

MIT Faculty Newsletter

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

in this issue: The financial crisis facing the Institute, as stated by Provost Reif below, provides "... an opportunity for MIT to demonstrate its deepest strengths as a community of innovative problem solvers." In this tradition, the Provost has summarized the nature of the difficulties we face, and Prof. Daniele Veneziano has provided a guest editorial that we hope will set the stage for participation by other MIT faculty in confronting this serious and challenging issue.



MIT's West Garage

An Integrated Approach to MIT's Financial Future

L. Rafael Reif

EVERY DAY WE ARE REMINDED in news reports and personal conversations about the world's financial turmoil and the hardships it has brought upon individuals and institutions. As you know from faculty meetings and our letters to the community, MIT is not immune from this turbulence.

As of the end of December 2008, we estimated the value of the MIT endowment had dropped by approximately 25% since June 30, 2008. We anticipate a reduction of closer to 30% by the end of this fiscal year if the trends of the fall and winter do not dramatically improve or worsen. For this reason the Institute must prepare to operate in an environment where the value of our endowment is closer to \$7 billion, rather than its June 30th value of \$10 billion.

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Can You Hear Me Now . . . ? Improving Cell Phone Coverage at MIT

Robyn Fizz, Joan Cyr, Jerrold Grochow

OVER THE PAST DECADE, cell phones have become essential to life at the Institute, both for daily business and the many research projects that focus on mobile devices. They can also serve as a critical source of communications during an emergency. Given the ubiquity and importance of mobile devices at MIT, why are cellular signals on campus so variable?

Imagine these three scenarios – which all happen to be true.

- Sprint Nextel leases space for a cell tower on the rooftop of a building near the MIT campus. When the building is sold, the new owner asks Sprint to remove the transmitter. As a result, cellular coverage with this carrier declines on West Campus. Sprint Nextel engages MIT to search for a new site, and testing pin-

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Editorial MIT Needs a Principled Response to the Current Economic Crisis

Daniele Veneziano

(The present communication is largely based on a message I sent on December 18, 2008, to MIT President Susan Hockfield and Provost L. Rafael Reif.)

LIKE OTHER ACADEMIC INSTITUTIONS, MIT is facing serious challenges caused by the current economic crisis. The leadership of the Institute has reacted laudably by seeking an "MIT way" to address the problem based on creative thinking, faculty participation, a long-term vision, and the preservation of the core values and mission of the Institute.

While the details of the plan will unfold in the months to come, some broad parameters of the strategy have already been communicated. These include progressive cuts to the operating budget of the Institute, by 5% in FY10 and by larger amounts in subsequent years.

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Photo credit: Page 1, David Lewis; Cartoon, Page 16, Jennifer DiMase

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Ways will be sought to achieve these cuts so that MIT will emerge as a strong institution from the economic crisis, but clearly no unit, program, or operation will be spared the pains of becoming leaner and adjusting to the new economic realities.

This note aims not at suggesting specific solutions but at framing what an “MIT way” out of the crisis might be and how to draw the line for the budget cuts. The focus is on broad principles and priorities not dollars and cents, perhaps to the point of being overly simplistic in the financial arguments. My own background, in risk analysis and probabilistic modeling, certainly biases the reasoning. I hope that others will join the discussion and contribute different perspectives.

My main concern is that several broad-scale considerations have been missing when the rationale for the cuts was presented to the faculty and that the faculty participation in molding that rationale has been limited. In the months to come, there will be opportunities for faculty engagement, but if the overall parameters are already set, rethinking the broad picture will be difficult. All comments are made in the spirit of open discussion set forth by the administration.

I shall focus on three issues: the technical way in which basic decisions about the operating budget are made, the large uncertainties about the future of the economy, and the importance of non-financial considerations. Out of this, a suggestion emerges on how MIT could address the crisis.

1. Technical Way in which Broad Decisions Are Made

How have the proposed cuts been arrived at? The overall objective of asset management at the Institute is to balance between two goals: having smooth short-term fluctuations in the operating budget and guaranteeing a steady long-term growth of the endowment. The former objective is usually achieved by using algorithms

(such as three-year averaging, weighting of the previous-year budget, etc.) that in ordinary times act as shock absorbers for the financial ups and downs. As presented, the 5%, 10%, ... cuts for FY10, FY11 and beyond came from applying one such algorithm to scenario projections of the endowment over the next few years. I find this way of deciding to be inadequate on several grounds, all of which are ultimately related to the large fluctuations of

My main concern is that several broad-scale considerations were missing when the rationale for the cuts was presented to the faculty . . . In the months to come, there will be opportunities for faculty engagement, but if the overall parameters are already set, rethinking the broad picture will be difficult.

the financial markets in recent months and the extreme volatility that is likely to endure for some time to come.

Formulas that work well under normal conditions cannot be expected to remain optimal under extraordinary circumstances. These are indeed extraordinary times, in which all the parameters of decision-making are different: the ability to borrow money is diminished, the frozen job market makes any layoff a tragedy, increases in tuition close the door to financially less-privileged students, etc. In addition, we are entering a new territory with significant nonlinearities; for example, on some scale a 10% cut to a program might be not two but 10 times as painful as a 5% cut. Algorithms that work well when the fluctuations are small and the consequences are linear and financial in nature must be revisited, making sure that the large uncertainties on the future of the economy are included (the endowment scenarios used to justify the cuts are hardly representative of these uncertainties) and a wide range of consequences to the people and the Institute are accounted for. The possibility of dipping into the endowment or financing the deficit should be part of the equation. The optimum solution will likely be different

from that of say a three-year averaging rule. MIT certainly has the brainpower to formulate and solve this complex and multi-faceted optimization problem.

One could stop here and rely on the power of modeling and analysis to set the course. However, as any modeler knows well, the results of an optimization problem are driven by the boundaries within which one seeks the solution and by how one assesses the financial and

non-financial consequences of any given action. I start with some remarks prompted by the large uncertainties on the future of the economy and later add non-financial considerations.

2. The Large Uncertainties on the Future of the Economy

As indicated above, one of the Institute’s main concerns is its long-term financial stability. Hence, it is important to understand how different adjustments to the budget over the next few years might affect that stability. Consider the value of the endowment at some future time, say the end of FY10. My uneducated guess is that the value may likely be \$1 billion above or below any best estimate one might produce right now. For example, if the current value is \$7 billion and one projects no change as the most likely scenario, the actual market value of the endowment at the end of FY10 might well be \$6 billion or \$8 billion. By comparison with this wide uncertainty range, the proposed cuts (\$50 million for the first year) are small. Suppose that the \$50 million could be taken out of the endowment. If the \$6-8 billion uncertainty range on the endowment applies when no

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A Principled Response from MIT
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\$50 million cut is made, then if the cut is made the uncertainty range becomes \$6.05 to \$8.05 billion – hardly a perceptible change. Of course the effect of the cuts over a longer time period would be larger,

While no hiring freeze has been announced by the administration, budget cuts on the order of 10% or 15% will inevitably reduce hiring to a trickle. This would happen at a time when young new talent finds reduced opportunities in academia because of the few available openings. By continuing hiring at the normal pace, MIT could distance itself from other peer institutions, help the new ranks in the academic profession, and attract top-quality individuals with little competition.

but so is the uncertainty of our forecasts; so the qualitative conclusion stands, that in spite of our efforts to maneuver it, the boat follows the current.

For another order-of-magnitude comparison, consider the daily fluctuations of the stock market. Fluctuations of 1-2% have become routine and hardly make the news. If the endowment changes by say $\pm 1\%$ daily, that is $\pm \$70$ million. Hence what we are talking about is making (painful) cuts that amount to the daily ups and downs of the endowment.

One could easily criticize my analysis as mixing apples with oranges because the endowment is not made of liquid assets. But the point I want to make is that, if the near-term shortfalls can be covered at least in part by dipping into the endowment or through some form of financing, the Institute could avoid making large cuts during the crisis without jeopardizing the long-term financial picture. Repaying the debt and making large adjustments to the operating budget could take place at more prosperous future times when the Institute and the people affected could better afford them.

3. MIT's Mission and Moral Responsibilities

Non-financial factors should feature prominently in MIT's response to the economic crisis. Among them are the wellbeing of the people at MIT, the mission of the Institute, and the moral responsibilities we have towards the aca-

demic community and the society at large during these difficult times. If there is an "MIT way" to deal with the present crisis, that way should be framed to a considerable extent by these concerns.

Let me amplify on a couple of points. At times of general economic distress, it is in the general interest that all who are able to survive the short-term turmoil do not make cuts or at least do not make synchronized cuts. This is the familiar situation when what seems optimal from the perspective of individuals at the time of decision-making does not produce the overall optimal solution (optimal not just for the society at large, but for the individuals themselves, in our case because of the worsening of the general economic climate and the down-spiraling feedbacks caused by everyone moving in unison). Rather, at a relatively small cost, MIT could set an example for other (wealthy) educational institutions to follow and declare that for the good of all it is making no deep cut. Such bold posture would pay back handsomely in reputation, future donations, etc.

What do I mean by "deep cut"? The Institute is forming a broad-based task force to review and streamline all MIT operations. This initiative will produce reductions in the operating budget that I view quite positively. Where the cuts get "deep" is when additional significant savings are mandated, possibly affecting academic programs, faculty hiring, support staff, student support, etc., unless these cuts are viewed as reasonable by the pertinent units.

Consider for example the issue of faculty hires. The projected reductions in the operating budget would lead to a virtual freeze in tenure-track hiring, with long-lasting repercussions on the intellectual strength of the Institute, its ability to steer into new directions, and its ability to renew its ranks. While no hiring freeze has been announced by the administration, budget cuts on the order of 10% or 15% will inevitably reduce hiring to a trickle. This would happen at a time when young new talent finds reduced opportunities in academia because of the few available openings. By continuing hiring at the normal pace, MIT could distance itself from other peer institutions, help the new ranks in the academic profession, and attract top-quality individuals with little competition.

In summary, for various internal and external, financial and non-financial reasons I find the proposed cuts – especially after FY10 – to be unwise. I would favor budget reductions to reflect gains in efficiency at all levels and in all Institute endeavors, but would withhold making deeper cuts unless the general economic conditions worsen significantly. Any residual deficit could be covered by a combination of dipping into the endowment and financing. More critical than a balanced budget at this time is to safeguard the core values and mission of the Institute, its outside image, and the wellbeing of the people who make MIT the unique place it is. ■

Daniele Veneziano is a Professor of Civil and Environmental Engineering (venezian@mit.edu).

From The Faculty Chair

The Role of Faculty Officers During MIT's Financial Restructuring

Bish Sanyal

WHAT IS THE APPROPRIATE ROLE for the faculty officers as MIT grapples with unprecedented financial problems?

One option, which some of you have already suggested to me, is for the faculty officers to be directly engaged in any Institute-wide effort, such as the one proposed by Provost Rafael Reif in his e-mail to the MIT Community on December 11, 2008. Provost Reif himself sought active participation by faculty officers as well as other faculty members since he started thinking about how to institutionally address the looming financial challenges. This deserves praise from the faculty because it acknowledges the primary role of the faculty in any restructuring effort at MIT and assumes that any innovative solution would require deep involvement by faculty who are known worldwide for innovative and fresh thinking not tainted by either ideology or political opportunism.

True, there is some concern about who should direct the deliberative process: Whether it should be top-down, meaning responding to priorities articulated by the senior administration, or whether it should be a relatively decentralized process, seeking the collective preferences of rank-and-file faculty members at MIT. Such faculty may not be knowledgeable about the intricacies of the Institute's financial investments, but understand at a gut level what it takes to produce top quality research and good teaching. I believe Provost Reif is quite aware of this dual need – some form of central guidance as well as decentralized sources of innovative ideas – and has blended the two sources of institutional intelligence in structuring the task forces. The faculty

officers were asked to participate actively in such task forces to ensure that policy outcomes will incorporate their concerns.

There is a second option, however, for the faculty officers – one that rests on the assumption that they should serve as a watchdog group articulating the anxieties of the faculty who may not be invited to join the task forces, while monitoring the process of policy formation without direct involvement. This option does not necessarily advocate a confrontational role for the faculty officers vis-à-vis the senior administration: It assumes that good policy making requires active participation by some faculty as well as careful monitoring by others, who, if needed, could “speak truth to power.” Accordingly, the faculty officers could serve as an institutional mechanism for faculty to voice critical opinions and propose alternative preferences that are less likely to emerge from centrally formulated task forces.

This does not mean, however, that the faculty officers would run a parallel process of policy making undermining the legitimacy of the formally constituted process. It would be quite the contrary: If faculty are provided an opportunity to express their concerns confidentially to the faculty officers who can then convey those concerns to the leaders of the task forces, the legitimacy of the formal policy outcomes will be further strengthened. While it is true that for such a process to work well the faculty officers cannot be totally outside the policy making process, this is not likely to occur because the Chair of the Faculty is a member of Academic Council, which meets weekly to deliberate all policy issues. In addition, the Chair of the Faculty attends meetings of

the MIT Corporation. Moreover, as Chair of the Faculty, I meet with the Provost, one-on-one, on a regular basis, and as faculty officers we meet with the President and the senior administration once a month in setting the agenda for the monthly faculty meetings – yet another venue when any faculty member can raise questions pertaining to Institute affairs. Add to that the role of the Faculty Policy Committee (FPC) that meets bi-weekly, providing yet another forum that can be utilized to converse with the task force leaders regarding issues of concern to FPC members.

As your Chair of the Faculty, I have decided that I can serve you best during the last semester of my two-year term by following option two. Needless to say, my effectiveness and that of the other faculty officers depend entirely on the level of communication with you. We hope you will share with us your hopes as well as anxieties, either via e-mail or in face-to-face meetings, and we will retain total confidentiality in conveying your preferences and worries to the task force leaders as well as to the senior administration. Please note that you can also meet with us over lunch on the first Wednesday of each month, and that one of us usually attends the monthly Random Faculty Dinners hosted by Jay Keyser. If none of these options are convenient for you, please e-mail me directly and I will set a time for us to meet.

I look forward to working closely with you in turning our financial difficulties into opportunities for making MIT an even better learning community. ■

Bish Sanyal is a Professor of Urban Planning and Faculty Chair (sanyal@mit.edu).

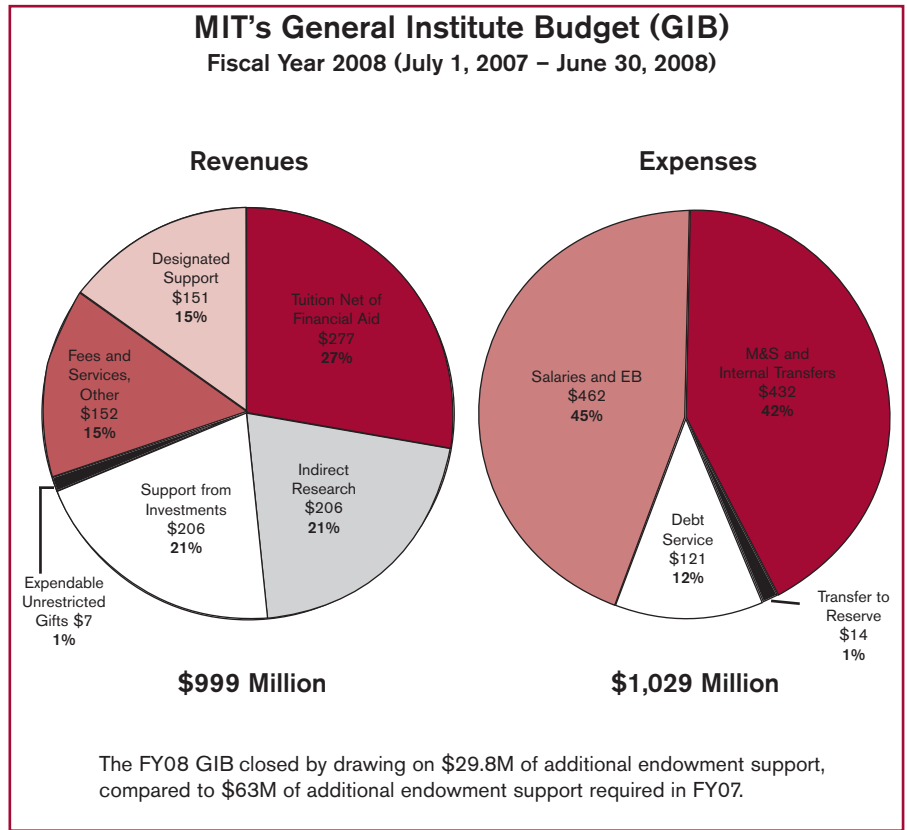
MIT's Financial Future
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A decrease of this magnitude means that budget revenues from endowment payout alone will drop by approximately \$150 million (assuming a 5% payout), and that we will have to decrease our expenses by a corresponding amount. I have been encouraged by the many faculty, students, and staff who have already shared ideas about how to make MIT stronger while reducing costs, and who have expressed their confidence in our ability to weather this financial storm. We all share the conviction that this is an opportunity for MIT to demonstrate its deepest strengths as a community of innovative problem solvers.

A revenue reduction of \$150 million calls for a careful and methodical approach. We are fortunate that MIT is in a relatively strong position to accomplish these reductions because of recent developments in our financial planning processes and policies [see May 2008 *MIT Faculty Newsletter*]. With the help of the heads of academic and administrative units, we are operating from a balanced budget this fiscal year 2009 (FY09). In addition, our endowment payout policy smooths the effects of market volatility over several years. However, with a potentially long period of economic recession ahead, we cannot afford to enter into a period of ongoing budget deficits. We must, therefore, plan prudently for a protracted period of financial constraint, while at the same time remaining flexible for a future in which the economy may remain volatile.

MIT's Budget Today

To best understand why budget reductions of this magnitude are necessary, it is first helpful to revisit how MIT's finances work. The chart (next column) shows a simplified version of MIT's General Institute Budget (GIB) for FY'08 (July 1, 2007-June 30, 2008). As you can see, we operated with a deficit of \$30 million last year, a significant improvement over the \$63 million deficit of the previous year. FY09 is pro-



jected to be the first time in quite a few years that we will have a balanced budget.

Our expenses, shown on the right in the chart above, were approximately \$1.03 billion, of which almost half were salaries.

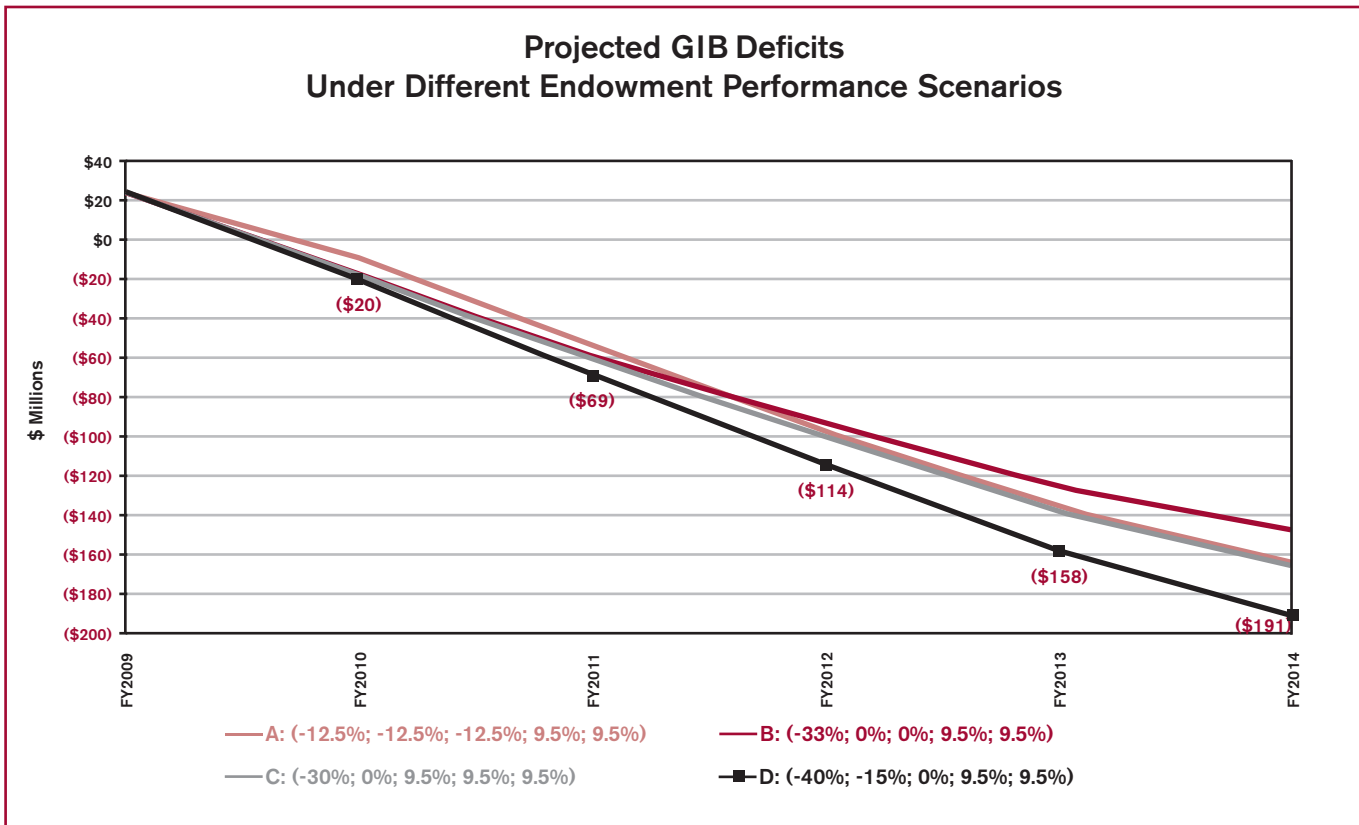
Our revenues, shown on the left, were just under \$1 billion. Looking at our revenue sources, the following are impacted by endowment payout and will decrease: (i) Support from Investments, (ii) Designated Support (mostly endowed chairs), and (iii) Tuition Net of Financial Aid (since a significant portion of the endowment supports scholarship funds). Moreover, research funding is unlikely to increase dramatically, and in these hard economic times we can reasonably expect a decline in revenues from fundraising.

Identifying Long-Term Budget Targets

To understand how financial conditions would impact our budget, MIT's Office of Finance performed a simulation of a number of different market conditions over the next several years and analyzed potential endowment returns.

The chart on the next page shows projected budget deficits under multiple endowment performance scenarios if we do not reduce our expenses. The chart assumes a smoothed endowment payout. For example, scenario D projects a FY09 endowment return of -40 percent, followed by years with annual endowment returns of -15 percent, 0 percent, and then +9.5 percent in FY12 and in subsequent years (+9.5 percent has been the long-term return performance of our endowment). In this scenario, while FY09 closes with a positive reserve of approximately \$20 million, FY10 would have a budget deficit of \$20 million, and that deficit would grow to \$158 million by FY13 – unless we begin to reduce expenses now.

You will likely notice that the budget deficit increases gradually in the chart, despite the rather abrupt decline simulated for endowment value. This is due to the smoothing policy assumed for the endowment payout. The endowment payout formula used in the simulations



smooths out short-term fluctuations in endowment value, and buffers the revenues from the endowment that support Institute operations. As a consequence, sustained declines (or increases) in market value translate into declines (or increases) in payout to MIT's operations over time. It is important to emphasize that the volatility of the financial markets, along with broader economic factors that affect other sources of MIT's revenue, such as gifts, make it impossible to predict the decline in budget revenue with certainty.

An Integrated Approach to Planning

In a December 2008 letter to the community [web.mit.edu/instituteplanning/letter2.html], Chancellor Clay, Executive Vice President and Treasurer Stone, and I shared a plan for reducing GIB expenses by \$100-150 million over the next two to three years. We will begin with an expense reduction of \$50 million in FY10, and units have been asked to decrease expenses by amounts that total \$50 million Institute-wide. Each unit has been asked to

review its core mission and align its reduced resources to that mission. We must prepare for the likely need to reduce expenses by another \$50 million in FY11 and again in FY12, for a total budget reduction of \$150 million over the next three years. This second and, if necessary, third \$50 million reduction will be achieved by a combination of unit-based expense reductions and the identification of new savings. The latter will be identified through an integrated planning process that will determine ways to carry out our core mission more efficiently, using fewer financial resources, and without decreasing the quality of our work.

This integrated process will be led by the Institute-wide Planning Task Force announced last December. The Task Force includes faculty, students, and staff, and has been charged with identifying substantial realignments of resources to serve MIT's mission. We expect preliminary recommendations by June 2009, with refinement of key recommendations by October. The Office of the Provost will vet

the recommendations and will oversee the implementation and monitoring of the adopted recommendations. You can learn about the Task Force's membership, charge, and progress at the new Institute-wide Planning Website (web.mit.edu/instituteplanning). The Website also features the MIT Idea Bank (idea-bank.mit.edu), an interactive forum for all members of the community to share innovative ideas on how MIT can pursue its mission more effectively.

Although the uncertainty of the global economy has created anxiety for all of us, this environment has also allowed me to observe the depth of commitment shared by the Institute's faculty, students, staff, alumni, Corporation members, and friends. In this difficult economy it is vitally important that we harness those qualities that are most enduring at MIT – creativity, innovation, and collaboration. These strengths will enable the Institute to remain vibrant and forward-looking during these challenging times. ■

L. Rafael Reif is MIT Provost (reif@mit.edu).

The Facilitating Effective Research Program

Janet Rankin

IN MOST SCIENCE AND ENGINEERING fields, success in research (in both academe and industry) requires not only advanced domain-specific knowledge and sophisticated experimental and analytical skills, but mentoring and managerial skills as well. Graduate students here at MIT (and throughout the country) usually have their first professional mentoring experiences when they are given responsibility for the day-to-day supervision of undergraduates in laboratories and/or other research environments. These close working-relationships between graduate students/post-docs and undergraduates can be very rewarding for all parties, but often graduate students and post-docs are given little explicit guidance or advice about planning research tasks, or how best to guide and manage undergraduate students.

In order to support graduate students and post-docs from across the Institute in their roles as undergraduate mentors, the Teaching and Learning Lab (TLL) and the Office of Undergraduate Advising and Academic Programming (UAAP) offer the Facilitating Effective Research (FER) Program. The FER Program strives to make the undergraduate research experience more meaningful for the undergraduate researchers, more rewarding for their graduate student and post-doctoral mentors, and more productive for everyone involved. FER provides a forum for grad students and post-docs to consider and discuss the issues and factors inherent in the effective mentoring of students and management of research activities.

The program has been offered five times over the past two years, and has assumed a variety of formats – from four individual one-hour sessions; to two two-hour sessions. In total, over 80 graduate students and post-docs have attended the program. FER addresses a variety of

topics, including: Mentoring and Advising Styles; Perspectives of Experienced Faculty Mentors; Perspectives of UROP Veterans and Experienced Graduate Student Advisors; and Case Studies (that address complex and/or difficult graduate student/undergraduate interactions).

In the Mentoring and Advising Styles session, participants discuss their own management/mentoring styles and preferences, along with the strengths, weaknesses, and biases of those styles. Participants are encouraged to consider the ways in which their management styles might lead to either synergistic or problematic interactions with others (specifically those whom they supervise). In addition, participants discuss the establishment of realistic and developmentally appropriate project goals [An undergraduate who is participating in her/his first research experience is likely to require (and appreciate) more explicit and detailed guidance than a student with more research experience.]; the importance of setting clear and realistic expectations at the onset; and the need for open lines of communication among all parties involved.

During the Perspectives of Experienced Faculty Mentors and the Perspectives of UROP Veterans and Experienced Graduate Student Advisors sessions, veteran advisors describe how their approaches to mentoring and project supervision have changed over time. They also offer their strategies for supporting student researchers with a range of experiences. Veteran UROPs provide valuable insights for participating graduate students. Most times, these seasoned UROPs have worked in multiple labs and on multiple projects, and are able to reflect on what has worked for them

and why. Program participants value the inclusion of “real” undergraduates who can answer direct and specific questions from the UROP student perspective.

The Case Studies session provides participants with the opportunity to discuss difficult graduate student/undergraduate interactions and reactions to a variety of problems and issues that can arise in a research setting. The cases presented underscore the importance of clear and open lines of communication (between undergrad and grad students, and between faculty advisors and grad students), the value of setting realistic goals, and the existence of external sources of advice and support (for situations that cannot or should not be addressed by the graduate student alone).

The FER Program can be adapted and modified for use in individual departments. It can be tailored to meet the needs of a particular group (post-docs, graduate students, or junior faculty) from a given department, or to support individuals in specific programs, groups, or initiatives at MIT.

The next FER sessions will be offered on Tuesday March 10, 2009 and Thursday March 12, 2009, from noon -1:30, location TBD. Pre-registration is required. For more information contact Janet Rankin (TLL): (jrankin@mit.edu) or Melissa Martin-Greene (UAAP-UROP): (melmart@mit.edu).

Please contact the Teaching and Learning Laboratory (tll@mit.edu) or the UROP Office (urop@mit.edu) if you have any questions about the FER Program or if you would like to discuss modification/implementation of the Program to fit your departmental needs. ■

Janet Rankin is an Associate Director of the Teaching and Learning Laboratory (jrankin@mit.edu).

A Call for Nominations to Faculty Newsletter Editorial Board

THE FACULTY NEWSLETTER IS now accepting nominations for candidates to serve on the *Newsletter* Editorial Board. Nominations must be received by March 20 to be considered. All current faculty members and professors emeriti are eligible to serve.

Continuing with the procedure initiated last spring, all Editorial Board members are now directly elected by the faculty. The Nominations Committee for

the *Newsletter* (chaired by Prof. John Belcher) will review all nominations and recommend candidates, in anticipation of faculty-wide, electronically based elections to be held in early spring.

Nominees will be asked to give evidence of commitment to the integrity and independence of the faculty, and to the role of the *Faculty Newsletter* as an important faculty voice.

Please forward all nominations to: fnl@mit.edu, or contact any member of the *Newsletter* Editorial Board. Please include Institute information (department, address, etc.) for both the nominee and the nominating faculty member, as well as a brief explanation of the qualifications of the nominee to serve on the Editorial Board. ■

Teaching this spring? You should know . . .

the faculty regulates examinations and assignments for all subjects.

Check the Web at web.mit.edu/faculty/termregs for the complete regulations.

Questions: Contact Faculty Chair Bish Sanyal at x3-3270 or sanyal@mit.edu.

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.

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.

For all Undergraduate Subjects, 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 Testing During the Last Week of Classes

Tests after Friday, May 8, 2009 must be scheduled in the Finals Period.

***It is important to define your expectations and academic integrity to your students at the beginning of each semester.**

Can You Hear Me Now . . . ?

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points the top of Building NW14. However, siting the transmitter at this “ideal” location would interfere with sensitive research being conducted inside the building.

- An MIT researcher is developing an in-car system for finding destinations – such as nearby restaurants or local museums. To test his system, he needs reliable cellular coverage in one of the parking levels beneath the Stata Center. Unfortunately, as he discovers, the penetration of cell signals below ground is very limited.
- On the main campus, MIT constructs Building 6C, an “infill” structure noted for its vibrant atrium floor by Sol LeWitt. As the building rises, the strength of cell signals in surrounding buildings drops significantly.

Say What?

Let’s take a closer look at our three scenarios to zero in on some of the challenges.

- The dragged-out tale of the West Campus transmitter underscores the fact that cellular carriers are the primary factor in this equation. While MIT operates its own networks – including the wireless network for computer communications and the on-campus phone system, now being converted to voice over IP (VoIP) technology – it does not operate its own cellular service. Coverage on campus has been totally dependent on the cellular companies – until recently. (See *Bridging the Gaps*, below, for how we can now have some impact.)

You might think the MIT name would carry weight with cellular service providers – and to some extent it does. MIT receives special pricing from Verizon Wireless and Sprint Nextel, and also has contracts with T-Mobile and AT&T. Still, with only about 600 busi-

ness accounts each with Verizon and Sprint Nextel, and even fewer with AT&T and T-Mobile, MIT is hardly a big customer.

The rooftop scenario also illustrates how complicated it can be to site cell towers

To date, no department or group at MIT has been given the mandate or resources (dollars, people, and real estate) to tackle the challenge of ensuring consistent cellular coverage across campus.

on campus. Care must be taken to ensure that radio frequencies from transmitters don’t disrupt MIT research. And negotiations for transmitters involve not only the cellular carriers and various MIT departments – Facilities, Information Services & Technology (IS&T), Procurement, and the Office of the General Counsel – but also the City of Cambridge, which grants permits for visible or rooftop structures.

- The researcher’s dilemma in the Stata garage highlights the difficulty of getting cellular coverage in underground locations. This is especially true when the structures are made of cement. Even above ground, signals may be weak or nonexistent in many inside locations. Several materials can impede outside signals from penetrating building exteriors. These include titanium outer shells, filtered glass windows, and older buildings with thicker walls and heavy infrastructures.
- As Building 6C demonstrates, new construction in close proximity to other buildings can affect the path of cellular signals. Shadowing by buildings can weaken or block signals that used to get through. MIT’s building boom has benefited the community in many ways, but has not been a plus in the cellular realm.

Clustered buildings (or clusters of people) can also cause unexpected voids in cellular coverage. This occurs when a large number of mobile devices vie for the same carrier signals in a small space.

Just picture Killian Court on Commencement Day.

In physical terms, then, there are several reasons why cellular coverage may be degraded or nonexistent at different places and at different times.

Contributing Factors

Beyond buildings, signals, and transmitters, other factors complicate the cellular environment at MIT.

- *Multiple carriers:* As noted, MIT does business with four cellular carriers: Verizon Wireless, Sprint Nextel, T-Mobile, and AT&T. The FCC licenses different signal frequencies for each carrier, so each needs to install and operate its own transmitters. And each carrier requires a separate contract with MIT for use of additional equipment to improve its signal inside buildings. Dealing with four service providers, rather than having leverage with one, makes it that much harder for MIT to resolve coverage issues on campus.
- *The moving target of technology:* New smartphones and platforms – such as Apple’s iPhone, Google Android, and Cisco’s Mobility Services Engine – may change the cellular landscape. Many analysts expect a migration of services to a converged platform using the IP data network. For now, with technology in flux and budgets being squeezed, investments in cellular solutions need to be targeted and pragmatic.
- *Limited resources:* To date, no department or group at MIT has been given the mandate or resources (dollars, people, and real estate) to tackle the challenge of ensuring consistent cellular coverage across campus. Resources from cellular carriers have also been scarce.

Cellular Resources from IS&T

IS&T continues to work with carriers and groups on campus to resolve cellular coverage issues. If you or your department has concerns, send e-mail to cell-feedback@mit.edu.

IS&T's Mobile Devices Team evaluates new cell phones, develops services such as MIT Mobile Web (m.mit.edu), and fields questions about mobile devices from members of the community. To reach this team, send e-mail to mobile-help@mit.edu.

The Mobile Devices Team also sponsors a user group. To keep up with meeting topics and announcements, join the Mobile Partners mailing list. You can sign up at mailman.mit.edu/mailman/listinfo/mobilepartners.

For online resources about mobile devices at MIT, visit these pages:

- Cellular Telephones (showing discounts available to departments and individuals) web.mit.edu/ist/topics/telecommunications/cellphones.html.
- Mobile Devices/PDAs at MIT: web.mit.edu/ist/topics/pda.
- Mobile Devices Wiki: wikis.mit.edu/confluence/display/MobileDevices/Mobile+Devices+Wiki (certificates required).

May the signal be with you!

Bridging the Gaps

IS&T has become the “go-to” group for telephone issues on campus, since IS&T provides the traditional and MITvoip phone services on campus. IS&T has heard a growing chorus of complaints from mobile device users on campus; it's clearly a frustrating experience for everyone. While IS&T does not control cellular service on campus, it has taken several steps to try to improve the situation.

- IS&T continues to work with cellular carriers to install outdoor transmitters on campus. Since outside cell signals often permeate building interiors, new transmitters will have the biggest impact on improving cellular coverage on campus.

The transmitter for West Campus is high on the priority list, since Campus Police, the Athletics Department, and other MIT service groups are Sprint Nextel customers. MIT is now negotiating with Sprint Nextel to install a transmitter on the roof of the Johnson Athletic Center – a location that will also boost signals for MIT's “dormitory row.”

To improve its coverage for the center of campus, Sprint Nextel plans to install a pair of transmitters on E17 and E19.

Plans for a new AT&T transmitter on or near Building 37 are moving forward. This installation will improve coverage for all AT&T customers on campus, including iPhone users.

- To bring interior signals up to satisfactory levels, IS&T led the installation of a multi-carrier, in-building Distributed Antenna System (DAS) in the Stata Center, plus its extension to the Broad Institute and the new Ashdown Dormitory (NW35). This type of system uses a group of antennas to capture and relay cellular signals, though at a very high cost. For example, MIT paid almost \$250,000 for the Stata DAS.

IS&T has also been involved in installing small, single-carrier, in-building Distributed Antenna Systems in E40, 46, and the Bates Linear Accelerator Center. However, setting up these systems in multiple locations throughout MIT is not a viable solution: in

larger numbers, they affect negatively the networks of cellular carriers.

- IS&T has assembled a team to evaluate other promising technologies. Of particular interest are:

– *Dual-mode handsets*. Devices such as T-Mobile's Unlicensed Mobile Access (UMA) phones allow users to roam by providing a seamless transition between MIT's wireless network and the carrier's cellular network. Among its advantages, UMA technology addresses coverage issues in underground spaces.

– *Fixed mobile convergence (FMC)*. This technology fuses WiFi, cellular, VoIP telephony, and location-awareness technology, and supports all cellular carriers. FMC technology provides MIT with the opportunity to leverage its campuswide WiFi network and recent investment in VoIP technology. This fall, in a joint collaborative effort with Agito Networks and Cisco, IS&T plans to conduct an evaluation of Agito's mobility router and Cisco's wireless services engine, using the recently upgraded MIT wireless network.

These technologies, along with new transmitters, hold the most promise for taming MIT's cellular challenges. Even so, to make the best use of new solutions, it will be important for individuals to choose carriers and mobile devices that are in line with MIT's recommendations.

With mobile devices so central to today's communications, it's important that the Institute throw its weight behind improving cellular coverage. It will take vision, resources, and a spirit of collaboration to bring strong signals to all corners of campus. ■

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When a Whistle in the Wind is the Sound of Steam: Lessons Learned from a Building Emergency

Susan Leite

HOW DO YOU RECALL the evening of Friday, October 31, 2008? For most, the evening held some connection with Halloween: that occasion known for flights of fear or pranks of all scales. For the occupants of Building 66, however, that Halloween Friday will be remembered as a trick in the form of a steam release and a lesson learned in the unpredictability of emergencies and the necessity of a business continuity strategy.

At 8:30 pm, condensation-induced water hammer occurred in 200 psi steam piping in the Building 66 sub-basement mechanical room. The hammer forces caused pipe anchors to pull out of the concrete ceiling slab, allowing enough pipe movement for an expansion joint to pull apart. From the two open pipe ends a significant volume of steam was released into the building. Thirty sprinkler heads fused due to the heat of the steam. Sprinkler water and condensed steam caused significant damage in the building. Subsequent inspection the following morning revealed the failure of a steam trap and damage observation supports the conclusion that the condensation-induced water hammer occurred at that location. Fortunately, no injuries or fatalities occurred and Department of Facilities staff worked ceaselessly over a 24-hour period to maintain essential building services and to ensure re-occupancy the following Monday.

In the following weeks, MIT engaged two independent third-party investigators to address the root cause of the incident and identify any follow-up recommendations. Professor Emeritus Peter Griffith of MIT's Mechanical

Engineering Department is considered an authority on heat transfer and thermodynamics and was able to lend his expertise to the assessment of the incident. From these reports, the Department of Facilities identified preventive measures that would mitigate the likelihood and impact of a recurrence.

Mitigating Factors

Several factors mitigated the impact of the steam line rupture. First, the timing of the release, combined with the evening being Halloween, meant the building was minimally occupied and no one was in the direct path of the release. Second, surveillance video revealed that approximately 90 seconds elapsed before steam infiltrated through hallways and doors. Those still in the building and immediately responding to the fire alarm had time to safely evacuate. Some air-handling units remained functional, which mitigated temperature effects. Areas with the most water damage either did not contain water reactive chemicals, or the containers were properly stored under inert atmospheres. Finally, the Facilities Manager and Environment, Health, and Safety (EHS) staff surveyed the building within 24 hours of the incident; this was essential to identifying any operations needed to make the building safe for re-occupancy.

Recovery

The recovery plan for Building 66 is a collaboration engaging the Department of Facilities, the Chemical Engineering Department Facilities Manager, the MIT Insurance Office Claims Adjuster, FM Global (MIT's property insurance

carrier), the EHS Office, and the Security and Emergency Management Office. The Chemical Engineering Department was fortunate in that no laboratory spaces experienced a complete loss of research facilities. Loss consultants who surveyed the extent of equipment and facilities damage applied the following guidelines for estimating individual lab losses:

- collect purchase/rental agreement records for all equipment acquired or leased for the lab.
- inventory all equipment with disposition status: salvage, test, or toss.
- if safe to do so, plug in equipment to determine if immediately functioning.
- equipment with sensitive electronics could be vulnerable to a steam condensation effect that may be beyond the temperature tolerance of the electronics; this equipment could require replacement.
- equipment with motor housings submerged in water could likely fail at a future time.
- request that equipment vendors test equipment on site, rather than sending equipment off site.
- review agreements for any equipment on loan and test and salvage equipment accordingly.
- plan on a lead time of at least eight weeks for ordering equipment replacements.

In December 2008, the Department of Facilities and the Chemical Engineering Department entered into a scope of work for reconstruction and repair of the building facilities, with the rebuild schedule slated to occur over several months.

The Value of Multi-Hazard Risk Identification, Assessment, and Mitigation

Though the incidence of steam line releases at MIT is extremely low, they are potentially high consequence events in terms of injury/fatality potential, loss of building function, and secondary hazards. What this spectrum of emergency scenarios that can impact a decentralized organization like the university setting underscores is the importance of a method to identify potential risks using a multi-hazard approach, and the need to develop strategies for their mitigation, including an effective business continuity strategy across research and administrative units.

Efforts to identify and mitigate impacts from a spectrum of man-made and natural hazard scenarios were the focus of a research project funded under the Federal Emergency Management Agency's Disaster Resistant University (DRU) program. The project, under the supervision of Professor George Apostolakis, who has dual faculty appointments in the Department of Nuclear Science and Engineering and the Engineering Systems Division, entailed developing a quantitative framework for identifying and assessing a universe of risks and their impact (or disutility) through a variety of lenses such as human and/or environmental health, infrastructure resilience, intellectual property, and reputation. The research effort engaged numerous stakeholders representing a cross section of the Institute's academic, research, and administrative units and generated a dialogue on the following questions and their role in building organizational resilience:

- for a given hazard scenario (e.g., flood, fire) how frequently does such an incident occur on our campus or is reported elsewhere? if losses are incurred, what is the value?
- if an outage occurs, what is the typical duration?
- if a particular operation experiences an outage, what is the critical timeframe for restoring operations?

- what mechanisms are in place to mitigate the risk, and what steps can be taken to enhance resilience moving forward?

Finally, researchers evaluated interdependencies across campus – for departments, this is where the proverbial rubber hits the road – understanding that the research and education enterprise is a network of building infrastructure, communications, and utilities systems, locally operated and maintained research equipment, administrative services, and the numerous departments which provide or use the service of a core facility that may support hundreds of research collaborations and represents millions of dollars of research investment.

Building organizational resilience is an effort that commands involvement across all departments and cannot be effectively achieved through delegation or outsourcing. The all-hazards assessment framework is a valuable heuristic technique for evaluating low probability-high consequence events alongside higher probability-lower consequence events. Lessons learned from the steam incident and events elsewhere continuously refine the model, enriching its future value as a decision-making tool and model for emergency planning.

Empowering Your Own Organizational Resilience

In the December 2007 *MIT Faculty Newsletter*, an article on the lessons learned from the December 2006 fire at One Broadway which resulted in an extended outage for several departments, summarized key considerations for emergency planning that are applicable to a whole host of scenarios including the steam incident described earlier. In underscoring the importance of proactive extended outage and emergency planning, academic, research, and administrative departments across the Institute are asked to consider the following:

- how would you stabilize research activity if water service or power was lost

for more than a day or a week; your building was closed due to a major fire, gas leak or other building system emergency for an extended period of time; or a significant natural disaster renders your research area indefinitely inaccessible?

- what are the major supply chains for your lab operations? What contracts are currently in place with vendors?
- is research and/or office data routinely backed up off site?
- has an alternate location been identified which includes the resources necessary to continue your group's business operations on a temporary basis?
- have you discussed how to handle emergency or outage with staff and students?
- do you have ready access to department phone lists and MIT office contacts that can assist you in an emergency? is there a strategy for communicating if e-mail and cell phone services are down?
- are building occupants well-versed in evacuation routes and rallying points? does the plan address ADA (Americans with Disabilities Act) needs?
- have individuals updated contact information on MIT Alert (web.mit.edu/mit-emergency/mitalert) in the event of a campus emergency?

All units are well-advised to engage in the process of identifying their critical activities and plan for the eventuality of an extended outage (e.g., implementing a local communications plan as well as ensuring support for activity that cannot be discontinued during an emergency). Bill VanSchalkwyk, Managing Director of Environmental Health and Safety (EHS) Programs, has made it an EHS priority to assist departments with developing local emergency preparedness and business continuity plans. Together, we can ensure a safe and orderly response to an emergency or outage and protect MIT's most important assets: its people and its research. ■

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Faculty Can Help Prevent Sensitive Data Loss

Allison Dolan

LAST JANUARY, A UNIVERSITY of Texas biological sciences professor put class test scores, with Social Security numbers (SSNs), online. In February, a Harvard computer was compromised, resulting in the need to notify about 6,000 individuals that their SSN could have been exposed. In March, Texas A&M University found that SSNs for students enrolled in a 1998 course were available online, and continued to be available in search engine caches even after the offending file had been taken offline. In June, a Stanford laptop containing SSNs as well as other personal information was stolen; over 60,000 faculty, staff, and students were notified. In July, a laptop was stolen from an Indiana State University economics professor; it had names and SSNs for students who had taken his class between 1997 and 2003.

Virtually every week, there is a report of some higher educational institution inadvertently losing custody of personal information. Because names in conjunction with SSNs can be used by identity thieves to get credit cards, loans, medical services, and even employment, most states, including Massachusetts, have passed data breach laws, which requires notifying those whose personal information has been exposed.

Admittedly, it is rare that accidental data breaches (e.g., a lost laptop; file discovered by Google) result in identity theft. However, any breach involves costs for the data owner, including notifying impacted individuals, providing credit monitoring, and possibly financial penalties. In addition, for many organizations, the reputational cost of a data breach can be

significant, resulting in the loss of customers, or, in the case of higher education, the loss of donors.

MIT has long been concerned about the implications of using SSNs as an identifier. In fact, when the MIT ID number was introduced in 1996, it was explicitly intended to replace the use of SSNs for members of the MIT community.

MIT has long been concerned about the implications of using SSNs as an identifier. In fact, when the MIT ID number was introduced in 1996, it was explicitly intended to replace the use of SSNs for members of the MIT community (see: web.mit.edu/mitid/www/history.html). Some other major institutions stopped using SSNs only as recently as last year.

In 2003, with the SAP-HR go-live, SSNs were no longer used by MIT as an employee identifier in the HR system, and with the 2006 SAP-Payroll implementation, SSN usage was further constrained. MIT HR has worked closely with our benefit providers to use alternate identifiers, and areas within the Office of the Dean for Undergraduate Admissions have taken a number of steps to protect SSNs of applicants, admitted students, and their parents.

Nevertheless, there are places where SSNs are still being used, or files related to old processes are still in electronic or paper archives. Because of the risks associated with these “unknown” areas, about a year ago MIT established the program,

“Protecting Personally Identifiable Information,” to understand where and how SSNs were still being used, and to

work to mitigate the risks of a breach at MIT. Since then, program staff have been working with administrators in departments, labs, and centers, as well as with central offices. However, as can be seen from the stories mentioned above, data losses do not always occur with administrators; the program would like to enlist the help of faculty and other academics in further reducing MIT’s risk.

Some steps that you can take:

- Think back over your career about when you might have had SSNs for students – either here or from a prior institution.
- For electronic files, you can use the search functionality on your computer, and look for files containing phrases such as “SSN” or “Social Security.”
- Consider whether you have kept written or electronic lists of SSNs of colleagues working on grants. Check whether an SSN is still needed. For example, NIH stopped requiring SSNs as of January 2008.

- If you paid an honorarium to an invited guest, then chances are you submitted a Request for Payment that included an SSN. Although it is necessary to have an SSN for such payments, you do not need to keep the SSN on your local copy.
 - If you are involved with Human Subject research, you may have asked for an SSN on the payment receipt; for smaller amounts, an SSN is no longer required.
 - If you have ever taken orders or collected money, you may want to check if you have paper or electronic personal credit card information for others.
 - Consider what you would have delegated to others, such as your administrative assistant, TA/RA, contractors, consultants, and temporary workers. You may want to touch base with them to see how they have handled such information.
- If you find you have SSNs (or other personal information) and no longer need

them, you should securely destroy them. There are recommendations for redacting as well as secure destruction of paper and electronic files (see: web.mit.edu/infoprotect/papershredding.html).

For further information about information protection, including processes that still require SSNs, and tools for secure destruction, please contact me. I am available for group presentations, and/or 1-1, confidential discussions. ■

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Online Textbook Information Project Needs Faculty Help

Elizabeth Reed

ACROSS THE COUNTRY RISING book prices have made it harder for some students to afford college. According to a 2005 report by the General Accounting Office, college students spend an average of \$900 a year for textbooks, an amount that has risen at more than twice the inflation rate over the past two decades. The GAO report found that college textbook prices almost tripled between 1986 and 2004, rising 186 percent by 2005. (Source: *Inside Higher Education*, August 16, 2005.) At MIT, the average annual book expenditure is estimated at \$1150, taking into account the higher prices of science and engineering texts.

In the past, students have asked to have a list of required textbooks published online before the start of each term, so they may shop for competitive retailers and possibly reduce expenses. Over a year-and-a-half ago, DUE, IS&T, MIT Libraries and the Undergraduate Association agreed to act immediately on the need for a system to help students do this. Since then, IS&T has worked with the Libraries

on an Online Textbook Information project (OTI) to provide a transparent and simple means for online access to required textbooks as far as possible before each term starts. The OTI workflow leverages the existing textbook information collection process in place between the Libraries and the faculty, and makes this information available via Stellar, where it is correlated with relevant course pages. Additionally, the OTI Web service makes this data available openly for use by other applications and services.

While this initiative began before Congress passed the Higher Education Act (HEA), it positions MIT to comply with HEA's new compliance requirements for textbook information. The HEA states that, effective July 2010, institutions must disclose retail price and ISBN of required and recommended textbooks in course materials used for pre-registration and registration purposes, if available. In the months ahead, MIT will consider plans and policies concerning the textbook provisions as well as other aspects of the

Higher Education Act intended to make college more affordable. This will include working with the COOP to have one collection point to avoid duplicate forms.

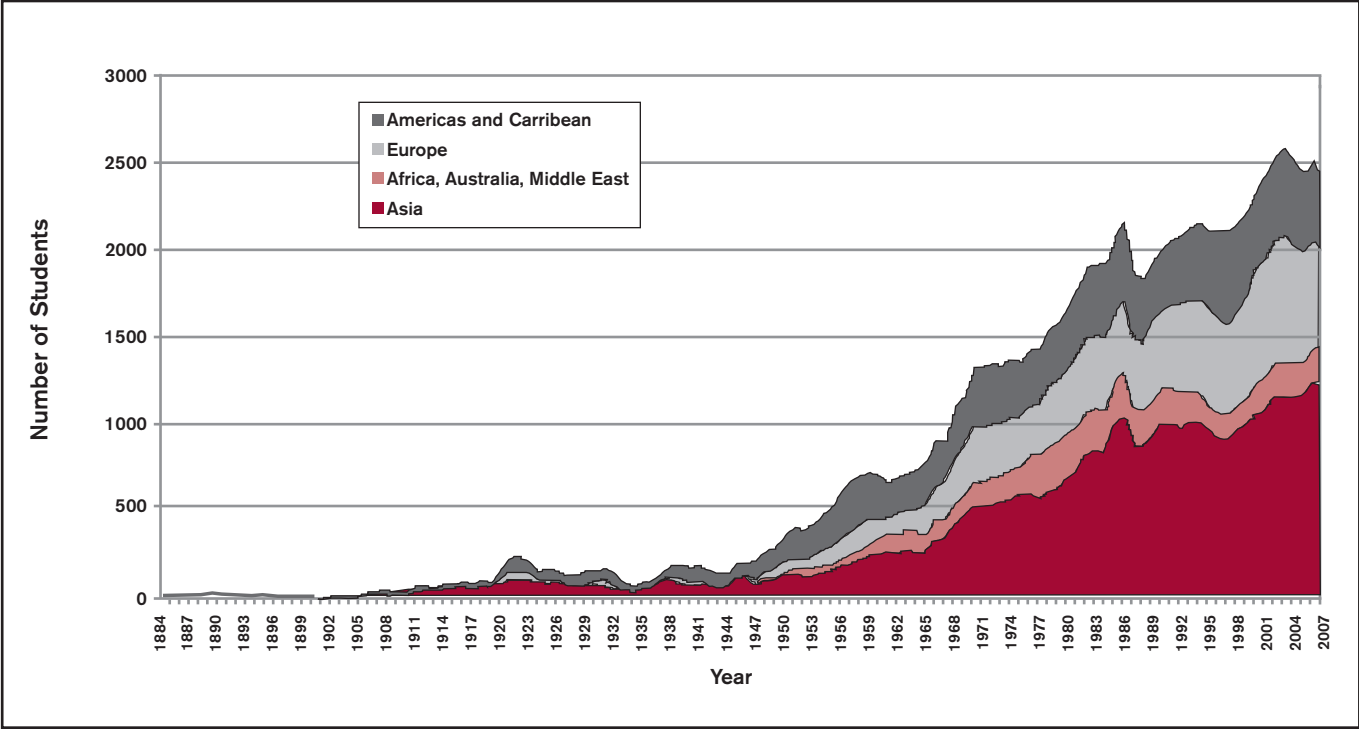
In May 2008, Dean for Undergraduate Education Daniel Hastings asked 10 departments to participate in the pilot version of OTI. The pilot proceeded smoothly and the plan was to have a full version ready for the spring 2009 semester. Many faculty facilitated the process by providing spring term information to the Libraries as soon as possible after receiving the Libraries' request in early November. (For an entertaining look at the OTI process and to add your own comments, see: <https://wikis.mit.edu/confluence/display/OTI2/OTI>.)

At this time of economic crisis, when families wonder more than ever how they will afford to send their children to college, we all must do as much as possible to reduce the costs. ■

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M.I.T. Numbers

Number of Foreign Students at MIT (1884-2007)



Source: Office of the Provost/Institutional Research

