by the faculty in spring 2003.

CUP determined that, over the duration of this educational experiment, III-C had evolved into an innovative and vibrant undergraduate program with committed faculty and excellent students. III-C has all the hallmarks of a successful program of the sort that CUP would like to encourage. Accordingly, at the May 2004 faculty meeting, CUP introduced a motion to make the S. B. in Archaeology and Materials a permanent major. The final vote on this motion was taken and passed at the September 15, 2004 faculty meeting.

Because the III-C program has raised several issues that have been under discussion for some time, some further explana-

tion of CUP's endorsement is in order. One of the original criteria articulated by CUP for evaluating the success of III-C was the number of students enrolled in the major. The committee no longer considers this criterion to be determinative. By endorsing III-C, it is not the intent of CUP to divert attention from the size of proposed programs, but to assert that the number of majors is not the only indicator of relevance. Overall enrollment in the subjects associated with this program has been substantial and continuing, and the HASS concentration has been markedly successful.

In the committee's deliberations, other criteria emerged as relevant in assessing the quality of the program, and they are the basis for CUP's recommendation that the program be made permanent. In particular, the III-C program has made a commitment to teaching students about the origins of the disciplines that it incorporates. This merging of the social sciences, humanities, science, and engineering within a single curriculum is something that the CUP has long favored and encouraged.

Temporary Restrictions on Enrollments

During the 2003-2004 academic year, CUP received proposals to limit temporarily enrollments in two new academic programs: the minor in Management and a major in Biological Engineering.

Minor in Management

The Sloan School has been developing a proposal for an undergraduate minor in Management. The proposal will be brought to the Committee on Curricula early in fall 2004. The expectation is that when it is launched in fall 2005, this minor will become an attractive option for undergraduates across the Institute, but there is a great deal of uncertainty as to what the actual demand will be. Consequently, Sloan has been working with CUP to develop a rationing mechanism that could be used to ease the transition into the new minor. Thus, while the minor in Management is being proposed as a permanent program, Sloan has asked

CUP to authorize a rationing mechanism on a transitional (experimental) basis, and the committee has endorsed the plan to use a lottery integrated into the existing Sloan bidding process to allocate space in the minor. The first such lottery will take place in spring 2005 and may continue for up to four years.

S. B. Degree in Biological Engineering

The Biological Engineering Division is developing a proposal for an undergraduate major in Biological Engineering. It, too, is concerned about the potential volume of students who might declare Biological Engineering as their major. CUP has had several discussions with the faculty who are developing this program, and it has become clear that the most important binding constraint is laboratory space for required subjects. CUP has advised the Biological Engineering Division as to what forms of allocation might be acceptable, and a final proposal is pending.

Changes in the Undergraduate Program

CUP is responsible for overseeing changes in the undergraduate program, particularly in the General Institute Requirements (GIRs). Recently, CUP has been called on to monitor the roll-out of the new Communication Requirement, the experiment with the sophomore Exploratory Subject option, and changes to spring-term grading for freshmen.

Responsibility for day-to-day oversight of the Communication Requirement falls to the CUP's Subcommittee on the Communication Requirement (SOCR). Over the past three years, SOCR has been particularly involved with the approval of CI-M subjects, those communication-intensive subjects that are offered as part of every major. There is considerable variation as to how departments implement this component of the requirement, and SOCR is working to make sure that this variation is sensible and appropriate to the disciplines.

2003-04 was the second year since spring-term freshman grading changed from Pass/No Record to A, B, C/No

Record. CUP has been monitoring the impact of these changes in detail, but it is too early to tell how they have been received either by the faculty or students.

Linked to the changes in freshman grading has been an experiment allowing sophomores to designate one subject each semester as "Exploratory." While there were some start-up issues linked to the roll-out of the Exploratory option, 289 sophomores chose to designate one of their subjects as Exploratory in the fall (ultimately, 64 of these students opted to convert the subject to Listener status), and 320 designated an Exploratory subject in the spring (with some 34 conversions to Listener status to date).

CUP will continue to monitor all of these changes in the coming year, particularly as more data become available as to their success (or failure).

Advising and Mentoring

Over the past several years, CUP has had a number of conversations concerning the quality of undergraduate advising and mentoring. CUP members are concerned about the relatively low number of faculty involved in freshman advising in general, and in Freshman Advisor Seminars in particular. We are also concerned about the quality of advising of upper-class students once they declare their majors. These concerns are shared by the Committee on Student Life, and the two groups have been developing a series of recommendations that we hope to present to the faculty this fall. We will also be coordinating this work with the Task Force on the Undergraduate Educational Commons.

It is my hope that these comments have made the work of CUP a bit more transparent to our faculty colleagues. As chair of CUP, I urge any faculty member who has an idea or a concern relating to the work of our committee to contact me directly at: jonmark@mit.edu. ■

J. Mark Schuster is a Professor of Urban Cultural Policy; Chair, Committee on the Undergraduate Program (jonmark@mit.edu).

Task Force on the Undergraduate Educational Commons

Robert J. Silbey

IT IS NECESSARY, from time to time, for a great university like MIT to take stock of its undergraduate educational programs from a fundamental perspective. As a matter of course, these programs evolve slowly over time as faculty introduce new ideas and new teaching techniques. Since the last thorough examination of the undergraduate curriculum, the MIT undergraduate student body has changed dramatically, becoming more diverse across a wide range of dimensions.

For these reasons, this is an appropriate time for us to reevaluate undergraduate education at MIT, and to ask if our students – when they graduate – are appropriately educated and have acquired the skills and attitudes necessary to make positive contributions to their field and to society. The report of the 1998 Task Force on Student Life & Learning discussed community life at MIT and made recommendations for improving our environment – some of which have been acted upon. Building on that foundation, the newly formed Task Force on the Undergraduate Educational Commons will affirm and update the goals of an MIT undergraduate education and propose improvements to the core educational experience that are tailored to the students we teach and the world in which they live.

During the spring term, the Task Force on the Undergraduate Educational Commons met bi-weekly to educate itself about the current state of the core educational program. The General Institute Requirements (GIRs) are designed to broaden our students' academic horizons, improve their problem solving and analytical skills, and provide a solid foundation upon which future learning can be

built. The Task Force dedicated a number of meetings to fully understanding what the GIRs encompass, the history that has led to their current form, how successful they are perceived to be, trends in enrollments and other data, and the issues and challenges faced by those who deliver the GIRs. As each requirement was reviewed, familiar themes emerged: pressure and pace; a desire to add to the curricular requirements coupled with a reluctance to take anything out; and issues with the retention and application of material learned in the first year. There was also discussion of a perceived lack of excitement and engagement among students in the first year and a need to articulate the purpose and goals of the core curriculum in a more effective manner.

Individual members of the Task Force gathered input from various stakeholders in the educational commons, including the faculty who teach the core subjects, the MacVicar Fellows, the faculty Undergraduate Officers in each department, the Engineering Council on Undergraduate Education, and the DUE Visiting Committee. These groups raised concerns over the allocation of time within the curriculum and the trade-offs necessary to add new components to the MIT educational experience. In addition, many members of these groups expressed a specific need to revisit the purpose, goals, and implementation of all the undergraduate requirements.

The student members of the Task Force reached out to the larger community through an open forum and two smaller student roundtable discussions. They also gathered student opinions through the UA Website and in conversa-

tions with the Student Senate. Much of the student sentiment focused on the need to simplify the HASS requirement and broaden the School's subject offerings. In addition, a group of students strongly advocated the development of a "diversity requirement." There was unanimous praise for undergraduate research opportunities, but students expressed a desire for interaction with faculty members in a wider variety of settings.

Dean of Admissions Marilee Jones attended an early Task Force meeting to report on the profile of the current generation of students, and how this profile has changed in the past 10 years. According to Marilee, our students have broader interests than MIT students of the past. They have been encouraged throughout their lives to engage in a wide range of activities and feel significant pressure to succeed in all of them. These students are accustomed to having little unstructured time and have had minimal experience with failure. All of these factors have significant implications for how we teach our students and consequently what and how well they learn.

During an intensive work week held shortly after commencement, the Task Force heard from instructors of a few of the innovative, hands-on subjects that are taught throughout the Institute, such as 12.000 (Solving Complex Problems); 2.000 (How and Why Machines Work); and 6.002X (an experimental version of Circuits and Electronics). The group considered whether these classes could serve as models for additions to the educational commons that would increase enthusiasm and conceptual learning among students. Dr. Lori Breslow of MIT's Teaching and Learning Lab joined the group for a dis-

cussion of recent pedagogical research underway at MIT and elsewhere. The group reviewed the success of active learning approaches and debated the methods and feasibility of incorporating this type of teaching into a wider range of subjects.

The Task Force spent a full morning talking with Associate Dean of Engineering Dick Yue, chair of the School of Engineering Council on Undergraduate Education (ECUE). In addition to hearing about the results of a number of surveys of SoE students and faculty (including a study of engineering student workload patterns), Professor Yue shared ECUE's thoughts on potential links between engineering education and the core educational program.

The Task Force also reviewed preliminary findings from this year's Senior Survey and requested additional analysis from the Institutional Research staff of the Provost's Office. As in the past, the data indicated that students at MIT place greater importance on developing analytical, quantitative, and problem solving abilities than on understanding and appreciating the humanities, arts, and social sciences. The Task Force hopes to be able to track the priorities of students over time and compare MIT results to those of other institutions, shedding light on whether it is reasonable for the MIT educational commons to encourage greater balance among these areas.

The remainder of the work week was dedicated to reviewing the findings of prior committees regarding the goals of an MIT education and the principles that guide the teaching of our students. At the end of the week, the group broadly defined four focus areas on which to concentrate. Members divided into small groups and will report their progress to the full Task Force this month.

The Task Force was charged to engage actively with the entire MIT community throughout its deliberations, and as the group moves in the upcoming months from learning mode to generating a draft set of educational goals and ideas, we intend to live up to this commitment. Members of the Task Force will begin an active outreach to departments, faculty,

Task Force Membership	
• Robert J. Silbey , Task Force Chair Chemistry Dean, School of Science	• Albert R. Meyer , Ex Officio Electrical Engineering and Computer Science Chair, Committee on Curricula
• Rafael L. Bras , Guest Member Civil and Environmental Engineering Chair, Faculty Policy Committee	• Haynes R. Miller Mathematics
• John G. Brisson II Mechanical Engineering	• David A. Mindell Science, Technology, and Society Program Engineering Systems Division
• Margaret S. Enders , Executive Officer Associate Dean, Office of the Dean for Undergraduate Education	• Heidi Nepf Civil and Environmental Engineering
• Steven D. Eppinger Sloan School of Management	• Dava J. Newman , Associate Chair Aeronautics and Astronautics
• Elizabeth L. Greenwood Mathematics, Class of 2005	• Robert P. Redwine Physics Dean for Undergraduate Education
• Thomas J. Greytak Physics	• Jessica B. Rhee Chemical Engineering, Class of 2006
• W. Eric Grimson Electrical Engineering and Computer Science	• J. Mark Schuster , Ex Officio Urban Studies and Planning Chair, Committee on the Undergraduate Program
• Paula Hammond Chemical Engineering	• Charles Stewart III , Associate Chair Political Science Associate Dean of the School of Humanities, Arts, and Social Sciences
• Diana Henderson Literature	• Christopher A. Suarez Electrical Engineering and Computer Science, Class of 2006
• Kip V. Hodges , Associate Chair Earth, Atmospheric and Planetary Sciences	• J. Kim Vandiver Ocean Engineering Dean for Undergraduate Research
• Chris Kaiser Biology	• John R. Velasco Political Science, Class of 2005
• Thomas Kochan Sloan School of Management	
• Tomas Lozano-Perez Electrical Engineering and Computer Science	
• John Maeda Media Arts and Sciences	
• Anne McLeod Staff Associate, Office of the Dean for Undergraduate Education	

students, staff, and alumni to share our work-in-progress, as well as to solicit feedback. In addition, our student members will establish a student advisory group to ensure that we receive regular input from the wider student community. While the Task Force has made progress, there is still much work to be done. Now that the group has developed a solid understanding of the current state of MIT's educational program and the forces that are impacting the MIT experience, we can focus on what aspects of the curriculum need to be addressed and how we can best

achieve educational reform. As we formulate a vision of the MIT of the future, we will look to you to provide your perspective. Contact your colleagues from the membership list to share your ideas for enhancements to the undergraduate educational commons. For more information, see the Task Force Website: <http://web.mit.edu/committees/edcommons>. ■

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Some Reflections on Aspects of the Undergraduate Education Policy

James B. Orlin

RECENTLY, I HAVE BEEN giving more than my usual amount of thought to some aspects of undergraduate policy, in part because of issues that have arisen in teaching undergraduates, and in part because of my new role as a member of the Committee on Academic Performance (CAP). My goal in this note is to raise issues for discussion, and not to propose new policies, per se.

Possible Limits on Units

This past semester, I became aware of three different students in my class who were taking over 100 units each. Each of them asked to take the final exam a day later than the scheduled time, not because of conflicts, but because of the stress they were feeling. I was surprised to learn that there is no upper limit on the number of units taken by undergraduates after their first year. A limit on units would have helped in these situations because it would have lowered the stress level, and because it would have made it much less likely that these students would have asked for special privileges.

I was relieved to learn that taking such an excessive number of units is not widespread. I obtained data from the Registrar's Office for this article, and learned that only six students out of more than 3000 students (2nd year and higher) completed the semester with 100 or more units, and fewer than 3% of students completed the semester with 75 or more units.

The table summarizes the number of units taken by students.

	<u>2nd year</u>	<u>3rd year</u>	<u>4th year</u>	<u>all students</u>
Avg. Number of Units				
Before Add Date	64	64	58	62
After Add Date	57	57	49	54
After Drop Date	54	53	45	50
Maximum Number of Units				
Before Add Date	150	207	267	267
After Add Date	126	186	195	195
After Drop Date	111	138	99	138
% taking 75 units or more				
Before Add Date	20.5%	21.2%	18.3%	20.0%
After Add Date	5.1%	7.6%	3.9%	5.6%
After Drop Date	3.1%	3.5%	2.0%	2.9%

Even if the problem of students completing the semester with very large subject loads is not common, it still may be worthwhile to consider limits on units, and to see whether it would be good educational policy. There are clearly pluses to permitting students to take as many units as they want. It shows that MIT values personal autonomy of students, and makes it easier for students to double major or to graduate in three years, or possibly both. It also avoids the need for mechanisms for limiting loads. But this liberty also comes with costs. It leads to students spreading their focus, and not giving the necessary attention to individual subjects. It increases the stress level. It negatively affects subjects that have group projects. Given the efforts and thought that went into limiting the number of units of first-year students, it is time to broaden that discussion to consider students after their first year.

Drop and Add Dates

Relating to the issue of overload is the issue of when drop and add dates occur in the semester. It seems to me (perhaps because I am naïve), that the primary advantage of having drop dates so late in the semester (and later than the dates for comparable universities) is so that students have even more time to assess what their final grade in the class will be, and thus make a more informed decision on how to improve their GPA via selective dropping. Undoubtedly most undergraduates value this option; however, it seems to me to hinder education at MIT rather than aid it. It results in students deliberately taking overloads, and spreading their efforts too thinly. And, it encourages them to overly focus on the grade rather than on the education. And for instructors, it means that the class size is not dependable. It is also incompatible with six-week subjects, which is a time period

that is becoming more common at the Sloan School.

Perhaps the greatest problem created by late dropping is the enormous waste of intellectual efforts and resources. Students waste enormous time in taking subjects for half a semester, and faculty and TAs waste enormous resources in teaching and grading these students. Given the scarce resources available, MIT should rethink when is an appropriate time for the drop date.

What is Acceptable Academic Performance?

When discussing academic performance of undergraduate students, we flag students who are taking fewer than 36 units, or who have a term GPA that is below 3.0. As I recall, this was the same criteria used when I arrived at MIT some 25 years ago, despite substantial changes in our undergraduate population and despite the possibility that there has been grade inflation. This may be a good time to review what is required for performance to be acceptable at MIT.

There are several issues to consider with respect to what constitutes acceptable academic performance. The first issue is what performance merits a warning. Given the grade distribution at MIT, I propose that anyone with a GPA under 3.0 merits a warning, as do some other students taking too light a load. The second issue concerns the circumstances under which a student is required to withdraw from MIT. Here I suggest that MIT should consider being much stricter, and

not permit students to continue at MIT with warnings in many different semes-

that some students will do better, be happier, and be more successful by trans-

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ters. Personally, I view a cumulative GPA of less than 3.0 after the sophomore year as not meeting what should be MIT standards, and except in unusual circumstances, such students should be asked to withdraw. While I do not expect everyone to agree with me, I do believe it would be beneficial to discuss, as a community, what constitutes acceptable performance.

Low Achieving Students

All undergraduate students at MIT were great achievers in high school, and arrive here with great academic potential. But for a variety of reasons, not all students have academic success after they arrive. Moreover, for a number of underachieving students, MIT is not only a source of constant stress and disappointment, but it can do serious damage to motivation and sense of self. This situation is made more complex because many students at MIT view a transfer as an admission of failure.

The MIT community needs to acknowledge the simple and obvious fact

ferring to another university. We need to challenge the widely held (and incorrect) view that a transfer out of MIT is an admission of failure. We at MIT are doing low achieving students (and some other students as well) no favor if we blindly let them continue at MIT without presenting academic counseling that includes alternatives.

I suggest that advice to students include thoughtful information about transfers to another university and advice concerning financial assistance. Furthermore, MIT should consider having one or two advising deans who specialize in transfers. And for those students interested in transferring, we should do our best to make sure that they can transfer to a university where they will be both happy and successful. In so doing, we would be serving these students quite well. ■

James B. Orlin is a Professor of Operations Research (jorlin@mit.edu).

Benefit Changes for Faculty Upon Retirement

Shawn Foley

YOU WILL BE AN MIT RETIREE if, when you leave the Institute, you are age 55 or older, and have completed 10 years of MIT Retirement Plan eligible service after age 45. The following is a summary of your Massachusetts Institute of Technology Health and Welfare Retiree Benefits.

Cost of Health Coverage at Retirement

As we announced to the MIT community on June 16, 2003, MIT implemented a new method of determining MIT's and retiree's share of the cost of retiree health coverage beginning January 1, 2004. You are not affected by the change if you were born before July 1, 1930 and were retirement plan eligible, or were born before July 1, 1940 and completed 10 years of retirement plan eligible service before July 1, 1995.

Health Insurance at Retirement

As an MIT Retiree, you, your spouse/partner covered by an MIT Plan at the time of your retirement, and eligible dependents qualify to elect to participate in one of MIT's health insurance plans. Your coverage options are dependent upon your age at retirement.

Health Insurance If You Retire Before Age 65

If you retire before age 65 and are not enrolled in Medicare Part A (Hospital Coverage) and Part B (Medical Coverage), you will continue to be covered by one of the health plans available to active MIT employees.

If your eligible spouse/partner is under age 65 at the time of your retirement, your spouse/partner will remain in an active MIT health plan. Retirees and spouses/partners without dependent

children will change from family coverage to two individual plans.

If you have dependent children on your family plan, the plan coverage will continue as family coverage until you and/or your spouse turns age 65 or your unmarried, dependent child is eligible for coverage through an employer or other group health plan or the end of the month they turn age 25, whichever occurs first.

Health Insurance If You Retire On or After Age 65

If you retire on or after age 65, Medicare Parts A and B will become your primary insurance. You may add to that coverage by choosing one of the MIT Group Medicare supplement plans. MIT currently offers several Medicare supplement plans:

1. Indemnity Supplement Plan – MIT Group Medex Plan
2. HMO Supplement Plans – Managed Blue for Seniors & Tufts Medicare Complement
3. Medicare HMO Plans – First Seniority & Secure Horizons

Note: In most cases, under the MIT Group Medex Plan, you may continue to use the MIT Medical Department for your services.

If Your Spouse/Partner is Age 65 or Older When You Retire

If your spouse/partner is age 65 or older when you retire and not actively working or receiving coverage through another employer or group health plan, and your spouse/partner has Medicare Parts A and B coverage, your spouse will be eligible for coverage through one of the MIT Group Medicare Supplement Plans. Your spouse/partner is not obligated to have the same supplemental coverage as you and may elect any one of the plans available.

Cost of Health Insurance Effective 1/1/2004 – Under Age 65

Any cost will be deducted from your MIT pension check or you will be billed monthly. MIT's share of the cost of coverage will be based on your years of retirement plan eligible service with the Institute after age 45. The percentage will be based on the full monthly cost of the Plan.

- MIT's share will equal 50% for retirees with 10 years of such service after age 45;
- MIT's share will increase two percentage points for each additional year of such service beyond the initial 10 years of required service to a maximum of 70% for retirees with 20 or more years of such service after age 45; and
- Partial years of such service will be prorated at .167% per month.

Over Age 65

Any cost for you and your eligible spouse/partner, will be deducted from your pension check or you will be billed monthly.

Cost sharing for retiree health plans:

- MIT's share will equal a percentage of the cost of MIT Group MEDEX Plan.
- This percentage will be based on your years of retirement plan eligible service after age 45, will be prorated for partial years, and is identical to the percentages that apply to retirees under age 65, as explained above.
- You will pay the remainder of the cost of your coverage.
- The dollar amount MIT pays will change as the cost of MIT Group MEDEX Plan changes.

The following chart illustrates the Institute's and retiree's cost sharing by years of service.

Years of Service After Age 45	MIT Share	Retiree Share
20	70%	30%
19	68%	32%
18	66%	34%
17	64%	36%
16	62%	38%
15	60%	40%
14	58%	42%
13	56%	44%
12	54%	46%
11	52%	48%
10	50%	50%

For More Information

Please contact the Benefits Office by e-mail at rthealthchanges@mit.edu or by telephone at (617) 452-3694 from 9:00 a.m. to 5:00 p.m. The office is located in E19-215. The office at Lincoln Laboratory is located at LL-A-128; the number is (781) 981-7055. Details of the plan changes can be found at http://web.mit.edu/hr/benefits/retire_prep_health.html. ■

Shawn Foley is Assistant Manager, Department of Human Resources (sfoley@mit.edu).

Short Takes

Newsletter Redesign Wins Award

JUDGES FROM THE UCDA Annual Design Competition have chosen the redesigned *MIT Faculty Newsletter* to appear in the 2004 Design Show. Appearance in the Design Show represents a Gold Award of design excellence.

The *Newsletter* redesign was done by Tim Moore and Jan Moscovitz of the design firm Moore Moscovitz, with input from representatives of the *Newsletter* Editorial Board and the President's Office.

Additional entries from MIT to appear in the Design Show include the *MIT_1990_2004.zip* brochure, and the *MIT FREE2B* brochure. The exhibition can be viewed at the UCDA Annual Conference, October 2-5, in Vail, Colorado.

Additional Design Certificates may be ordered for MIT departments. For more information, please contact Moore Moscovitz directly at (617-731-7783; <http://www.mooremoscovitz.com>). ■

Nominations Open for 2004/2005 MIT Excellence Awards

NOMINATIONS FOR THE MIT Excellence Awards are being accepted online at http://web.mit.edu/hr/rewards/ex_nominate/. These awards honor the exceptional achievements of staff across the Institute in the categories of leadership, client service, collaboration and innovation, community service, and work-life balance.

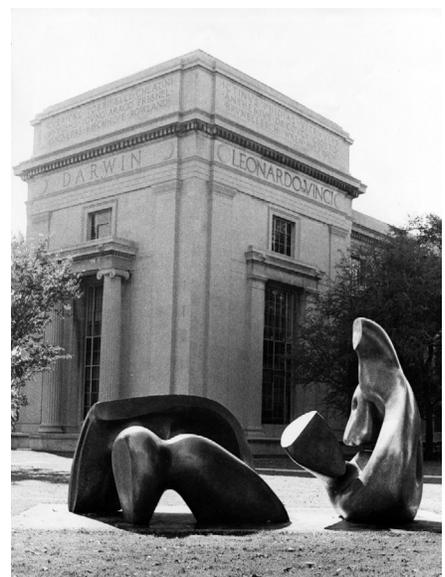
The nomination deadline is Wednesday, October 13, 2004 for the 2004/2005 awards. The Excellence Awards ceremony will take place on March 2, 2005 in Kresge Auditorium at 12 noon. For more information and the nomination form, please visit <http://web.mit.edu/hr/rewards/excellence/> or contact Kande Culver, program administrator, at rewards@mit.edu. ■

Times Square Offers Concerto for Erhu and Subway

THIS ISSUE'S MIT POETRY offering, "Concerto for Erhu and Subway" by Prof. Tunney Lee (page 20), was submitted some months before a July 6, 2004 *New York Times* article "Asian Music, Accompanied By the A Train." The article described the New York subways as a performance space in which the ancient musical arts of China, including music for the instrument described by Prof. Lee, is kept alive by master musicians.

"Before the attacks of Sept. 11, 2001, many of the musicians said, an eight-hour day of performing at a subway station fetched an average of \$70," according to the article. "Since then their income has dropped by roughly a third because of the economic doldrums and, they speculate, increased suspicion of foreigners." ■

Where Is This?



Can you identify this location on the MIT campus?

Establishing Leadership in the Emerging Field of Engineering Systems

Daniel Hastings
Daniel Roos

IN DECEMBER 1998, THE School of Engineering established a second new division, the Engineering Systems Division (ESD), which focuses on the engineering of complex systems. ESD's creation responds to the rapidly evolving field of engineering where there is a need for the development of new approaches, frameworks, and theories to better understand engineering systems behavior and design. It also responds to a need within the School of Engineering for the development and support of educational programs on complex systems and design synthesis that will prepare students for leadership positions.

To quote from a recent letter from Dean Magnanti:

"The engineering profession today faces a number of unprecedented challenges, many reflecting the changed context in which engineers practice. It is no longer enough to design a product or a system without accounting for the world in which it will operate. Today, many large-scale, extraordinarily complicated systems call out for a systems-driven engineering approach. Just consider a few of these critical systems challenges:

- redesigning transportation systems such as airline, rail, and urban highway systems that have increasingly reached their capacity and created enormous delays;*
- using information technologies to create products that are more timely, less expensive, and increasingly responsive to consumer needs;*
- reconciling the inevitable growth in world-wide energy demand with potential environmental costs;*

- creating product development systems that address the full spectrum of conceiving, designing, and developing a new product; and*
- developing manufacturing systems that are more attuned to the human impacts they generate, from wage attenuation and job losses to dislocations linked to globalization.*

At MIT, our role is to help meet these and other societal needs, through leadership grounded in technical excellence and innovation. Indeed, we feel an obligation to focus our attention on addressing these challenging issues. We believe that the converging forces of increased system complexity and the social impact of technology – combined with a need for increased leadership by engineers – create opportunities for new directions in engineering education and practice. The most successful engineers must possess superb professional skills as engineers, including a keen understanding of social, regulatory, environmental, cultural, and other forces. In short . . . we need Engineering Systems."

To fully appreciate complex engineering systems requires an integrative holistic view that bridges traditional engineering approaches with insights from management and social science. Therefore, ESD is an integrative effort that cuts across the School of Engineering departments, the Sloan School of Management, and the School of Humanities and Social Sciences. The Division has over 40 faculty members including two Institute Professors (Joel Moses and Sheila Widnall). All ESD faculty have either a joint or dual appointment with another academic unit. [The dual faculty appointment was introduced

when the two new Divisions were formed in the School of Engineering. Dual faculty share their time equally between two units; the division and a department.] These shared appointments enable ESD faculty to work with their engineering departments on system related initiatives. Overall, the Division provides an institutional framework and intellectual home for engineering systems faculty to develop and support system oriented educational and research programs, facilitate the admission of students to various interdisciplinary academic programs, and provide governance on key issues such as faculty hires, promotion, and tenure.

ESD brings together several systems-oriented educational professional programs and research centers that were developed at MIT over the past several decades. Five Master's-level interdisciplinary professional practice educational programs at the Institute are serving over 300 students today. These programs include Leaders for Manufacturing (LFM), System Design and Management (SDM), Technology and Policy Program (TPP), ESD SM, and Master of Engineering in Logistics (MLOG). The ESD research centers are the Center for Innovation in Product Development (CIPD), Center for Technology, Policy and Industrial Development (CTPID), and Center for Transportation & Logistics (CTL). Like the ESD academic programs, these centers are interdisciplinary, involving faculty from engineering, management, and the social sciences

ESD builds upon these pre-existing educational programs and research centers. The mission of the Division is to

create a new field of study and to broaden Engineering education and practice. To accomplish this mission ESD has launched several new educational and research initiatives described below.

ESD PhD

ESD received approval from the MIT faculty in 2003 to offer a Doctoral program. The mission of the program is to undertake fundamental in-depth research oriented around theory, policy, and practice associated with engineering systems. All doctoral students take a core composed of courses in system theory, quantitative methods, and socio/technical contexts. The ESD PhD acquired the interdisciplinary Technology, Policy and Management (TMP) PhD. It currently has some 40 doctoral students including students from the legacy TMP program.

The Engineering Systems Symposium

On March 29-31, 2004, the Engineering Systems Symposium brought over 360 leading academics, industry, and government representatives, and students to MIT to learn about the emerging field of Engineering Systems and to consider ways to work together. In the opening session, Dr. Vest noted, "This is a remarkable, perhaps historic, event of great import to engineering education and to our Institution. If we are to continue to be a great Engineering school in the future and help address complex problems like anti-terrorism, the Columbia Shuttle tragedy, globalization and sustainability in ways that benefit humankind, we will need to be great in Engineering Systems." In addition to Dr. Vest, speakers included MIT School of Engineering Dean Thomas Magnanti; Institute Professor Sheila Widnall; William Wulf, president of the National Academy of Engineering, Dr. Joseph Bordogna, deputy director of the National Science Foundation, and Travis Engen, president of Alcan. Several of the presentations are available on MIT World at <http://mitworld.mit.edu/series/57/>.

A key feature of the Symposium was the release of the Engineering Systems Monograph by ESD faculty and staff. In

addition to a paper by Dan Roos on the history leading to ESD's creation and a paper by Daniel Hastings on ESD's future and the creation of Engineering Systems leaders, there are six papers on the foundations of Engineering Systems. A framing paper on foundational issues by Joel Moses is followed by five papers on various aspects of the field. Dan Whitney was principal author of a paper on systems architecture, Richard de Neufville played a similar role in a paper on uncertainty, Tom Allen wrote on enterprise systems, David Marks on sustainability, and Nancy Leveson on systems safety. The Monograph papers can be found at <http://esd.mit.edu/symposium/monograph/>. The remaining papers presented at the Symposium can be viewed at http://esd.mit.edu/symposium/agenda_day3.htm.

At the Symposium, Dan Roos announced that over 20 of the top engineering schools in the U.S. and Europe have agreed to work collaboratively to define and evolve the field of Engineering Systems by sharing educational materials and information on job opportunities for PhDs in Engineering Systems, and holding inter-university student colloquia.

New Research

ESD's TPP program, along with the Center for International Studies (CIS), the Department of Political Science, and the Science, Technology, and Society (STS) program was awarded \$2.9 million from the National Science Foundation's prestigious Integrative Graduate Education and Research Traineeship (IGERT) Program for a multidisciplinary program on assessing effects of emerging technologies.

The Program on Emerging Technologies (PoET) is led by four principal investigators: ESD/TPP's Daniel Hastings and Dava Newman; Kenneth Oye of the Department of Political Science, ESD, and CIS, and Merritt Roe Smith of STS. A workshop entitled "Emerging Technologies: Recognizing Uncertainty and Assessing Implications" (also the fourth annual TPP symposium) was held on April 12, 2004. More

information is available at <http://poet.mit.edu/igert.htm>.

ESD's Center for Transportation & Logistics signed a multi-year, multi-million dollar agreement with the government of Aragón, Spain, to help create an international education and research program in logistics and supply chain management. The MIT-Zaragoza International Logistics Program is part of a large-scale initiative to develop the Aragón region of Spain, around its capital city of Zaragoza, into a significant logistics center in Europe. The MIT-Zaragoza International Logistics Program is the Center's flagship effort. In addition to conducting cutting-edge research, CTL will work with the Zaragoza Logistics Center to offer graduate and executive education in logistics to students from around the world. The offerings will include a Master's degree modeled on MIT's Master of Engineering in Logistics (MLOG), a Doctoral degree, and a set of executive education courses leading to certificates in various logistics-related disciplines.

The Future

ESD is working concertedly to build upon this foundation and to strengthen its leadership position. With our interdisciplinary faculty, new PhD program and research programs, we have laid the groundwork for continuing to define and develop the new field of Engineering Systems. However, there is much work to be done. We have made an excellent start on defining the intellectual foundations of engineering systems and in the future years we will deliver on that promise. ESD is taking a leadership role in engaging the extended community, including students, faculty, alums, partner companies, and staff within ESD, and reaching out into the world of academia, government, and industry at large. We are building a lifelong learning community that encourages active and sustained partnership from all of our constituencies over the short and long term. ■

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Daniel Roos is Founding Director, Engineering Systems Division (roos@mit.edu).

MIT Poetry

CONCERTO FOR ERHU AND SUBWAY

*Erhu. A two-stringed, vertical fiddle introduced into China
from Mongolia in the Song dynasty, 960-1279.*

on the uptown platform at Times Square
black brown pale tall short fat skinny people
swaddled in wool leather fur fleece jackets
hoods hats balaclavas gloves mittens filling
all the bits of left-over space

on the downtown platform a train screeches to a halt
graffiti and scratchiti is forbidden violators subject to fine and imprisonment
indecipherable language gurgles from the loudspeakers
is it baluchistani chechen cham chamorro chimbu, chukchi or maybe esperanto
delayb mmmnot stoppming at ppenmstaysnnnn bewarnm pinkpomkets

creating a sense of crisis nature and location unspecified
jack-hammers join in adding an emphatic stop and go beat

the Chinese man
age indeterminate
jet black hair brush cut
wearing a navy blue Fila sweater
brown corduroy pants
down jacket on a crate
elevated
from the grit
ground into grime

he
sits
reed
straight
aloof
on his folding stool
his left hand
holds
the erhu
by
its
long
slender
sandal
wood
neck

curved
elegantly
at
the top
punctuated by
paired pegs

sitting on his left thigh
the ebony base
black and polished
covered with python skin
black and white pattern
bold strokes of calligraphy

fingers
flit
like
cicadas
over
the strings

his right hand sweeps the bow its two strings of horse hair
remembering the captive barbarians mourning for their homeland

the uptown train thunders in brakes squealing adding to
garble jack-hammer cell-phones chatter

eyes closed he persists
with fingers and bow
swaying to an inner voice

the plaintive wail sad mysterious almost human
rises dips
rises dips
weaving through the din
a temporary structuring of the cacophony

–Tunney Lee

Spaces, Software, and Services – Supporting Educational Innovation and Sustainability with Technology

Vijay Kumar

ACADEMIC COMPUTING, PART OF MIT's Information Services & Technology (IS&T) organization, is committed to supporting faculty in creating innovative uses of technology for education. Tied to this commitment is Academic Computing's objective to enable and assert MIT's global leadership in educational technology, by leveraging its expertise and experiences.

Looking ahead to the coming academic year, we will see major growth and transitions in the spaces, software, and services which are key to supporting educational technology, with a particular focus on sustainability. Following are summaries of five of Academic Computing's current initiatives characterizing this growth and transition.

Spreading the Word – Collectively

One of Academic Computing's goals is to find better ways to communicate to faculty what educational technology services are at MIT, and to report on projects and activities. The result is two new Web resources. The Teaching with Technology (<http://web.mit.edu/teachtech/>) Website is designed to make it easier for faculty to find the educational technology services provided by numerous organizations throughout MIT. A new interactive, online newsletter, the *Ed Tech Times* (<http://edtech.mit.edu/times/>), replaces the old paper *Insider*. *Ed Tech Times* publishes the latest information on educational technology projects, services, events, and trends.

Other outreach for the coming year includes the popular Crosstalk (<http://web.mit.edu/acs/Crosstalk>) seminar series, and the second Ed Tech Fair.

Crosstalk gives MIT faculty and the larger MIT community a forum for information and intellectual exchange about educational technologies. Following the success of the first MIT Ed Tech Fair, held during IAP 2003, another Ed Tech Fair is being

Emerging interdisciplinary computational requirements are driving faculty to look for high-performance and high-throughput computing resources for their teaching and research. In response, Academic Computing has started a pair of projects to shape HPC services for teaching.

planned for November 2. This will be an opportunity for MIT faculty, students, and others working on educational technology projects to demonstrate their work to all of the MIT community.

From Computing Clusters to Flexible Learning Spaces

Trends in student use of laptop computers, commercial advances in software and hardware, and changing pedagogical practices challenge MIT to provide spaces more aligned with contemporary learning and technology needs. Surveys of MIT students and faculty have substantiated these needs on the campus. Redesigns of a few traditional Athena clusters as well as other computing spaces were launched this summer. These are pilot efforts to explore different approaches for supporting student computing, and to provide informal and flexible learning spaces. Parts of four public clusters (W20, 56-129, E51-075, and Hayden Library) were renovated to accommodate students needing group collaboration space.

Featuring comfortable soft seating, large wall-mounted flat-panel displays, and Web-enabled white boards, these spaces promote cooperation and teamwork as an essential part of an MIT undergraduate's education.

Academic Computing will be hosting tours of these clusters and other new learning spaces on campus in September. To join a tour or for more information, send e-mail to acis-help@mit.edu. The renovated clusters and other MIT new learning spaces will be featured in a September workshop on learning-space design, co-sponsored by the National Learning Infrastructure Initiative (NLII) and MIT (see <http://www.educause.edu/nlii/keythemes/spacedesign.asp>).

Undergraduate High-Performance Computing (HPC) Arrives

Emerging interdisciplinary computational requirements are driving faculty to look for high-performance and high-throughput computing resources for their teaching and research. In response, Academic Computing has started a pair of projects to shape HPC services for teaching. The first is a Website to support a community of practice for those interested in high-performance parallel computing (<http://stellar.mit.edu/S/project/>

computationallyinten/) (HPPC). The HPPC Website serves as a focal point for information exchange and reference materials related to clustering hardware and software technology, as well as a forum to guide decisions regarding hardware and software procurements.

The second project leverages MIT's computing infrastructure in two pilot, undergraduate HPC teaching clusters. One cluster has Intel hardware running Red Hat Linux (the ROCKS Beowulf distribution), and the other cluster has Apple PowerPC hardware running Mac OS X (using the Sun-grid engine). The Athena student computing space in 4-035 was repurposed to house the Linux Beowulf cluster; the Mac OS X cluster is located in Building W91, and is accessible remotely. The implementation of these two HPC pilots in classes this year will provide information about what is needed to effectively use and support these systems.

Prof. Dave Darmofal, of Aeronautics and Astronautics, intends to use the Beowulf cluster for his 16.100 class this fall. In the spring, Profs. Gerd Ceder and Nicola Marzari, both in Materials Science and Engineering, will be trying it out with their students.

The Apple HPC cluster uses OKI authentication and authorization, and focuses on specific applications such as gridMathematica, a parallel implementation of Mathematica. Prof. Jim Elliot, from EAPS, and Prof. Raul Radovitsky, from Aeronautics and Astronautics, are among those considering use of this resource for their classes in the spring.

Faculty who are interested in learning more about the HPC clusters, or using them for their class work, should contact Phil Long, longpd@mit.edu.

Open Source – The Future of Online Learning Tools

MIT's collaboration with the University of Michigan, Indiana University, and Stanford University on the Sakai (<http://www.sakaiproject.org>) project provides direction for the on-going work and sustainability of Stellar.

Quick Survey on PDA Support for Faculty

Information Services and Technology (IS&T) is exploring faculty interest to extend our services for and use of handheld devices – PDAs (Personal Digital Assistants) for access to MIT services such as e-mail, TechTime, and the Web. At this time, IS&T is building support for e-mail access via devices such as Blackberries and Treos, and we already offer support for PDAs running PalmOS and PocketPC (please see <http://web/ist/topics/hardware/pda>).

We would be grateful for a few minutes of your time to provide feedback to guide our efforts going forward. If you would like to weigh in on the usefulness of such support and to share with us your interest in devices beyond those already offered, please fill out the feedback form at <http://web.mit.edu/ist/survey/pda/>.

Supported by the Mellon Foundation, Sakai will develop and share open-source software for learning tools based on service specifications from OKI. While there will be limited pilots of Sakai tools in fall 2004, the production implementation of a Sakai-based course management system (CMS) is planned for fall 2005. The Sakai CMS will include new features, plus tools and applications developed in collaboration with other universities and commercial vendors. The framework will ultimately support new tools and services developed by MIT faculty and staff, such as an online gradebook that promises to make the grading process easier for MIT faculty.

Shop Online for Educational Technology Projects

To help faculty “shop” for technology which might support particular pedagogical goals, Academic Computing is creating an online catalogue of educational technology projects at MIT.

We are beginning to inventory such projects in close collaboration with MITCET and the Teaching and Learning Lab. The inventory seeks to identify and describe both large and small-scale uses of educational technology. The collected data will take advantage of the Carnegie Foundation's Snapshot tool to display details about each project's pedagogical goals, technical information, and assessment outcomes.

The new initiatives described above are by no means the only activities keeping IS&T Academic Computing busy in the

coming months. We continue to maintain and update third-party software for the Athena computing environment, offer spatial data and GIS services in conjunction with the MIT Libraries, provide faculty consulting services through our newly named Educational Technology Consultants (formerly know as the Faculty Liaisons), and offer training to faculty in the use of the educational technologies available to them.

The period ahead will be characterized by an assessment of academic computing priorities as Academic Computing, collaborating with other groups engaged in supporting educational technology, shapes new services and responds to the sustainability needs of new initiatives. Faculty and student input is paramount to our efforts in identifying and building a rich and enduring ecosystem for educational technology. We welcome and invite your feedback. If you would like to find out more about any of the services or projects offered by Academic Computing, or to send us your thoughts, feel free to contact the Educational Technology Consultants at x3-0115, et-consult@mit.edu. ■

Vijay Kumar is Director of Academic Computing, Information Services and Technology (vkumar@mit.edu).

Web Accessibility: What Faculty Should Know

Kathleen Cahill
Edward Barrett

AS INCREASING NUMBERS OF course materials migrate from paper to the Web, the issue of equal access for all becomes more than just a trite saying. For people with disabilities, especially those with visual, hearing, or motor disabilities, the World Wide Web presents an opportunity to find and read materials they may never have had access to previously. How to author a Web page so that all users can retrieve the same information is a vital and important part of Website design. The 2000 U.S. Census estimates that approximately 15-20% of residents surveyed reported a disability.

Take an example of a blind computer user. Many blind and visually impaired users have screen readers installed on their computers, which read text out loud. The screen readers can only parse text, which makes it important for Web pages to have text equivalents (also called ALT text) for graphics, pictures, and other non-textual information. Some people with disabilities use assistive technology (such as the screen reader described above) to help them access a conventional computer. Other examples of assistive technologies include screen magnification software, voice recognition software, head pointing devices, eyegaze devices, or refreshable Braille devices. Some of these are available to try out in the ATIC Lab (see <http://web.mit.edu/atic/www/>).

The World Wide Web Consortium (W3C), based here at MIT, has developed Web Content Accessibility Guidelines (<http://www.w3.org/TR/2004/WD-WCAG20-20040311/>) to assist Web developers. MIT uses the Web Content Accessibility Guidelines in its own MIT Accessibility Policy and Guidelines (<http://web.mit.edu/atic/www/sw/>) which have been in place since 1999. However, many Webmasters, or those who do Web page updates, use Web editing software such as Dreamweaver or Home Page, and do not

know how to code in HTML for accessibility. Luckily, Dreamweaver, which is an MIT-supported product, has a built-in accessibility checker that allows a Web page author to make sure a Web page is as accessible as possible.

There are federal laws that apply to accessibility of programs and services offered by entities receiving federal funds. MIT is one such entity. Section 504 of the Rehabilitation Act of 1973 requires that educational programs be made accessible to people with disabilities. That includes accessibility of information and materials presented, be it over the World Wide Web or on paper.

For Web accessibility, the issue often becomes one of consciousness raising and education. Most Web developers would not knowingly design an inaccessible page and once given the information, are willing to make the necessary changes. And the changes are not difficult ones to make. Many Website changes involve adding ALT text, making links more descriptive, making sure the Web page can be navigated with the keyboard, and using colors and fonts that are easy to read.

One of the biggest challenges involved in Web accessibility is making non-textual information accessible, be it online video, audio, simulations, or graphs and charts (see <http://web.mit.edu/atic/www/sw/developweb.html> to find out more about Web page accessibility and Adobe™ PDF accessibility).

Some of the MIT ATIC lab staff serve on the Information Systems and Technology Usability Team, which assists developers of Websites and applications in evaluating ease of use. ATIC lab staff have made presentations on Web accessibility for various departments and groups including 21W.785, Communicating in Cyberspace, (instructor, Dr. Ed Barrett). In this class, students work in small collaborative groups proposing and implementing a variety of Websites.

Early in the semester, ATIC Lab Web Accessibility experts visit the class when students are beginning the design process. A Web Accessibility expert demonstrates how a blind person interacts with several mainstream Websites through a screen reader. What students hear is a cacophony of sounds emanating from his laptop as his screen reader attempts to voice information from sites that have not been designed in accordance with Web accessibility guidelines.

The Web Accessibility experts then demonstrate several sites designed in accordance with Web accessibility guidelines. Compliance with these guidelines not only allows visually impaired users to retrieve information more easily, but also strengthens basic information architecture within the site, making it more coherent and organically related to interface design elements sighted users perceive on their screens.

So, in summary, what should a faculty member do to make their course Websites and information more accessible?

- Perform a 5-minute quick check for accessibility, located at <http://web.mit.edu/atic/www/sw/developweb.html#check>.
- If you are composing a page in Dreamweaver, check the accessibility of your page in File > Check Page > Check Accessibility.
- If you use PDF files on your site, please take a look at information on making PDF files accessible: <http://web.mit.edu/atic/www/sw/developweb.html#pdf>.

If you need further help, please contact the ATIC Lab at 253-7808 or atic@mit.edu. We would be happy to review your site and offer feedback. ■

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OpenCourseWare Update What Was it Like Working with OCW?

Mary P. Rowe

IN 1985, I COULD NOT find a course anywhere that linked negotiation theory with conflicts within the workplace. So I set out to apply the theories of my Sloan colleague, Bob McKersie, to my work as an organizational ombudsman. Most of the theory and practice of modern-day negotiation draws on the 1960s work of Richard Walton and Robert McKersie. Their theories have been widely applied – to world peace, the martial arts and modern dance, corporate strategy, courtship, and real estate transactions – but my course appears to have been the first on “Negotiation and Conflict Management.”

In the spirit of McKersie’s work, “Course 15.667: Negotiation and Conflict Management” was designed to deliver theory to practitioners and to develop theory from practice. And, following McKersie, my course deals with intangibles (how do people feel about the negotiation, about the conflict) as well as tangibles (what will they get). The course is realistic (and messy) since my cases are drawn from real life. (There are no “optimum solutions,” just ranges of better and worse solutions depending on the negotiators and the setting). In the spirit of MIT, I have taken an integrated systems approach to organizational conflict management. Over the years, I have contributed a bit, here and there, both to negotiations theory and conflict management theory.

Fortunately, this subject matter turned out to be very popular. However, like other long-term faculty, I now get calls and e-mails from colleagues all over the world. Having my course published on the OpenCourseWare Website lets me just refer many teachers, practitioners, students, alums, and perplexed negotiators to OCW.

So, what was it like, working with OCW?

I figured the process of publishing would be awful. I mentioned that the course is “messy,” and so, I thought, were my files. I have revised the course ~20 percent each year, so my computers were full of stuff – cases, brief negotiation “recipes” I had developed, outlines for lectures, an Introductory Test, instructions for a “Negotiations Journal,” and advisories for negotiators. I thought gloomily that it would take a year to organize these course materials into a coherent Website. My spirits sank lower when I got a call from OCW asking, “Could you deliver 15.667 in a week?”

I thought this was hopeless. Maybe I would get it done in 2010?

But a long-suffering OCW department liaison – a recent MIT alum with good negotiations skills who could not be discouraged – came and downloaded everything, and then organized it overnight into the distinctive OCW template. Presto! The course looked much better than ever before.

I edited, over a weekend on e-mail, with the patient OCW wizard who kept indefatigably encouraging me. It got done. (Of course it is never done. But I now have an exceptionally useful framework for my teaching notes, and for adding new material. And some of the burden on our wonderfully able office assistant has been lifted – I am no longer asking her quite as often how to find something.)

In the last several months since 15.667 was published on OCW, I have welcomed new colleagues who visit or call from around the world, having found the course on OCW. (These are people I wanted to meet – OCW takes care of random e-mail). A few cloned courses are

springing up around the world. Students use fragments from the site. Some MIT alumni tell me they are happy to see 15.667 course materials available for them to teach, and use, at work. OCW has also saved many hours that would have been spent in correspondence with conflict management practitioners and their senior managers.

I was concerned about intellectual property. To my relief, this concern disappeared with all the others. OCW took care of the permissions process for third-party materials I had borrowed for the course, just as Graphic Arts had done for me in the past.

In addition, I am also happy about the fate of my own intellectual property. I am suddenly getting more credit, including acknowledgement for a number of my ideas from the past. So one happy outcome was that I found one can actually get more recognition for one’s work via OCW. Moreover, people are much more likely to find something I have written on OCW than on my office Website. (Of course this new recognition is sometimes expressed in quixotic terms – “you mean you came up with that concept?”)

So – overall – what was it like working with OCW? I have great respect for OCW. For a member of the faculty getting started or an instructor who is really working to pull together a life’s work, this seems to me a very unusual gift from MIT.

If you are interested in participating in the OCW, please contact Jon Paul Potts, OCW communications manager, at jpotts@mit.edu or 617-452-3621. ■

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Management of the MIT Endowment
Bufferd, from page 1

Organization and Conceptual Overview

The investment policies governing the endowment are established by a standing committee of the MIT Corporation, the Investment Committee, in accordance with Section 16 of the *Bylaws of the Corporation of the Massachusetts Institute of Technology*. The Investment Committee is comprised of nine members of the Corporation, two of whom, the Chairman of the Corporation and the Treasurer of the Corporation, serve as *ex officio* members. This Committee meets three or four times annually to review investment policies and monitor investment activities and results for the Endowment and other assets of the Corporation. The implementation of the policies approved by this Committee is carried out by the Office of the Treasurer through external investment management organizations. The Corporation recently approved the formation of the MIT Investment Management Company, effective July 1, 2004. The major impact of this change will be to add additional members to the Board overseeing the management of the Institute's assets.

Endowment assets are those assets resulting primarily from gifts to the Institute where the donors have imposed the condition that only the income provided by the investment of the gifts might be expended for the educational and research purposes of the Institute. These assets are known as *True Endowment* assets. In addition, the Executive Committee of the MIT Corporation may designate otherwise expendable funds to be managed as Endowment funds. These latter funds are known as *Quasi-Endowment* (or *Funds Functioning as Endowment*). Either of these two classes of endowment assets may be restricted as to purpose of use, such as strictly for scholarships or fellowships, for professorships, or for research; or they may be unrestricted as to purpose of use, in which case they are known as *Unrestricted Endowment* and are available for any general purpose

of the Institute. Since the major focus of this discussion is on the management of these assets, rather than the use of these funds, we will not focus further on these distinctions, other than to note that it is necessary for the Institute to carefully balance its budgetary needs with the nature of the resources available to it from the endowed assets.

Another aspect of this discussion is to note that the primary investment pool for the Endowment is known at MIT as Pool A. Although Pool A is neither the complete Endowment nor is it comprised only of Endowment assets, it is for this discussion a good proxy to discuss the management of the Endowment and the annual distributions that support operations. A department's funds that are invested in Pool A will receive annual distributions based on the number of units held in the Pool. The units are valued monthly and new gifts or other additions to the Pool are credited with new Pool A units based on the current month's unit market value. In many respects this is similar to the creation of shares in an open-end mutual fund, about which many may have direct personal experience.

The Pool A assets are managed to maximize total investment return relative to appropriate risk, which in this case refers to the volatility of returns. The challenge is in developing investment and

power of the endowed assets. Investment income earned (in the form of interest, dividends, and rents) and a portion of investment gains are distributed in a manner that, over the long term, allows for the retention and reinvestment of an amount at least equal to the inflation rate, thereby satisfying the legal obligation to endowed funds.

Financial Strength of the Institute

Before more completely describing the management of these assets, we emphasize that the Institute is a financially stronger institution today than it was 20, or even 10, years ago. A few numbers describing the general investments of the Institute, the bulk of which is the Endowment, will illustrate this point. In presenting this information, and other data to follow, we note that the financial records for Fiscal 2004 will not be finalized until October 2004. In addition, some information on peer and benchmark measures are not yet available for Fiscal 2004. We are therefore presenting both 2003 and 2004 information where available, not to suggest that the short-term performance should be the basis of presentation, but rather to provide both comparable information and the most current information possible.

Table I
Ratio of Total Investments to Total Operating Expenses for Selected Fiscal Years

Fiscal Year	Total Investments \$ Million	Total Operating Expenditures \$ Million	Ratio of Investments/ Expenditures
1983	767.3	588.7	1.303
1993	2,126.1	1,133.9	1.875
2003	6,174.1	1,686.6	3.661
2004	7,251.9 (est)	1,844.1 (est)	3.932 (est)

distribution policies which over time support the operations of the Institute and protect the underlying purchasing

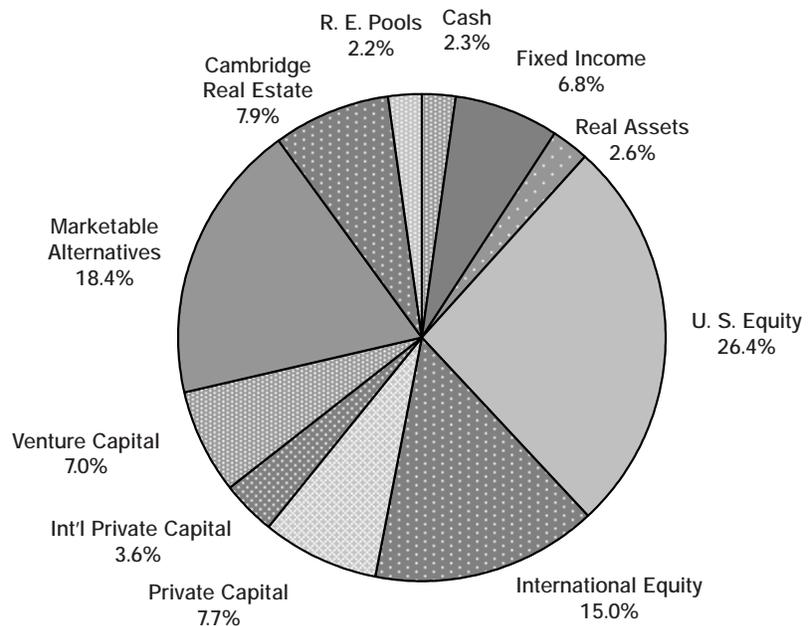
A tripling of the ratio of total investments to operating expenditures over the past 20 years is only one of many measures

that demonstrate a financially stronger institution than in prior years. This has occurred as a result of two enormously successful capital campaigns, the Campaign for the Future, which raised \$710 million in 1987 to 1992, and the Campaign for MIT, now closing in on \$2 billion in gifts and pledges over the period 1999 to 2005. The generally favorable investment climate for much of the last 20 years is another important factor, as well as an appropriate balance between current and future needs through the application of a moderate distribution rate and the reinvestment of a portion of the investment return for future generations – the intergenerational equity issue. This is not to suggest that this institution does not face continuing challenges on both an absolute and relative basis. It is only to emphasize that we face this future much stronger than we did a few years ago.

Endowment Investments, Past and Present

Figure 1 presents the investments of Pool A as of June 30, 2004. Pool A assets were \$6,141.8 million, an increase of \$748.1 million from the \$5,393.7 million of June 30, 2003. This change in market value, 13.9%, is not the investment return for the year. It is the change in asset value which is comprised of income, market value appreciation (or depreciation), new gifts added to the investment pool, less amounts distributed for spending. Investment return is that measure of change in value due solely to investment results and does not take account of new gifts or of the amount distributed for spending. For the fiscal year just closed, the investment return was 18.1%. Since the amount distributed for spending always includes a portion of gains, the change in asset value will always lag the investment return, unless gifts received are unusually large. In reviewing Figure 1 and other comments on the asset classes comprising Pool A, reference may be made to the Glossary (back page) for a better understanding of the asset classes in which MIT invests.

Figure 1
Pool A Asset Allocation on June 30, 2004 (See Glossary)



The overall policy allocation of Pool A has changed over the past 10 years, a period of time during which economic outlook went from euphoria to malaise. The Pool A strategic asset allocation is reviewed annually by the Investment Committee and changed only modestly as a result of periodic studies which incorporate a broad range of inputs on expected returns, volatilities and correlations among the asset classes considered for investment. These portfolio optimization studies, including Monte Carlo simulations of longer term expected values for the endowment, are inherently sensitive to the quality of the inputs and tend to reflect recent performance results and outlook. The range of inputs from consultants, investment managers, and other institutional investors helps to provide a general guideline to an “optimized” portfolio, optimized in the sense of expected return and volatility (risk). The optimized portfolio further incorporates boundary conditions and other practical constraints that reflect a sense of the execution skills of staff and the viewpoints of the staff and the Investment Committee as to where the best risk-adjusted investment return

will be realized. The objective of this effort is the construction of a portfolio with assets showing low correlation with each other, to minimize overall portfolio volatility while maximizing expected portfolio return over time. The most uncertain aspect of this approach is the short-term volatility.

Table II shows the changes in the asset allocation over the past one, three, five and 10 years back to Fiscal 1994. Some important changes in outlook are reflected in these allocations.

While there are few unidirectional changes during the past 10 years, there now is a substantially decreased exposure to the domestic equity markets and fixed income markets, and a significantly increasing exposure to marketable alternatives (see Glossary), private equity (both venture capital and private capital, see Glossary), and real estate during this period. As described above, these changes reflected policy guidelines and outlooks as reviewed periodically with the Investment Committee of the Corporation.

In practice, we are guided by a policy portfolio with allocation weights centered

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Management of the MIT Endowment
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Table II
Pool A Asset Allocation for Past One, Three, Five and Ten Years

Asset Class	2004	2003	2001	1999	1994
Fixed Income & Cash	9.1%	11.5%	15.1%	15.5%	17.6%
Real Assets	2.6%	1.0%	0.0%	0.0%	0.0%
U.S. Equity	26.4%	26.6%	38.5%	47.2%	49.3%
International Equity	15.0%	7.5%	7.7%	10.8%	20.3%
Private Equity	18.4%	18.3%	19.0%	15.0%	8.0%
Marketable Alternatives	18.4%	20.3%	8.7%	4.6%	0.0%
Real Estate	10.1%	14.8%	11.0%	6.9%	4.8%

Table III
Fiscal 2004 Pool A Target Allocation and Acceptable Ranges

Asset Class	Target Allocation	Acceptable Range
Fixed Income	10%	5-15%
Real Assets	5%	0-10%
U.S. Equity	21%	16-26%
International Equity	14%	9-19%
Private Equity	20%	15-25%
Marketable Alternatives	20%	15-25%
Real Estate	10%	5-15%

on a single value for each asset class, but we allow for variation within an acceptable band around that value. The Pool A policy portfolio and the acceptable bands for fiscal 2004 are shown in Table III.

The very slight differences between actual allocations and the policy range for U.S. Equity primarily reflects implementation issues with regard to allocating funds to external managers and to some degree the result of market action. Significant out-of-range allocations are rebalanced periodically.

Performance

How does the MIT asset allocation compare with that of other colleges and universities? This information is collected periodically by Cambridge Associates, a consulting organization with whom MIT has worked for more than 25 years. Figure 2 compares the MIT Pool A Allocation to that of the Cambridge Associates Mean Allocation at

the end of Fiscal 2003. Peer information for Fiscal 2004 is not yet available.

In general, our underweight in Global Equity (Domestic and International Equities) and Global Bonds (Fixed Income) is offset by an increased allocation to Non-Marketable Alternatives (Private Equity) and Real Estate. Such differences are less pronounced in comparison to the largest endowments in the survey group, as they have a greater fraction of their assets in alternative investments and a commensurate reduction in the marketable securities areas.

Figure 3 presents a comparison of the investment results for each Pool A asset class to its respective benchmark for the five years ended December 31, 2003, the last date at which all benchmark information was available for the broad range of alternative assets.

All the benchmarks against which the Pool A performance is measured are widely accepted standard benchmarks, with the exception of that for International Equities, which was custom designed by MIT with the assistance of Professor Stewart Myers of the Sloan School for the purpose of deemphasizing larger capitalization markets in the international sector and affecting external manager behavior. Since adoption in

Figure 2
Comparative Asset Allocation of MIT Pool A to Cambridge Associates Mean as of June 30, 2003

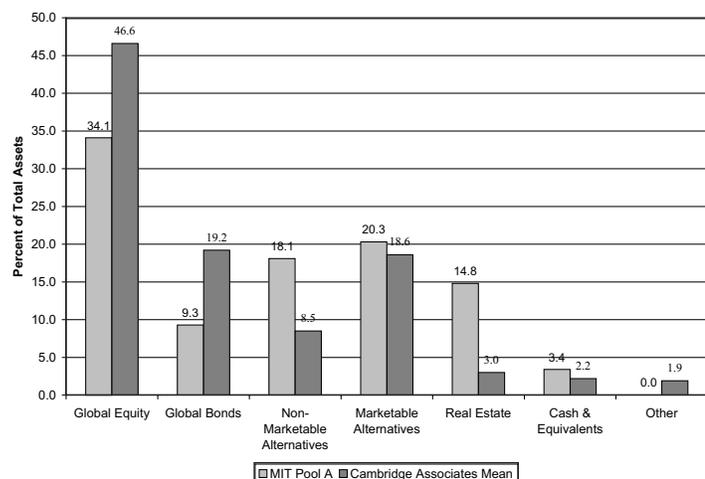
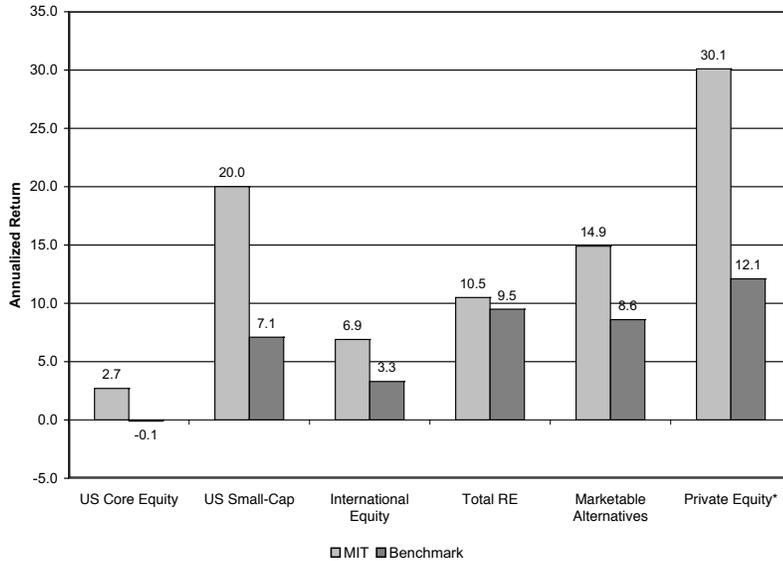


Figure 3
Asset Benchmarks and Results for the Five Years Ended December 31, 2003



Asset Class	Benchmark
U.S. Core Equity	Russell 1000
Small Cap Equity	Russell 2000
International Equity	MIT CI20% EM/MSCI EAFE
Total Real Estate	NCREIF (1 qtr. lag)
Marketable Alternatives	T-Bills Plus 5%
Private Equity*	Cambridge Associates (1 qtr. lag)

*The Private Equity returns for MIT and the Benchmark are calculated by linked quarterly IRR's in this graph. The annualized five-year point-to-point IRR returns would be 98% for MIT and 31% for the Benchmark.

1998, the MIT Custom International Benchmark has exceeded the index more commonly used in the investment management field, and our managers have outperformed the Custom Benchmark. It is to be especially noted that for each of the asset classes the Pool A managers have outperformed the respective benchmarks for the five-year period, a few by quite significant margins.

Another way to review the longer term history of the investment results is to compare the aggregate results to a proxy for the portfolio. In this case we have selected a composite of 85% in the domestic equity market, measured by the S&P 500 Index, and 15% in the domestic bond market, measured by the Lehman Aggregate Bond Index, as well as the median return of all funds in the Trust Universe Composite Service ("TUCS"),

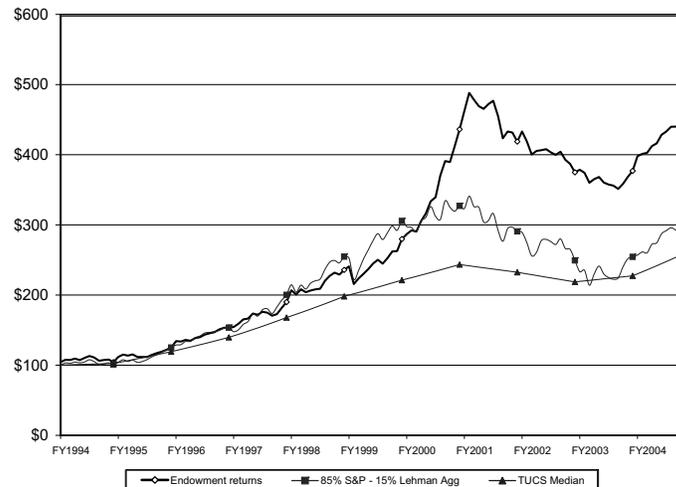
the broadest comparison of institutional asset pools, over the period 1994 through 2004. We chose the 85/15 proxy as Pool A has been comprised of 85% equity or equity-like assets. Figure 4 illustrates these comparisons.

Recent comments about endowment performance over this period recognize that the Institute participated significantly in the strong markets of the late 1990's through the early part of Fiscal 2001, substantially outperforming a broad universe of comparable funds and in particular a portfolio proxy without any alternative assets participation. However, the fall in relative and absolute performance for the past three years, as illustrated in Figure 4, has raised concerns about the investment policy and also the distribution policy which has been followed. We also have had inquiries about distribution models that may be used by other major private universities.

While there have been adjustments over the past few years in the allocation of assets, the general tenor of our policy has been constant over the past three years. The recovery noted in this past year emphasizes the underlying rationale of the Pool A policy portfolio.

Let us examine the history of the distributions from Pool A with these thoughts in mind.

Figure 4
Comparison of Investment Returns from Fiscal 1994 through Fiscal 2004 for Pool A, the TUCS All Master Trust Median, and an 85%/S&P/15% Lehman Aggregate Bond Indices Proxy



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Distribution Policy

Over the 28-year period from 1970 through 1998, the annual distribution from the endowment grew 6% annually, with no decrease from year to year. The policy guidelines over this period varied as the respective Investment and Executive Committees looked to formulations as guidance in balancing the need for current resources against sustaining the longer term purchasing power of the Endowment. In addition, from 1973 to 1998 there was only one annual increase greater than 10% (10.4% in 1989) in the distribution rate. During this period specific formulas were used as guides, rather than being followed explicitly. The most

This rate of growth in the distribution rate coincided with the very robust markets and a call for increased resources to fund initiatives outlined by President Vest's 1998 report, entitled *The Path to the Future*, and described in more detail by

Provost Brown in his article titled "Financing MIT" in the December/January 2004 issue of the *MIT Faculty Newsletter* (Vol. XVI No. 3). As the baseline distribution indicated by the formula (the long-term distribution rate applied to the three-year average market value)

Comparison to Other Distribution Policies

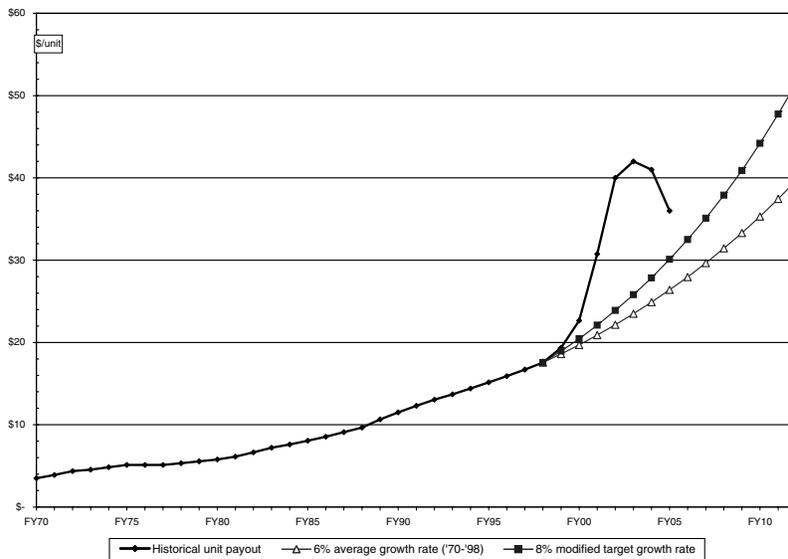
There are many other distribution models in use at peer endowments which serve either as firm formulae or as indicative guidelines. These include a cap on the

Even with the subsequent decrease in the distribution rate over the past two years, the distribution rate from 1998 through 2005 will have grown at an annually compounded rate of over 10%.

annual rate of change in the distribution rate, a model followed by at least one major endowment during the "bubble" period. Another model defines the distribution as a weighted average of prior year's spending and a percentage of this year's market value, a so-called 70/30 formula. The formula generally uses the "spot" market value, as the prior year's spending itself incorporates prior year market values (through a recursive application of the formula). This approach is effectively a modified exponential weighting of market values, adjusted for inflation.

Figure 6 presents a comparison of what the MIT distribution would have been with the 70/30 formula applied to the Institute's actual investment results from Fiscal 1973 through Fiscal 2005. The spot unit value used here is of the December preceding the fiscal year for which a budget is being prepared, as the Institute's budget is finalized in the winter months preceding a fiscal year. While the resulting distribution rate would have been smoother from 1998 through 2005 than we experienced under our current formula, the distribution would have been cumulatively almost \$26 per unit less than what was historically distributed, half of which was post-1998. To the extent operations and the new initiatives were to follow their original time plan, the draw on *quasi-endowment* assets would have had to increase by that amount. With a nominal seven million units in the Endowment over the 1998-2005 period, the difference of \$13 per unit distribution would have resulted in an additional \$85

Figure 5
Pool A Distribution per Unit from 1970 to 2005

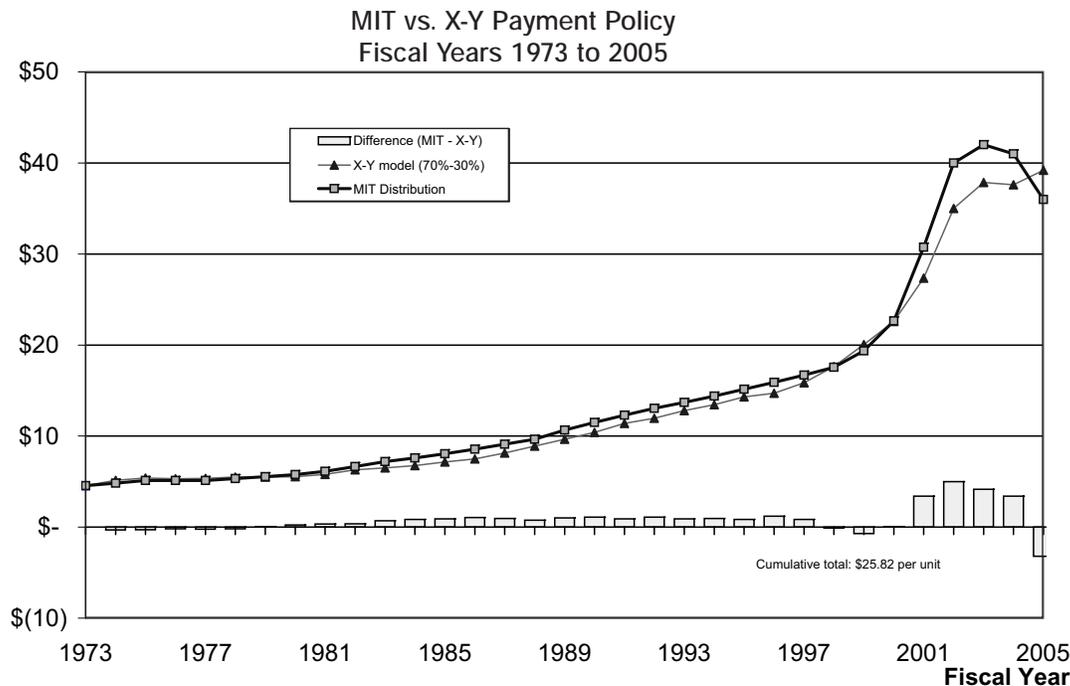


recent formulation sets the distribution rate in the range of 4.75% to 5.5% of the lagging 36-month average unit market value.

This formulation and the sharply increased unit market values due to the strong investment performance in the late 1990's resulted in the distribution increasing at an average annual compounded growth rate of more than 19% from 1998 to 2003, as illustrated in Figure 5.

did not meet demands for resources outlined in that report, the balance was supported by an additional allocation by the Executive Committee of \$500 million of Endowment de-capitalization (technically a draw on unrestricted *quasi-endowment*). That program, authorized for the period 2000-2010, is being implemented on that original schedule.

Figure 6
Comparison of the Actual MIT Pool A Distributions Per Unit to Implicit 70%/30% Model



million of draw on unrestricted *quasi-endowment* funds.

Even with the subsequent decrease in the distribution rate over the past two years, the distribution rate from 1998 through 2005 will have grown at an annually compounded rate of over 10%. While the purposes for which the increased rate of change in the distribution was effected were appropriate and directed to important initiatives, there is the question of what can we reasonably expect for the future rate of growth in the distribution?

This longer-term outlook is suggested by Figure 5, above. The average annual growth rate in the distribution rate was 6.15% for the 1970 through 1998 period. This period included years of economic strength, of economic weakness, of high inflation, and of low inflation – essentially a full spectrum of economic results. Based on this history, it seems difficult to expect that distribution rates should grow on balance much more than 6% annually. On a rough, intuitive level, the 6% growth in

distribution is the *net of investment return of the Endowment, less the annual distribution*. In those terms, the average investment return of the Endowment was 11% over that period. This is only a rule-of-thumb, as the process of calculating the distribution incorporates a 36-month average of market values, and the distribution rate as a percent of market value varied over that period. But as such, it gives a ballpark figure for us to consider the impact of the current market environment and a 5-6% effective distribution rate (incorporating the impact of the use of *quasi-endowed* funds raises the effective distribution rate). To continue the comparison, Figure 5 shows two projections, one at 6% and one at 8%. It is to be noted that had the 1998 distribution rate been increased at a 6% rate from 1998 forward, the fiscal 2005 distribution would have been \$26.40 per unit, and the projection at 8% would have yielded a \$30.10 per unit distribution, in comparison to the \$36.00 per unit currently being distributed.

The challenge for the future is to achieve an appropriate coupling of the distribution rate to a longer term view of what can be expected from investment results, and by doing so, balance the funding of our current needs with our obligation to ensure the financial, and ultimately the operational, flexibility of the Institute.

We welcome the opportunity to discuss these issues further with interested members of the community and thank the editors for providing an opportunity for a broader discussion of the investment program and its implications for support from the Endowment. ■

Editor's Note: An exception was made to the normal length restrictions of *Newsletter* articles for the above report on the MIT Endowment, due to its unusual content and interest to the MIT community.

Allan S. Bufferd is Treasurer (bufferd@mit.edu).

The Management of the MIT Endowment Glossary

THE ASSETS OF THE Institute's major investment pools are divided into eight sub-portfolios. This Glossary has been prepared to assist in understanding these eight portfolios and the assets and strategies in which the Endowment participates. [See article, page 1.]

Fixed Income and Cash

The Fixed Income and Cash portfolio employs a conservative investment strategy diversified among U.S. Treasuries, U.S. Agencies, high-quality corporate debt, and mortgage-backed and other asset-backed securities, with a modest allocation to high-yield and non-U.S. bonds. This type of strategy is typically described as "core fixed income." The portfolio benchmark is the Lehman Aggregate Bond Index.

Real Assets (TIPS)

The *Real Assets* portfolio is designed to further diversify the assets and, more importantly, to provide inflation protection. The portfolio includes Treasury Inflation-Protected Securities ("TIPS") other inflation hedges, commodity futures and natural resource-related equities. The current benchmark is the Lehman U.S. TIPS Index.

U.S. Equity

The major portion of the *U.S. Equity* portfolio is focused on large-cap domestic equities but includes the capability to invest up to 20% of the sector in large-cap international equities. Approximately 5% of the sector is currently invested in international equities.

The large-cap portfolio and an Energy sector fund comprise about 75% of the *U.S. Equity* portfolio.

The balance of the *U.S. Equity* portfolio is the Small-Cap sector. We follow various approaches from broad diversification within the sector, to size – and industry – specific strategies. The applicable benchmarks are the Russell 2000 Index and the AMEX Biotech Index.

International Equity

The *International Equity* portfolio has three distinct sectors. The first is a large-cap allocation that is the largest commitment in this portfolio and is benchmarked against a derivative of the MSCI EAFE Index, one that was developed and customized by MIT with the assistance of Professor Stewart Myers of the Sloan School almost six years ago. The MIT Custom International Index consistently has outperformed the standard MSCI EAFE Index and serves as a higher standard for our managers.

The second sector of the *International Equity* portfolio is dedicated to emerging markets, debt and equity. The benchmark is the MSCI Emerging Markets (Gross) Index.

The third sector of the *International Equity* portfolio is comprised of international small-cap equities. One of the mandates is a long/short* strategy that was developed by and for MIT. The benchmark is the Citigroup EMI Ex US Index.

* *In a long strategy, one purchases a security expecting to sell at a future time at a higher price. In a short strategy, one sells a security not owned ("short") hoping to purchase it in the future at a lower price.*

Private Capital

The *Private Capital* portfolio is comprised predominantly of investments in private, and usually non-technology, companies, domestic and international. The Institute was one of the early institutional investors in this strategy, executed through various partnerships with selected managers. Originally termed "leveraged buyouts," it is more correctly characterized as growth financing in addition to buyouts. The portfolio is highly diversified among domestic and international managers, with very little overlap in specific holdings. There are a few direct positions as well as some public holdings in this portfolio. This portfolio and the *Venture Capital* portfolio comprise the area known as private equity. The Cambridge Associates Private Equity Index is the benchmark.

Venture Capital

The *Venture Capital* portfolio is comprised predominantly of investments in private, usually technology-based, domestic companies. The Institute was one of the early institutional investors in this strategy, executed through various partnerships with selected managers. This portfolio has more overlap in specific holdings than experienced in the *Private Capital* portfolio. There are a few direct positions and some public companies in this portfolio. This portfolio and the *Private Capital* portfolio comprise the area known as private equity. The Cambridge Associates Venture Capital Index is the benchmark.

Marketable Alternatives

The *Marketable Alternatives* portfolio is comprised of diverse investment strategies in hedge funds and other marketable alternative investments. The *Marketable Alternatives* portfolio includes areas such as: event and merger arbitrage, distressed debt and credit-oriented funds; special situations; and long-short equity management. Approximately one-third of the portfolio's exposure across the strategies is outside of the United States. Most of the underlying investments are in marketable securities, although some of the investments are private positions or subject to limited liquidity due to the organizational structure of the manager. The benchmark is the 91-Day Treasury Bill Rate Plus 500 Basis Points (i.e., a 5% return over the risk-free rate).

Real Estate

The *Real Estate* portfolio is 75% in Cambridge through land holdings and direct investments in office and laboratory space, more or less contiguous with the MIT campus. While this real estate has a strategic purpose, purchase criteria include a sufficient return for the Endowment to commit capital. The two most significant holdings are University Park at MIT, and the Technology Square development. The balance of the *Real Estate* portfolio is invested in diverse property types, domestic and international. The NCREIF Property Index is the benchmark. ■