The MIT Faculty Newsletter

Globalization of MIT: GSSD on the WWW

Nazli Choucri

As an international institution focusing on science and technology, MIT has a long tradition of interest in public policy and innovations in policy responses. Looking toward the twenty-first century, almost everyone agrees that "sustainability" constitutes one of the international community's major challenges and that strategies toward sustainable development are wanted

What is sustainability? And how would we recognize it if we, per chance, stumbled across it? Uncertainties and ambiguities aside – along with disciplinary priorities and political contentions – the fact remains that sustainability is more a vision and a challenge than an operational strategy guided by theory and buttressed by specific action. And its requirements and conditions seem to be more posited rather than subject to analytical rigor or based on empirical scrutiny.

But everyone agrees that the challenges are daunting in intellectual and policy terms. The Institute has made major commitments in supporting research and education related to sustainability, environmental management, and global

Penny Wise and Pound Foolish: Re-Engineering Reengineering

James L. Kirtley Jr.

The process of "Reengineering" should have, as its objective, operation of MIT in a more cost effective fashion. There is nothing wrong with this. It is most important that we use our limited resources in the most efficient way possible so that we can do the most with what we have. Unfortunately, it appears that the people actually making decisions in this process may have allowed their focus to shift from cost effectiveness to cost alone. That is, they are looking only at the bottom line. Some of the changes that have been made or are in the works may sound good, but are not going to be beneficial in the long run.

An example is the new mail regime. In order to cut costs, MIT has established a number of satellite mail rooms to which the mail is delivered in bulk. These replace those efficient people who hustled mail to all of the offices. Now what happens is everyone must go to the mail room to get his or her mail (or those of us fortunate enough to have a secretary can send that person). The result is that MIT spends less in General and Overhead Pool funds on mail.

Revolutionary Times Require Revolutionary Goals

Rosalind Williams

"It was the best of times, it was the worst of times, it was the age of wisdom, it was the age of foolishness, it was the epoch of belief, it was the epoch of incredulity, it was the season of Light, it was the season of Darkness, it was the spring of hope, it was the winter of despair,..."

So begins *A Tale of Two Cities* by Charles Dickens, who certainly knew how to write an opener. In that novel he was writing about the creative destruction of the French Revolution, which rocked the two cities of Paris and London. At the end of the opening paragraph, Dickens concludes that his own time was no different from those revolutionary times: only superlatives seemed fit to describe his age as well as theirs.

And our age too. Dickens published *A Tale of Two Cities* in 1859, just a few years before MIT was founded. We at MIT now have every reason to believe we too are living in the best and worst of times. This institution, dedicated to generating change, is now tossed by many of the dynamic currents we ourselves have helped create. During the past several years, we have lived out

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Editorial

In Our Name

Organizations have structure and spirit. In many ways, it is the intangible spirit rather than the easily discerned structure that truly defines an organization. In the short run, it is the spirit, the style, the mood of a place that makes it a good or a bad place to work. In the long run, it is the spirit that determines whether an organization will survive and prosper.

A good organization has a communal spirit, manifesting itself in a general willingness to work together and make compromises for the common good. Communal spirit manifests itself in the belief that effort expended to improve the lot of one's colleagues will eventually, somehow, be reciprocated.

In a triumph of personal leadership over structure, MIT has been noteworthy for its ability to make a community out of a group of people selected for individuality and independence. MIT has been a good place to work. The spirit of an organization is hard to change and, in that, we are lucky because MIT will remain a good place to work only if the communal spirit can be maintained in the face of enormous changes in the structure. We are taking actions, in the name of Reengineering, that will make it unnecessarily difficult to maintain that spirit of community.

The resources available in the United States are no longer what they were, and to make matters worse, the share of those limited resources accessible by MIT through its usual channels is shrinking as well. MIT must change in response. The need for change has been coming for a long time and perhaps we have been remiss in not anticipating it and acting sooner. The wave has moved through our national community, striking first unskilled labor, then the factory workforce, then middle management, and now, finally, the "professional" class, the doctors, the lawyers, and us. What made us think we would be different? We will have to change what we do, how we do it, and who we do it for. If we lose our

communal spirit in the process, the change will have, almost certainly, been for the worse.

It is easy to maintain a communal spirit when there are sufficient resources to make sharing relatively painless; it is more difficult when resources are limited. Thus it is more important than ever for us to nurture and reinforce the communal spirit. But the emphasis on rapid reductions in the support staff as the first step in the Reengineering of MIT is short-sighted and gives at least the appearance of being mean spirited. We don't question the need for change but the rate and manner of the change should be reconsidered.

It will take more than support staff reductions to meet the challenges imposed by changing conditions. It will take the invention and development of new revenue streams and perhaps fundamental changes in the size and status of the faculty and research staff. Slicing away at the support, custodial, and technical staff is easy; it shows instant financial gains but the institutional costs, although hidden, are large and long term. In many cases, we are not even saving the salaries, but are only reaping the incremental differences between in-house and "out-sourced" employees. Imposing high human costs in the interest of relatively modest financial gain can only weaken the communal spirit that will be required to survive the difficult times ahead.

The staff at MIT has invested as much, and more, of their lives in the Institute as we have. They have worked long hours for low pay because they believe in the Institute and its mission. They are proud of the reputation of the Institute and they take joy in watching the students learn and grow. They think the work the faculty is doing is

> In proposing rapid and deep reductions in the staff, we are not showing sufficient respect for the dignity of the people who have been working with us for many years. We are not honoring their contributions to our work and to a feeling of community. The faculty has been largely oblivious to the major impacts of the proposed changes on the people who have worked alongside us for many years. But we cannot ignore them, for we and the Institute will each pay a price.

In Our Name

important and they try to provide us the proper conditions to facilitate our work. They are part of our community and they make it a better place for all of us. They believe in our community and that belief compensates for the higher material rewards many of them could get elsewhere.

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The faculty has been largely oblivious to the major impacts of the proposed changes on the people who have worked alongside us for many years. But we cannot ignore them, for we and the Institute will each pay a price. The institutional price is obvious: MIT will not be as pleasant a place to work as it is now and more and more of us will see our interests and those of the Institute begin to diverge. The faculty will pay a moral price. Treating our friends and colleagues on the staff in this fashion is wrong. We did not make the policy but it is being carried out in our name. If we do not seek to temper the proposed changes, we will have lent our credibility to an unneccessarily mean action. Silent acquiesence will raise again the question of whether we view ourselves as MIT or as employees of the MIT Corporation.

Parking – The Further Selling of MIT

The MIT administration has decided to outsource another service that used to be handled internally. Along with the food service, lab supplies, office supplies, etc., the Institute will no longer be responsible for parking. It is not clear whether the change will save or cost money. It will certainly result in the layoffs of several long-term employees.

There were some interesting anomalies in the September 13th *Tech Talk* announcement of this change: "The decision to charge a $300 annual fee for parking…meant that an expensive computer system would have to be built and additional staff hired, Mr. Dickson [William R., senior vice president] said. A committee…studied the matter and recommended an outside firm as the solution that would be cost-effective and would ensure the delivery of a high-level of professional service to the community in the areas of parking of transportation."

Thus by deciding to raise the parking fee from $20/year to $300/year (effective this January), it became necessary to secure an outside firm to deal with the complexity of the service. Which raises the question: Would there have been a need to hire an outside firm (and layoff the parking attendants) if the parking fee remained low?

But there are still more salient questions concerning the decision to raise the parking fee so dramatically.

1) What was the rush? Couldn't the fee have been raised gradually over two or three years, rather than all-at-once, allowing employees to get used to it and (in many cases) to rearrange their budget?

2) Why, in recognition of the enormous disparity of salaries at MIT, particularly between support staff and full professors and administrators, was the possibility of a sliding fee schedule abandoned so easily?

3) The plan to deduct the money after taxes amounts to an additional $100 fee per employee (see Prof. Kirtley's article on Page 1 for more information). Couldn't this have been thought out more clearly?

All of which leads to perhaps the greatest problem in the ongoing Reengineering/restructuring of MIT: The individual seems to have been lost in this massive reorganization. The lack of concern for the common MIT community member is, unfortunately, glaringly apparent in all aspects of the process. This has been acknowledged as a flaw in corporate restructuring and it is particularly inexcusable in an academic institution.

Editorial Committee

Special Thanks

Associate Dean Margaret (Peggy) Enders generously provided her time and insight to the *Newsletter* by serving on this issue's Editorial Committee.

Combining her vast knowledge of the Institute with her particular persuasive powers over (unnamed) faculty and administrators, she was a great asset in producing this month's *Newsletter*.

Thanks again, Peg.

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It's Up To You

This month's extra large edition of the *Faculty Newsletter* was made possible by the efforts of a variety of people; the most important of whom were the faculty members who took the considerable time and effort to write it.

Either by responding positively to a request from the Editorial Committee or by submitting unsolicited material, this and every issue of the *Newsletter* is a product of, by, and for the MIT faculty.

As always, we encourage submissions on any topic of interest to the MIT community. You can reach us in the following ways: telephone, x3-7303; mail, 38-160; e-mail, fnl@athena.mit.edu; or FAX, x3-0458.

We look forward to hearing from you.

From The Faculty Chair

Newsletter Can Be Vehicle For Keeping Community Informed

Lawrence S. Bacow

As chair of the faculty, the Editorial Board of the *Newsletter* has invited me to become a regular contributor. To a certain extent, this is a home coming for me. I was a member of the first Editorial Board. The *Newsletter* emerged out of the fall-out from the closing of the Department of Applied Biological Sciences. At the time, people observed that the faculty lacked a mechanism for communicating with each other. The students had *The Tech*. The administration had *Tech Talk*, but the faculty lacked a forum where policy issues could be debated and alternative views expressed. The *Newsletter* is that forum, and I suspect is far more widely read than the minutes of our monthly faculty meetings. If the *Newsletter* is to succeed in its mission, the faculty must support it and contribute regularly. I hope you will do so.

These are challenging times in which difficult questions are being asked and even tougher choices made. Reengineering, faculty retirement policy, the undergraduate writing requirement, potential changes to post-doc appointments, and the changing demographics of our undergraduate population are just a few of the issues that will be taken up this fall by the standing committees of the faculty. Our committee structure gives the faculty a voice in these decisions, and I encourage you to get involved. Serious and often spirited debate occurs in these committees. However, paradoxically, the success of our

committees also contributes to the low level of attendance at our regular monthly faculty meetings. Most interesting questions are resolved in committee well before the issues reach the full faculty for consideration. As a result, presentations at monthly faculty meetings are frequently *pro forma*, and faculty attendance sparse. Of course, every few years compromise eludes our committees or, worse, issues do not find their way to the committees at all, in which case 10-250 is jammed. From my perspective, neither of these are good outcomes.

I intend to encourage the chairs of the standing committees to use the *Newsletter* to inform the community of issues developing within their committees. I hope this process will draw more faculty into the debate over policy choices even if attendance at regular faculty meetings continues to be sparse. In addition, we are also taking steps to make more information about faculty governance available electronically. Early this fall, minutes of faculty meetings from the previous two years along with agendas and

attachments for these meetings will be available over the Web. We are also looking into creating a faculty Home Page on the Web that could be used to solicit faculty opinions on specific topics.

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Along with those issues noted above, a number of other issues are likely to command the attention of the faculty this fall.

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An innovative proposal for a new Master of Science in Systems Design and Management is being put forward jointly by the School of Engineering and the Sloan School of Management. This program represents a new approach to the education of technically sophisticated leaders with responsibility for the management of engineering systems. The proposal is likely to be on the agenda for the October faculty meeting. Re-engineering of student services is just getting off the ground. In contrast to other Reengineering teams, re-engineering of student services is being

Newsletter Can Be Vehicle For Keeping Community Informed
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directed (or in the lexicon of reengineering, "captained") by a faculty member, Professor Marty Schlecht of EECS. Professor Schlecht has already met with the Faculty Policy Committee and with the Committee on the Undergraduate Program to discuss plans for involving faculty, students, and staff. While faculty participation is important in all of the Institute's reengineering efforts, it is essential for reengineering of student services where the boundaries between education and administrative services are far from distinct. I am also pleased to note that a faculty member, Jonathan Allen, has joined the Reengineering Steering Committee.

This fall, President Vest will appoint a special faculty task force to evaluate MIT's position on future participation in ROTC. In 1990, the faculty adopted a resolution requesting that such a task force be established after five years to evaluate progress towards elimination of the Department of Defense policy regarding sexual orientation and military service. The task force is expected to report in the spring.

In a subsequent issue of the *Newsletter*, Professor John Hansman,

chairman of the Committee on Faculty Administration, will report the results of last spring's survey of faculty attitudes towards retirement. This survey provides the first real data we have on how faculty members view their retirement plans. One of our greatest challenges is to provide for the continuing intellectual renewal of the faculty now that mandatory retirement has ended. I hope the CFA survey will stimulate people to think creatively of ways that would accommodate the desires of our most senior colleagues who wish to continue to contribute to the Institute while also providing opportunities for the appointment of new junior faculty.

Let me close on a personal note. Rarely a day goes by in which someone fails to ask me: "What do the faculty think about…?" Usually these requests come from administrators who wish to incorporate faculty views into a decision, but I have also received similar inquiries from students, Corporation members, other faculty, as well as *The Tech*. The faculty are a diverse group and it is not easy to describe our thinking on any given

issue because we do not speak with one voice. Also, few opportunities exist to sample a broad cross-section of faculty opinion. Where does one go to learn what is on the mind of the faculty? To the Deans? The Department Chairs? Clearly the call for new business that closes each monthly faculty meeting rarely, if ever, elicits any response.

By contrast, Jay Keyser's monthly random faculty dinners provide not only good food and conversation, but one of the few occasions when a true cross-section of the Institute's faculty come together without an agenda. Moreover, attendance usually dwarfs attendance at faculty meetings. At the end of each dinner, Jay invites attendees to describe what is on their mind. Discussions are always lively, and with Jay as the moderator, invariably peppered with good humor. By agreement with Jay, I have wrangled a standing invitation to these dinners during my term as chair. I encourage each of you to accept Jay's invitation when it arrives via Institute mail. Not only will you meet some interesting colleagues, you will also help provide an answer to my most frequently asked question. I hope to see you there.✤

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Newsletter Web Page in Process

Plans for a *Faculty Newsletter* Home Page on the World Wide Web continue, with an on-line date for later this fall.

Several issues concerning the *Newsletter's* appearance on the Internet still need to be resolved, including questions of access. A link to the *Newsletter* from the MIT Home Page is

intended, as well as a variety of links from the *Newsletter* to other Institute and non-Institute Web sites. Back issues of the *Newsletter* will also be available in time.

In response to community concern, there are no plans for elimination of the hard copy version of the *Newsletter*, and all current recipients will continue to receive a copy in the mail.

A faculty Bulletin Board is also planned in addition to the Home Page. It is hoped that faculty will take advantage of electronic communication among themselves as well as other members of the MIT community, and that a more ongoing dialogue about both scientific and non-scientific issues will ensue.✤

MIT IN CHINA

Chinese Internships Offer Unique Opportunity
Suzanne Berger

One year ago, the MIT International Science and Technology Initiative program for China (MISTI/China) was launched as the first of a series of new programs to "internationalize" education and research at the Institute. Over the past decade there has been growing recognition at MIT of the need to offer faculty and students ways to learn from the best in foreign science, technology, and business through collaborations with outstanding institutions outside the United States. In the period after World War II when the US economy and research establishment turned out the lion's share of innovative activities in the world, US institutions – and MIT among them – became parochial in outlook and less and less capable of identifying and utilizing significant innovations as they emerged in other countries. The costs of this "NIH – Not-Invented-Here" complacency were high for American society.

Perhaps nothing raised this issue to public awareness more forcefully than the massive entry of Japanese consumer products into US markets in the eighties. Japanese technology and manufacturing success had in the past been so often dismissed as due to low labor costs, or to purely imitative talents that it took American companies far too long to appreciate how much they might learn from Japanese research and development patterns and manufacturing organization. The shock of Japan may explain why the first successful attempt at MIT to present students with linguistic, cultural, historical, and practical skills to engage as professionals in a foreign country was the MIT-Japan Program. The MIT-Japan program started in 1981, by 1983 sent a

Sustainable Development of the Yellow River Delta
Karen R. Polenske

Xiannuan Lin (Ph.D., 1994), of the Center for Energy and Environmental Studies of Boston University and I are two of three international economic experts working on the sustainable development of the Yellow River Delta (YRD) in the People's Republic of China (China). China Agenda 21, which was ratified by the State Council on March 25, 1994, designated work on the YRD as part of its nine major priorities.

Compared with other regions in China, the YRD is unique in the following ways:

• The land area is expanding by about 22 square kilometers annually as the delta mouth moves out into the Bohai sea.

• The region, although located by a major river, suffers a water shortage for more than 160 days each year.

• The population density is one of the lowest on the Eastern seaboard, creating a labor shortage.

• All the 1.6 million population, both urban and rural, have electricity (as is the case in the rest of Shandong Province).

• Infrastructure facilities (especially roads, but also water reservoirs, electricity-generation plants, etc.) have been built far in advance of industrial development. These have mainly been built by the Shengli Oil Corporation, which operates the second largest oil field in China.

The YRD Project is centered in Dongying Municipality – a new urban center in Shandong Province that was begun in the late 1970s. The municipality currently has a population of about 300,000. It was granted status as an

Economic Development Propels Chinese Growth
Lester C. Thurow

The economic momentum gathering in China is probably the most exciting economic event of the twentieth century. There is a long way yet to go but almost one quarter of humanity may be on the path to first world standards of living.

If one looks at the list of the world's wealthiest countries at the end of the twentieth century, the major countries, with one great exception, are essentially the same countries that were wealthy at the end of the nineteenth century. The great exception is, of course, Japan. Otherwise, the only changes have been among small natural resource rich countries – a few of them, such as Chile, have dropped off the list and a few of them, such as Kuwait, have joined the list.

China's economic development if it can be sustained has the promise of bringing more people up to an acceptable standard of living than anything that has happened at any time in human history. But Chinese success is not foreordained. Two great problems stand in the way.

The vast majority of the Chinese are still attached to an agricultural economy. In the very long run, most of them will end up in urban areas employed in industry. But in the medium term, a large majority will remain in agriculture and as a consequence raising agricultural productivity is central to maintaining China's economic momentum. Agricultural output must be refocused to meet new demands to develop export markets. Rural incomes are now stagnating, a huge rural-urban income gap is widening, and tens of millions of rural workers are moving into the urban areas before they can be absorbed in

TEACH TALK

Question: What Makes A Good Question?

Lori Breslow

This "Teach Talk" column was motivated by and draws upon material found in the new edition of *The Torch or the Firehose: A Guide to Section Teaching* published this past August. Written by Professor Arthur Mattuck of the Mathematics Department, *The Torch or the Firehose* has become an invaluable guide not only for recitation instructors, but for faculty teaching small classes and lecturers with recitation sections attached to their courses. *The Torch or the Firehose* is arranged according to the "most common problems" instructors face, so it's not surprising that the second chapter (after one on classroom interaction) is devoted to the process of asking and answering questions.

Questions are the instructor's stock in trade. Just as the desire to get an answer to a thorny, troubling, or intriguing question starts the researcher on his or her way, the need to know the answers to questions (if for no other reason than they're likely to be on the test!) sparks student learning. At the heart of the business of producing knowledge – wherever that takes place – is the process of posing questions and looking for answers.

Instructors can use questions successfully even in large lectures and certainly should give students an opportunity to ask questions of them during the hour. In smaller classes and recitations, questions can be a fundamental building block that shapes the content and structure of the class and helps manage the way the material is assimilated. This means that how

questions are asked and answered has broader implications that go beyond mastering the content of specific course material: Instructors also need to model the process of framing an inquiry and organizing the search for a solution for their students. The way the question and answer process is handled can affect the climate in the classroom as well: It can promote cooperation or competition, and it can drum up or dampen down student enthusiasm for the subject at hand.

The craft of asking and answering questions is one that is built upon several different skills: phrasing and sequencing questions effectively; responding to questions so that class time is used efficiently; keeping questions from leading into digressions (unless those digressions are a worthwhile investment of the students' time and energy); using the right tone and delivery when asking questions or responding to them; dealing with the personalities and methods of interaction of your students as questioners and respondents.

In the spirit of "practicing what you preach," this "Teach Talk" attempts to answer five commonly asked questions about using questions; the next "Teach Talk" will cover fielding responses and answering questions.

What do I do if I don't know the answer to a question?

This is often the number one concern of instructors, especially new faculty. Fortunately, it's an easy one to respond to. The safest answer is to say simply: "I'm sorry I don't know the answer to that question, but I'll find out."

However, as Urban Studies Professor Mark Schuster points out, once the question has been asked in public, it must be answered in public. In other words, it's not enough to get back to the individual student who asked the question; you need to answer the question for the entire class, preferably the next time it meets.

What makes a question effective?

A good question is relatively short, clear, and unambiguous. Ask only one question at a time. Pouring out a string of questions (even if they are on the same topic) is likely to confuse students, who often won't know where to begin an answer.

Pay attention to the responses you get because they will tell you much about how effectively you have phrased the question. Sometimes when students don't respond or respond poorly, it's because the question has been worded either too vaguely or too broadly. It may help to think backwards: Begin with the answer you want to get and then devise a question that will lead to that answer.

What are the different kinds of questions I can use?

Researchers and teaching experts have devised a number of different "typologies of questions," but perhaps the best way to categorize questions for science and engineering classes is to think of them along a continuum of relatively closed or relatively open questions.

Closed questions ask for a very specific answer. In the *Torch of the Firehose,* Arthur Mattuck describes

Teach Talk

Question: What Makes A Good Question?
Breslow, from preceding page

"Are-you-with-me?" questions (relatively closed) that ask the students to supply some detail of a problem that is being discussed ("and the derivative of sin x is?").

Open questions require more thought. ("What would happen if the force were reversed?"). There may even be a range

should also prepare questions ahead of time based on the key points you want to make in that class.

Think, too, about the range of answers you are likely to get to your questions and plan your response to each. This will help guarantee the answers you get won't take you off on a tangent. Having

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of potentially good answers – you can ask students to judge which ones are better than others or which one is best. Then ask them to justify their choices. If you are asking a more complex question that requires calculations, write key elements on the blackboard or prepare an overhead transparency that provides necessary information.

One general piece of advice: Be careful about asking a question that is too easy. At best, your students may feel it's not worth answering; at worst, they may feel insulted at having been asked a question with an obvious answer.

Should I let the course of the class dictate the questions I ask, or should I plan out questions ahead of time?

Both. While you need to be flexible enough to allow questions to emerge spontaneously during discussion, you

anticipated the responses, you can determine how to get back to the business at hand in the most efficient way possible.

Should I "cold call" students?

When you "cold call," you ask students to answer a question even if they haven't volunteered. While cold calling can increase the level of anxiety in a classroom, one of its benefits is that it gives students the chance to practice speaking while under pressure, a skill that will be important to them in their professional lives. You can also "warm call" by asking a question of one or two students and then giving them five minutes to frame a response while you discuss something else.

Each of these techniques has its strengths and drawbacks. However, their success will be enhanced if you:

• Establish a norm early in the semester and stick to it. (In other words, don't start cold calling students after midterms!)

• Keep track of which students you have called on when so that you can be fair in your calling pattern. Ideally, you will come to know some of the strengths and weaknesses of each of your students (e.g., Sally is good at calculations; Mark tends to think intuitively and globally) so that you can play to their strengths when calling on them.

• Help students save face by responding to wrong answers with tact and generosity.

Next "Teach Talk": Fielding responses and encouraging questions.

A Note on Resources: Two excellent books on science and engineering teaching now available are: *Teaching Engineering,* by Phillip C. Wankat and Frank S. Oreovicz, published by McGraw-Hill, Inc.; and *The New Professor's Handbook: A Guide to Teaching and Research in Engineering and Science,* by Cliff I. Davidson and Susan A. Ambrose, published by Anker Publishing, P.O. Box 249, Bolton, MA 01740-0249; phone (508) 779-6190; fax (508) 779-6366. Besides covering teaching, *The New Professor's Handbook* also provides guidelines for the other responsibilities new science and engineering faculty members face, including getting funding, writing papers, and delivering talks.

Copies of *The Torch or the Firehose* may be obtained by calling the Teaching Resource Network, x3-9419, or requesting copies via e-mail at firehose@mit.edu.✤

Globalization of MIT: GSSD on the WWW

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change. And MIT is not unique in this regard. A large number of research programs are underway as both faculty and students direct their attention to the intellectual and analytical challenges at hand. Almost every major international institution of research and education is engaged in sustainability activities.

Problem and Need

The essence of the substantive problem is that expansion of human activities (due to rapid population growth in conjunction with resource uses and accelerated technological developments) continue to place strains on life supporting properties. Precisely **how** and **what** can be done about it is the essence of the policy challenge. Equally pressing is the information challenge. A cursory cruise through the World Wide Web (WWW) shows an avalanche of sustainability sites coupled with a dearth of "quality" materials (defining quality in terms of reliability, replicability, respectability, etc.).

More daunting is the challenge of making some sense of the cruise, the destination, and the contributions to enhancing understanding of sustainability issues, policies, strategies, or even mere "wishes." What is now available to us all is akin to a sustainability-spaghetti-plate. What is needed is an intelligent system for sustainability studies, adaptive to changing conditions, responsive to scientific inquiry and technological responses, and accommodating the diversity of sustainability priorities and preferences.

Intelligent System for Sustainability Studies

What is an intelligent system in this context? It is one that streamlines maintenance (through uses of authoring tools and object-oriented programming) and enhanced applicability (automatic generation of WWW pages, automatic updates of data bases, and wide area network). These capabilities would reduce the transaction costs (not to mention inconvenience) inherent in WWW conventions and modalities. As pioneers in policy applications of intelligent systems, researchers in the AI (Artificial Intelligence) Lab (in John Mallery's group) have extended the basic server capabilities developed for the White House initiative on "reinventing government," and collaborated in allocations to the domain of sustainability (with all the ambiguities and complexities therein).

Strategy and Logic

The Global System for Sustainable Development (GSSD) is an effort to provide some intelligent and adaptive order, both access to and contents of sustainability materials, on the WWW. It is also designed to engage the research and the policy communities in different parts of the world in an exercise of "sorting out" the sustainability-spaghetti-plate into some semblance of intellectual order and analytical coherence. GSSD consists of an agent interface, coupled to an intelligent-adaptive server, streamlined access to WWW search engines, subject-driven rules for search conduct, with "quality" criteria for site identification and use of materials.

For users who prefer the spaghetti-plate strategy (or the filing cabinet format), an "alpha option" is available, enabling them to by-pass any semblance of social science theory pertaining to sustainability, and skate unimpeded through the crevasses of the WWW. This "following the blue line links" – shades of the "yellow brick road" – constitutes the no-theory strategy.

As a collaborative initiative among researchers in the Artificial Intelligence Laboratory, the Department of Political Science, the Center for International Studies and the Technology and Development Program, the GSSD capitalizes on MIT's international linkages and current collaboration with the set of international and regional institutions responsible for the "application" of sustainability concepts and theory. By far the most important element of the design involves the participation of undergraduate and graduate students from the initial conception to the present version. Here our purpose is to highlight the importance of *intelligence* in thinking about sustainability, and of *internationalization*

WHAT IS THE PROBLEM?

On the subject of sustainable development there is not one single problem but several.

These include:

- **CONCEPTUAL AMBIGUITIES**

  PERTAINING TO SUSTAINABILITY THEORY, PROCESS, ACTIONS, AND OUTCOMES

- **EXPLOSION OF INFORMATION**

  INCLUDING DATA, DOCUMENTS, IDEAS, ASSESSMENTS, EVENTS, ORGANIZATIONS, NETWORKS, ETC.

- **OBSTACLES IN TRACKING**

  WITH RESPECT TO CONTENT AND EVALUATION OF INFORMATION ON THEORY, POLICY, AND ACTION

- **ABSENCE OF GLOBAL CONFERENCING**

  FOR INFORMATION SHARING, CONSENSUS BUILDING, REALITY-CHECKING, AND UPGRADING OF EVALUATIONS ON THEORY, POLICY, AND ACTION

- **DISCONNECTS AND LIMITED FEEDBACK**

  WITHIN SNF SMONH INDYIYUYIOND OG (A) SCIENCE AND TECHNOLOGY, (B) BUSINESS AND INDUSTRY, AND (C) GOVERNANCE AND GOVERNMENTS WORLDWIDE

Globalization of MIT: GSSD on the WWW

Choucri, from preceding page

INTEGRATED SUSTAINABILITY FRAMEWORK
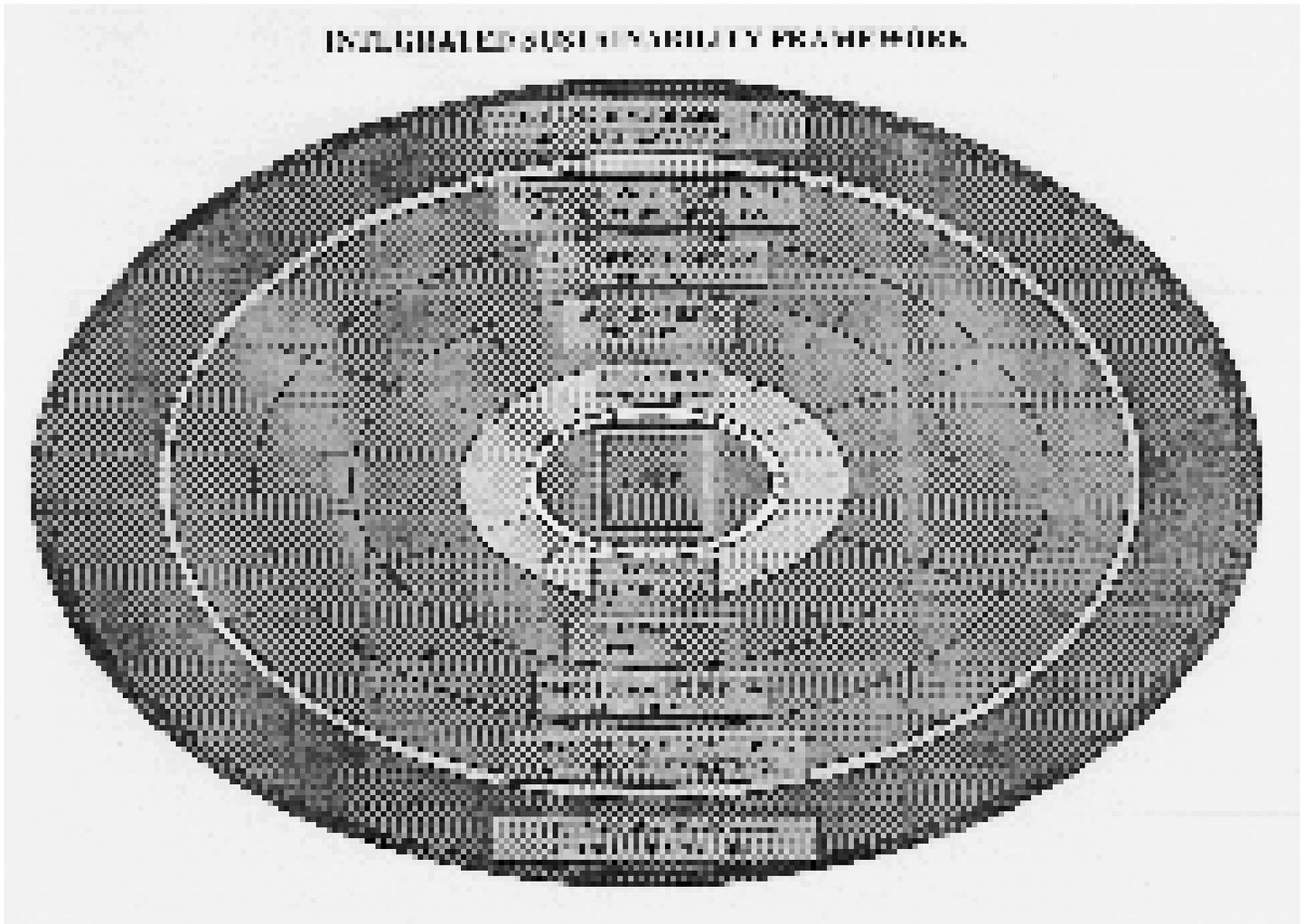
in the conduct of intellectual discussions and policy deliberations.

Design and Implementation

GSSD consists of *conceptual framework* (substance and coherence) *application* (user access, system input, and wide area network), *implementation* (adaptive code and user responsiveness); and *alpha system* (the no-theory option). The basic design begins with a principle of consistency, then subject to modification resulting from adaptation, use, and information-driven adjustments.

Conceptual coherence means integrated nested and hierarchical relation, starting from the core (population demands, economic performance, etc.) to activities and conditions, to views of sustainability-related problems, to scientific and technical solutions, then to social, economic, and political solutions. The radial line facilitates "tracing outward" the consequences and proposed "solutions strategies" associated with specific sustainability dilemmas. The figure's resolution does not show the set of entries within the radials. A "slice" is shown here for illustration.

Research and Education at MIT

Central to GSSD is contribution to education and research at MIT through the use of advanced technology. The interdisciplinarity of the substantive issues and of the application of innovative technology provides some challenges of interest to both students and faculty. Specifically, these challenges bear directly on the missions of two initiatives reported in this issue of the *Faculty Newsletter* – namely, Education Via Advanced Technologies (EVAT) and the activities of the Center for Advanced Educational Services (CAES) [see Page 13].

In its design and objectives, GSSD is entirely consistent with the goals and objectives of EVAT as potentials are explored in the use of advanced technologies for drawing upon MIT's unique capabilities. The GSSD initiative makes use of advanced technologies, but it draws upon intellectual insights and conceptual advances made on sustainability issues by faculty and students over the past several years. Many of these have been presented before the MIT Forum on Sustainable Development (an outcome

Globalization of MIT:
GSSD on the WWW

Choucri, from preceding page

of the Faculty Seminar on Global Environment and Sustainable Development over the past five years), and may well represent the state-of-the-art on sustainability dilemmas.

Student Participation
in Sustainability Strategies

Wide-area networking provides practical opportunities for MIT students to participate in research and policy deliberations serving as "inputs" into the forthcoming inter-governmental evaluation of the Post-Rio process (the Conventions, Agenda 21, the Principles on Sustainable Development, the funds, etc.). Mandated by the General Assembly of the United Nations, the product of this evaluation will set the institutional and financing priorities for the global community during the next five years. It would benefit our students if we could facilitate their own access to these processes.

In this connection, the new CAES mission is of particular relevance. Utilizing advanced technology to distribute educational materials, CAES is establishing an important diffusion role for enhancing accessibility of MIT's intellectual products. To the extent that the GSSD initiative can facilitate diffusion of education materials on sustainability and environment, there is a synergism between CAES (in educational services) and GSSD (as an interdisciplinary initiative addressing sustainability challenges).

World Wide Network
and Enhanced Access

The wide-area network capabilities of GSSD provide a means of "leapfrogging" conventional modes of communication, conferencing, and feedback. For our purposes, the initial applications are for exchanges on research activities and inputs into policy developments. In practice, wide-area networking translates into participation of research teams in key nodes worldwide – i.e., Asia, Africa, Latin America, East Europe, and the industrial world. Regional offices of international institutions serve as the "field" links. Wide area conferencing capabilities are still to be fully framed and tested. Inputs from the "nodes" at this point help to anticipate some of the practical difficulties at hand.
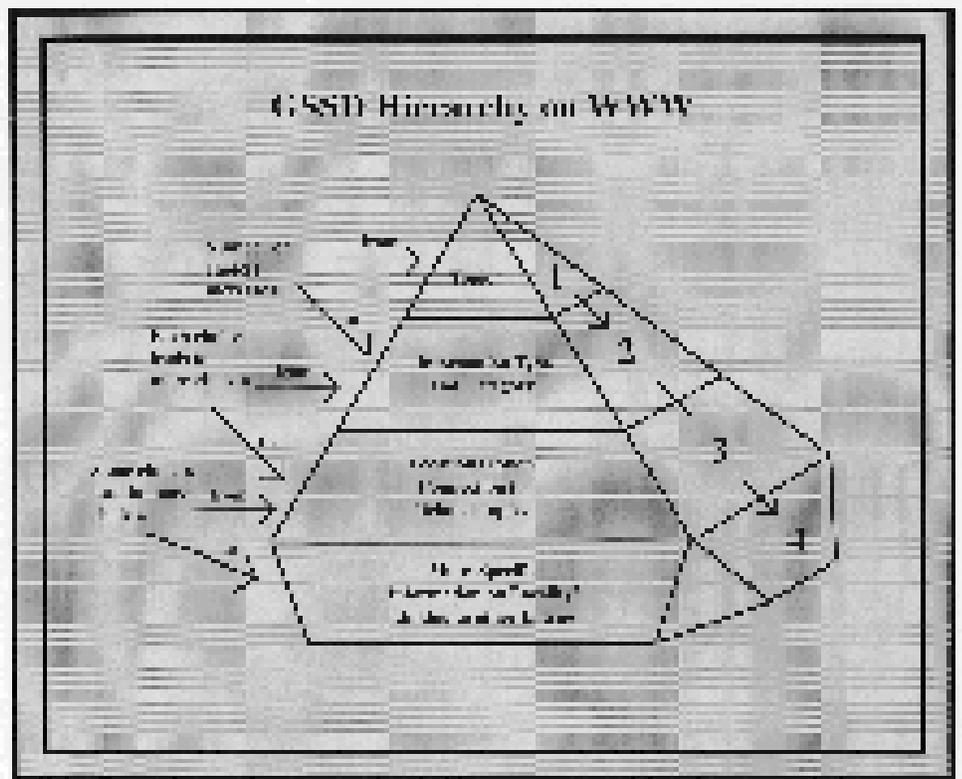
An added dimensions of networking is connecting GSSD users to the national electronic networks established since Rio under the Agenda 21 program. This "connection" is a part of the GSSD implementation worldwide. To the extent that linguistic capabilities can be interfaced with GSSD, then "leap-frogging" communications would take place.

MIT as a Global Institution

There are two sides to this issue: one is MIT's potential contribution to global thinking and policy response; the other is the globalization of MIT itself.

MIT's institutional commitment to environmental research and education, and to improving the knowledge-base related to sustainability, have already contributed to new insights on sustainability – some information, some "findings," some testable propositions, and some basic "theory" or precepts. As an evolving enterprise, these policies can well serve the international community if, through advanced technologies, they can be made more readily available and more easily accessible.

To the extent that faculty members and students do wish to "interface" with policy deliberation at the global level, GSSD is intended to facilitate this "interface." Increasingly, the WWW is a an important medium for global communication; so introducing some intelligence in sustainability materials and deliberations may well be a relatively low-cost and potentially high value-added outcome.

The other side of the coin is the globalization of MIT. So far, the Institute has focused on "internationalization" and on expanding international reach. Semantics aside, MIT internationalization has not kept pace with the globalization processes worldwide. The potential synergism between the goals and activities of EVAT and CAES on the one hand, and the world wide network of GSSD on the other, may enhance MIT's role in the globalization process. In the sustainability domain, this involves interacting with international institutions responsible for designing and implementing strategies for sustainable development.✤

*C*enter for *A*dvanced *E*ducational *S*ervices Evolves from Old CAES
Richard C. Larson

On September 1, 1995 a new MIT-wide facility was born, the Center for Advanced Educational Services, or "CAES." The new Center builds from the former CAES, Center for Advanced Engineering Study, that operated successfully within MIT's School of Engineering since 1963. The new CAES is an Institute-wide facility, serving all five schools, and providing more services and opportunities for the entire MIT community. In this article we briefly describe the goals and objectives of the new CAES (henceforth simply called "CAES"). We then ask for your suggestions, advice and participation, as we are in the formative stages of this new and exciting enterprise.

In the twenty-first century MIT must assume a broader leadership role in education, both nationally and internationally. This is the key premise supporting the creation of CAES. Operationalizing this goal requires increased utilization of advanced technologies to distribute our educational offerings – both current and future – beyond the Cambridge campus. We hope to build from related efforts at MIT, including the "Penfield Committee" on education using advanced technologies [see next column], hypermedia activities within the Mechanical Engineering Department, collaborative distance design efforts in the School of Architecture and Planning, multimedia educational initiatives in the School of Humanities, a new distance learning initiative of the Sloan School of Management, as well as the long history of video educational services provided by the former CAES.

If – after reading this – you are interested in learning more, perhaps even participating in CAES creations or research, send an e-mail to rclarson@mit.edu simply saying "More." We will provide you with additional information and we will e-mail to you a very brief survey questionnaire seeking your opinions about our proposed initiatives. We will add you to our e-mail distribution list.

1. CAES Mission Statement

The mission of the Center for Advanced Educational Services is to create and distribute educational products and services world-wide. The off campus offerings will leverage the growing capabilities of computer and telecommunication technologies, including interactive multimedia, the Internet, the World Wide Web (WWW), interactive TV, as well as more mature delivery mechanisms such as videotapes and books. In support of its primary goal and as a service to participating organizations, the Center will also offer short term (non-degree) programs having both on-campus and off-campus components.

Committee on Education Via Advanced Technologies: Final Report Available on the World Wide Web
Paul Penfield

The MIT ad hoc Committee on Education Via Advanced Technologies (EVAT) was formed in the fall of 1994 to investigate the potential for using advanced technologies such as the World Wide Web in MIT education. The Committee issued its final report on July 31, 1995. Unlike most reports, this one was not designed to be printed. Instead, it resides on the World Wide Web at the URL (Uniform Resource Locator) http://www-evat.mit.edu/report/ and can be easily read from anywhere in the world, using any standard Web browser. You can read the highlights of the report here, but to learn more you will have to be connected to the Net.

How We Got Started

During the spring of 1994, I heard of a few independent ideas that faculty had of using modern technology to deliver education in a more effective way. Jon Allen (EECS) wanted to write a VLSI design textbook with imbedded, interactive simulation. Tony Patera (Mechanical Engineering) was investigating the use of hypermedia for the exposition and demonstration of fluid flow. Earlier, Tom Cormen, Charles Leiserson, and Ron Rivest (EECS) had overseen the development of a hypercard-based set of animations to accompany their algorithms textbook (as a byproduct of this work, the textbook itself was converted to hypertext form and appears on the same CD-ROM). I concluded that there might be a benefit if all these people could exchange ideas, and asked Dick Larson (EECS) to organize a one-day, off-site workshop on the topic. Dick discovered still other activity at MIT, including the use of hypermedia to express critical reviews of Shakespeare plays, in the MIT Literature Section.

About 25 faculty attended the workshop on September 19, 1994. Joel Moses, then dean of Engineering, was there all day along with John Vander Sande, the associate dean. Joel later reported on the workshop to Academic Council. President Vest, deciding that the idea was important enough to warrant a closer look, asked Joel to set up an ad hoc committee, with representation from all five Schools at MIT. I was asked to be the chair. Membership included the chair of the MIT faculty (Bob Jaffe), a dean (Bill Mitchell) a department head (me), and a section head (Peter Donaldson). Other members were MacVicar Faculty Fellow Hal Abelson, Director of Academic Computing Greg Jackson, Chris Kemerer of the Sloan School, Dick Larson, and Tony Patera.

Athena Training Opportunities For Your Students

Jeanne A. Cavanaugh

The Athena Computing Environment has become an integral part of the MIT educational experience. As of Registration Day this year, 97% of the Freshman class and 88% of the incoming graduate students had Athena accounts.

Electronic mail, the Zephyr interactive message system, NEOS (the Networked Educational On-line System) for electronic submission, exchange, annotation, grading and return of assignments and course handouts, and OLTA (On-Line Teaching Assistant), are proven ways faculty members have successfully used Athena to work more closely with their students. Many classes also make use of MIT-developed or third-party educational software as part of their curriculum.

Five Electronic Classrooms, with Athena workstations at each desk and an instructor machine attached to a projection system, can be reserved for lectures and labs. (Some Institute classrooms are also equipped with an Athena workstation and projector; these rooms are reserved through the Registrar's office like any other classroom.) New software is added regularly to Athena software suites. If you wish to learn more about how Athena can be used in courses, please contact the Academic Computing Services Faculty Liaison Office, E40-357/359/360, x3-0115, <f_l@mit.edu>.

In order for MIT students to successfully use Athena, Information Systems offers a comprehensive series of short courses (called minicourses) on a variety of Athena-related topics. These courses are offered frequently throughout the academic year.

During R/O week, incoming freshmen, graduate, and transfer students had the opportunity to attend four basic courses:

Intro to Athena, Working on Athena, Basic Word Processing and Electronic Mail, and Advanced Word Processing with EZ. These courses are offered before classes start, so new MIT students can become familiar with the system before they receive their first problem sets and paper assignments.

During the coming year, IS is offering new and revised minicourses for all levels of users. Minicourses are held the first six weeks of each semester, the week after Thanksgiving and spring break, and during IAP. The courses are offered Monday through Thursday at noon, 7 pm, and 8 pm in Room 3-343. No registration is necessary, and they are free.

We would like to encourage you to remind your students to take advantage of this excellent opportunity to learn more about the computer system that will be part of their MIT experience.

Following is a listing and brief description of the courses offered. [See next page for the fall '95 schedule.]

Advanced Word Processing: EZ (EZ)
Pre-requisites: Basic WP
Introduction to EZ, a combination text editor and formatter, with text-editing commands that are similar to Emacs. As a formatter, it is menu-driven and easy to learn, in the popular style of the "What You See Is (pretty much) What You Get" packages.

Advanced Word Processing: LATEX (Latex)
Pre-requisites: Basic WP
An introduction to Latex, a widely-used text formatter, used for converting a text file into an attractive, professional-looking document. It is a powerful and flexible program, with the capability to typeset many foreign characters and very complex mathematical text.

Customization on Athena (Dotfiles)
Pre-requisites: Serious Emacs, some Athena experience
Intended for the intermediate-level Athena user, this course will discuss the Athena login sequence and the user-configuration files (dotfiles) that affect it, as well as changes the user can make to those and other files to customize their working environment.

FrameMaker for Reports (Frame)
Pre-requisites: Intro, Basic WP
FrameMaker is a powerful word-processing and document preparation package now available on Athena. It is introduced here as a tool for preparing an MIT thesis, or other large reports and articles.

Information Resources on Athena (Info)
Pre-requisites: Basic WP
A survey of the communications, help, and other resources available on Athena.

Latex Thesis (Thesis)
Pre-requisites: Latex, some Latex experience
Using the Latex text formatter to produce a fully-featured thesis that meets all MIT format requirements.

Maple (Maple)
Pre-requisites: Basic WP
A mathematics program that can perform numerical and symbolic calculations, including formal and numerical integration, solving algebraic or transcendental systems and differential equations, and series expansion and matrix manipulation. It also has extensive graphics capabilities.

Math Software Overview (MSO)
Pre-requisites: Basic WP
A survey of major mathematics and graphing packages available on Athena.

Matlab (Matlab)
Pre-requisites: Basic WP
An interactive program for scientific and engineering numeric calculation. Applications include: matrix manipulation, digital signal processing, and 3-dimensional graphics.

Serious Emacs (Ser. Emacs)
Pre-requisites: Basic WP, some Emacs experience
The text editor introduced in Basic Word Processing has many useful features not covered in that course. This course is a must for anyone who uses Emacs more than an hour or two each week.

Xess (Xess)
Pre-requisites: Basic WP
A powerful and easy-to-learn spreadsheet, with a full range of mathematical, statistical, matrix, and string functions. It will be useful for scientific and engineering computations, as well as for general and financial uses.

Athena(R) is a registered trademark of the Massachusetts Institute of Technology.✣

ATHENA MINICOURSES
Fall Term 1995

	Mon	Tue	Wed	Thu
	11 Sep	12	13	14
12 noon	MSO	Matlab	Maple	Xess
7 p.m.	MSO	MSO	Maple	Maple
8 p.m.	Matlab	Matlab	Xess	Xess
	18	19	20	21
12 noon	Intro	Basic WP	Working	EZ
7 p.m.	Intro	Intro	Working	Working
8 p.m.	Basic WP	Basic WP	EZ	EZ
	25	26	27	28
12 noon	Holiday	Latex	Frame	Info Res
7 p.m.	No	Latex	Frame	Ser. Emacs
8 p.m.	Classes	L.Thesis	Info Res	Dotfiles
	2 Oct	3	4	5
12 noon	Intro	Basic WP	Working	EZ
7 p.m.	Intro	Intro	Working	Working
8 p.m.	Basic WP	Basic WP	EZ	EZ
	9	10	11	12
12 noon	Holiday	Holiday	MSO	Matlab
7 p.m.	No	No	MSO	Maple
8 p.m.	Classes	Classes	Matlab	Xess
	16	17	18	19
12 noon	Ser. Emacs	Dotfiles	Frame	Info Res
7 p.m.	Latex	Ser. Emacs	Frame	Frame
8 p.m.	L.Thesis	Dotfiles	Info Res	Info Res

Remarks to the Corporation at its Commencement Meeting – 1995

Robert L. Jaffe

Dr. Gray, President Vest, Members of the Corporation, thank you for the opportunity to address you at the conclusion of my two years as faculty chair.

It would, perhaps, be conventional for me to talk about the problems and projects which have dominated my term. Instead let me merely note the remarkable breadth of issues which has made the job of faculty chair so interesting. To mention a few:

• Creating a new academic calendar and strengthening IAP.

• Reviewing and revising faculty retirement policy in an era without mandatory retirement.

• Improving race relations and the MIT experience for minorities.

• Shepherding new undergraduate and graduate degree programs through faculty approval processes.

• Responding to the CMRAE closing: Establishing guidelines for closing or reorganizing laboratories, programs and centers and reviewing faculty grievance procedures.

• Trying to bring faculty into the Reengineering effort in a creative way.

• Revising, implementing, and then optimizing MIT's harassment policies.

Many dedicated – and overworked – faculty colleagues have contributed to these efforts and to other essential Institute activities as housemasters, committee chairs, advisors, and so on.

I would like to mention especially, Professor Linn Hobbs, Material Science and Engineering, associate chair of the faculty, Professor Irene Tayler, Literature, secretary of the faculty, and for the past year, Professor Larry Bacow, Urban Studies and Planning, faculty chair-elect. In addition, about 100 faculty each year serve the Institute on standing committees of the faculty. It has been an active and constructive two years.

> I worry that too myopic a concept of efficiency will compromise our ability to do the things by which in the end we must be judged. The fact is that traditional measures of efficiency fail to capture crucial aspects of teaching, advising, counseling, or creating new knowledge. The best teaching may take place between UROP supervisor and student, one-on-one, after hours in an otherwise empty lab, or between students arguing political economy over beer in Central Square.

Now I would like to focus, if only briefly, on a more general issue which I believe clouds and confuses the perception of the place of higher education in modern America. The issue can be summarized in the word "efficiency." I recognize the incongruity that I – a theoretical physicist – should speak about this subject to you, who have been stalked by efficiency much of your lives. Please bear with me.

As MIT re-engineers, efficiency is on everybody's mind. University costs and processes are under the microscope of government and public scrutiny. How can we streamline our operations? avoid waste and repetition? do more with less? The faculty, like myself, who have looked at MIT's administrative processes share the conviction that we have much to gain by redesigning them more efficiently. There is no argument on that. But what about teaching and learning? research and creative scholarship? How will they fare during this period of re-examination? I worry that too myopic a concept of efficiency will compromise our ability to do the things by which in the end we must be judged. The fact is that traditional measures of efficiency fail to capture crucial aspects of teaching, advising, counseling, or creating new knowledge. The best teaching may take place between UROP supervisor and student, one-on-one, after hours in an otherwise empty lab, or between students arguing political economy over beer in Central Square. Great ideas in physics or mathematics may come once in a lifetime – or not at all!

Remarks to the Corporation at its Commencement Meeting

Jaffe, from preceding page

We can count the hours our faculty spend in student contact. We can demand our students fulfill requirements in lab work or writing. We can assign a mentor to every graduate student. But we cannot mandate the commitment and passion which characterize the best education. I am reminded of the talk Professor Amar Bose gave at this year's MacVicar lunch, where he focused on the extraordinary work done by Jaime Escalante, a high school calculus teacher, with disadvantaged minority youths in Los Angeles. It was a story of seemingly endless patience, dedication, and belief in their capacity to excel. What a wonderful achievement – but efficient? – By what measure?

As for research and scholarship, those of us who have dedicated our lives to it know that even relatively ordinary progress on a hard problem often comes only after years of frustrating and fruitless work. How well can this be measured in terms of "deliverables" or "quarterly progress reports" now frequently required by funding agencies and research sponsors? These thoughts lead me to make a couple of requests of you as members of MIT's Corporation. First, to understand the dilemma faced by our faculty in these difficult times; to support their attempts to preserve the most creative and in a deep sense, the most efficient part of their work; and to value in your own considerations, the distinction between efficiency in administrative and support processes and creativity in teaching and research.

And, second, to support our administration's efforts to preserve the quality of academic life. Under this administration and its predecessor, MIT has taken significant steps to provide faculty and students a richer environment for education and research – even in these difficult times – by, for example:

> As for research and scholarship, those of us who have dedicated our lives to it know that even relatively ordinary progress on a hard problem often comes only after years of frustrating and fruitless work. How well can this be measured in terms of "deliverables" or "quarterly progress reports" now frequently required by funding agencies and research sponsors?

• Hardening faculty salaries – to secure faculty commitment to the Institute, to free external funds for student and lab support, and to reduce our exposure to unanticipated changes in external support.

• Providing generous startup packages for junior faculty – to offer resources to match their creative energy.

• Recognizing truly outstanding teaching through the MacVicar Fellows Program – to honor dedicated and creative teachers as role models.

• Encouraging and supporting Dean Travis Merritt's freshman seminar initiative – to put faculty together with our youngest students in a creative environment early in their years at MIT.

Many other similar opportunities lie ahead, including:

• Reinvigorating UROP, which has suffered significantly from short-sighted changes in federal regulations; and which offers students unique opportunities to work with our research community,

• Streamlining our promotion processes, which occupy inordinate amounts of faculty time, and take us away from teaching and research,

• Re-working the connection between education and the living experience for our students – a complex and challenging opportunity which the faculty and administration have recently begun to examine.

I trust that you recognize the true efficiencies of MIT's educational and research programs and will be there to support our faculty and administration through what promise to be exciting, if difficult, times. ⬧

M.I.T. Card Holds Promise and Pitfalls;
Questions of Privacy and Security

Amy S. Bruckman
Special to the Faculty Newsletter

The social implications of new technologies are not always obvious. Consider MIT's installation of key-card operated gates in parking lots. This greatly increases security for parking lots, reduces individual privacy by creating a record of people's comings and goings, and makes it awkward to loan your car to a friend during the work day.

Parking gates are in place in the Albany Garage and West, Westgate, and Pacific Annex parking lots, and will be installed in the West Garage this winter. To enter or leave these lots, you need to swipe your MIT Card through a card reader. To date, the security benefits of the new system have far exceeded expectations. Chief of Police Anne Glavin reports that only four cars have been stolen from those lots since the gate system was first installed in 1994 (and in that case the gate arm was mis-adjusted, something which can be prevented in the future). Previously, one car was stolen per month from Westgate lot alone.

This increase in security comes at the price of decreased privacy. Most areas of MIT using the MIT Card have chosen to record little data about people's comings and goings. However, if the parking lots are to prevent people from parking multiple cars on the same card, all comings and goings must be recorded. Regardless of Chief Glavin's good intentions for the use of that data, it must be remembered that if the data exists, it is vulnerable to a court subpoena, and could be used in court proceedings. Further, even more potential issues are raised with the announced plan to outsource the parking.

There are also other, logistical problems. Suppose you want to lend your car to a friend. If the friend is a member of the MIT community and uses his or her ID to get out of the lot, to the lot management program it may look like you are trying to park multiple cars on one card. (Glavin plans to confront only repeat offenders with a pattern of abuse.) If the friend is not a member of the MIT community, then you will need to lend them your card – which becomes problematic if you now need it to open doors, take books out of the library, and buy things around campus. The problem has been somewhat ameliorated since Campus Police started issuing additional cards for spouses of authorized parkers. Difficulty lending cars may well be a fair price to pay for a dramatic decrease in car thefts. Is decreased individual privacy a fair price to pay for more effective parking lot management? There are a variety of trade-offs to consider.

Similar problems arise when dormitories want to take people's MIT Cards as collateral for the loan of equipment like vacuum cleaners. You might have trouble stepping outside, buying a soda, or doing laundry while you've borrowed a vacuum cleaner. If the MIT Card is now to be used for financial transactions, there is the added problem of whether they could potentially be stolen – what happens when a dormitory desk attendant wanders away for a few moments? Are cards to be kept under lock and key? The Committee on Athletics is to be commended for switching to a separate athletic card for exactly these reasons.

A number of these difficulties could be avoided by having separate cards for each function. The MIT Card Office has advocated combining many functions on one card for reasons of administrative efficiency. However, this overloading of functions gives the card conflicting requirements. It is impossible to make it fill all these requirements well.

The MIT Card began as a project of Housing and Food Services. Enthusiastic about the initiative they were taking, they convinced many other parts of MIT's administration to adopt it. When it became clear that the card had broader social implications for people on campus, there was no one charged with the task of seeing this broader picture – it's certainly not the job of Housing and Food Services to tell the Campus Police how much data it's reasonable to collect when people come and go from parking lots. Unfortunately, right now it's no one's job.

Privacy-related issues fall under the purview of The Privacy Committee, but that committee has not met since May of 1994, because it has had no chair. Fortunately, Professor Joseph Ferreira of Urban Studies and Planning has now agreed to chair the committee. However, even when the committee has met in the past, it had no authority or resources, and its recommendations were often ignored or laxly enforced. Furthermore, the issues the MIT Card raises for the MIT community go well beyond privacy concerns. Consider, for example, trade-offs between security and openness. This is particularly well illustrated by the issue of whether to lock doors with keys, combinations, or key cards.

The Medical Center door is one example. If a friend who is not part of the MIT community would like to meet me at my office in the evening or over the weekend, I can tell him or her the combination to the Medical Building atrium door, and to the Media Lab elevator. If the door and elevator were operated by keys, I might make copies for a regular visitor and I could lend a

M.I.T. Card Holds
Promise and Pitfalls
Bruckman, from preceding page

copy to a visiting colleague in town for a few days, but I'd be unlikely to give direct access to someone who visits only occasionally. If the door and elevator were controlled by key cards, I'd need permission from an official authority to give my friend access (which I'd be unlikely to seek).

Combinations slowly spread to a wider segment of the population, but that access can be periodically revoked by resetting the combination – you have to know someone currently at MIT to know the combination. Key access is more tightly controlled – I might tell the medical center combo to a stranger trying to get through, but I wouldn't give a stranger a key. However, because key locks are harder to change than combination locks, the group of people with access grows over time and is not easy to reset. Key cards are tightly controlled by a central authority, and access can be easily revoked to all who are not official, current members of the community. However, ironically, controlling access too tightly may sometimes result in decreased security – doors that are too frustrating to get through often simply get propped open.

The Medical Center door has long operated on a combination lock. Plans are in place to change it to the MIT Card in the fall. Signs protesting this change recently appeared around campus:

<div align="center">

**MIT Card Access
coming soon
A joint surveillance project
brought to you by
The MIT Card Office
Big Brother
SPODSA
and the Committee to Keep Alumni
Off Campus**

</div>

("SPODSA" evidently stands for "Secret Police of the Office of the Dean for Student Affairs.")

MIT makes an effort to include members of the broader community in a number of its activities – bridge, folk dancing, and community league softball are just a few examples. These take place in the evenings after the Medical Center door is locked, and many participants arrive by T. These participants are generally told the Medical Center combo to make it easier for them to reach campus. There are currently no plans to allow members of the broader community to get MIT Cards. While it's true they can still walk around the long way, anyone who has watched visitors stare at that locked door in frustration on a cold, rainy day knows that this will have an impact on how people feel about MIT. The efforts made by some parts of MIT to embrace the broader community will be somewhat undermined as a result. Of course it's also important to acknowledge the very real security concerns of the people who work in that building. There is a trade off here between openness and security.

These details are not mere matters of convenience: they affect the openness of the MIT community. Key card locks generally provide increased security at the expense of decreased openness, the potential for decreased privacy, and decreased flexibility. Is this what is most desirable for the MIT community? There are multiple legitimate answers to that question. My primary concern is that no one at MIT is currently even asking these sorts of questions. In the spring of 1994, Professor Jerry Saltzer assigned his Computer System Engineering (6.033) class to design a new plan for the MIT Card to better respect individual privacy, using "smart card" technology. Saltzer tells the story

of a student who came to him seeking additional information– she wanted to know where she could get a copy of the master plan for implementation of the card at MIT. When she was told there was no such plan, she was flabbergasted. Graduate student Andre Dehon has pointed out that the security of the MIT Card is inadequate. While the same system is in use at a number of other universities, other universities are not MIT.

MIT has a long-standing tradition of "hacking" technologies and the physical plant of the university. Dehon was easily able to decode the card's data structure, and show how it could be hacked. He presents a number of possible scenarios. For example, he describes how for $500, a fraternity could easily make a set of cards to give its members access to any building on campus accessed by The Card. (See http://www.ai.mit.edu/people/andre/mit_card/.)

The administration is reportedly trying to remedy these shortcomings. I believe the hacker community is up in arms against The MIT Card for aesthetic as well as practical reasons – it's perceived as so low-tech and poorly engineered that it seems an insult to an MIT sensibility.

There are a myriad of small and large issues that arise. The broader problem is one of administrative structure: no one was initially charged with overseeing the MIT Card and the broader social and practical implications of its uses on campus. Fortunately, Dean Art Smith recognized this problem, and before retirement set into motion the process of appointing a new committee to take on this task. If the committee is given adequate resources and authority, it should be possible to resolve these issues. ✤

Recentering the S.A.T.

Michael Behnke

The boxer Joe Louis once said, "I don't like money really, but it quiets my nerves." Some have a similar ambivalence about standardized testing and especially the SAT. Although uneasy with multiple choice tests, many of you may feel comforted by the presence of students with 800s. It calms your nerves. Well, get ready to be really calm.

Some of you may have been noticing the laudatory articles in home town newspapers about students getting double 800s on the SAT. Some parents are suddenly discovering that a younger child is much smarter than older brothers or sisters who took the SAT some years ago. These reporters and parents have not heard that the SAT has been recentered, which means that scores are, for the most part, shifted up.

This article will help you become experts on recentering. If you're at a social occasion and someone starts bragging about how smart their child is, I would suggest that you not show off your knowledge of recentering by pointing out that the kid isn't so smart after all. However, if you're planning to participate in the admissions process this coming year, as I hope you will, it might help to start thinking about the scores a little differently. The same is true for advisors who will see recentered scores in the folders of students entering in 1996. Please note that students who just entered MIT this year still have scores on the original scale.

To illustrate the difference between the original scale and the recentered one, I am providing the scores from the middle 50% range of students entering this year. We have converted their scores to the recentered scale (see next page). You can see, for example, that before recentering, students between the 25th and 75th percentiles scored between 590 and 690 on the SAT-I Verbal. On the

> **On the SAT-I Math, the scores between 660 and 710 actually go down from the original to the recentered scale. The importance of this for us lies in the fact that women nationally, on average, score somewhat lower than men on the math section, and minority students, other than Asian Americans, score, on average, lower still. We admit quite a few minority and female applicants with scores in the 660 to 710 range, and they do well at MIT. Recentering will make them look like weaker applicants compared to Asian and white men.**

recentered scale, they score between 660 and 750. The other scores given are for the SAT-I Math, the SAT-II Math I, and the SAT-II Math II.

Some of you may be confused by recent name changes. The old SAT (Scholastic Aptitude Test) had a Verbal and a Math score. Then there were various Achievement Tests required by the most selective colleges. MIT has required three of those: Mathematics Level I or II, a science, and a humanities. The new SAT (Scholastic Assessment Tests) consists of the SAT-I Reasoning Tests (which is the old SAT with a Verbal and Math score) and the SAT-II Subject Tests (which are the old Achievement Tests).

The decision by the College Board to recenter has been a controversial one, and one which was taken after many years of debate within the College Board. The SAT is a norm referenced test for use in making comparisons within a population of test takers at a particular time. Most such tests are renormed on a regular basis. The SAT, however, has also become a "yardstick" used by government, school districts, the media and others to measure educational attainment over time. Some said the decision to recenter was one more step in dumbing down expectations in education.

The reference group used up until now was the original group of about 10,000 test takers in 1941. They were mostly white males applying to the few private selective colleges asking students to take the tests at that time. The average score for students in that group was 500 on both the verbal and math on a scale from 200 to 800.

Since then, the average verbal has gone down to the 420s and the average math has gone down to around 480. The changes have been attributed to changes in the make-up of the test-taking population, the increase in the volume of test takers to over a million, and changes in what students are taught in schools.

Because the scores had to be "stretched" up to use the whole top of the scale and other scores were bunched near the bottom, the validity (ability to predict grades in college) and the reliability (likelihood that a student will get relatively the same score on different administrations of the test) were weakened. This was primarily true of the SAT-I Verbal. Getting all questions correct on that test actually earned one a 730 which was then "stretched" up to an 800. Some points on the high end of the scale haven't been used in years. A further problem was comparing verbal and math scores. While it is hard to believe that students couldn't understand percentiles, many apparently persisted in believing that a higher score on one part of the test meant that they were better in that area when percentiles might have been showing them the opposite. Personnel trying to counsel students in secondary schools wanted the scores to be comparable.

It is important to note that the level of difficulty of the test will remain the same and that percentiles will be virtually unchanged. It is also interesting to note that not all scores will go up. On the SAT-I Math, the scores between 660 and 710 actually

go down from the original to the recentered scale. The importance of this for us lies in the fact that women nationally, on average, score somewhat lower than men on the math section and minority students, other

than Asian Americans, score, on average, lower still. We admit quite a few minority and female applicants with scores in the 660 to 710 range, and they do well at MIT. Recentering will make them look like weaker applicants compared to Asian and white men. The other interesting change for us is with the SAT-II Subject test in Math Level II. Most of our applicants take this test (the others take Math Level I), and we depend heavily on it in making decisions. A score of 750 on the original scale is a 724 on the recentered scale.

We in the Admissions Office have done studies involving such things as converting the scores of this past year's applicants to the recentered scale and studying how that might have affected decisions. We are also

giving prospective applicants information about scores at MIT on both the original and recentered scales. If students apply for '96 entry with a mix of original and recentered scores, we will use conversion tables to convert to the recentered scale.

The main problem for someone like me, having been in admissions for 25 years, is that recentering the ranges in my brain won't be as easy as installing the conversion tables in our computer system. That makes me nervous, but maybe the sight of all those 800s will calm my nerves. ✣

Middle 50% for the Class Entering in 1995

	Pre-Recentering Enrolled		Post-Recentering Enrolled	
SAT-I Verbal	590	690	660	750
SAT-I Math	720	770	720	790
SAT-II Math I	670	740	690	750
SAT-II Math IIc	720	800	690	800

**Penny Wise and Pound Foolish:
Re-Engineering Reengineering**
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On the surface this may seem reasonable, but look one level deeper. The mail delivery people could load up a cart and make a chain of deliveries, going from office to office, with little time spent in transit between stops. This was quite an effective use of someone's time. As it is now a large number of people each have to make a two-way trip to the mail room. The actual time expended in fetching mail, expressed in people-hours, must be substantially greater now than it was before.

There are other problems with this situation now. Many of us deal with potentially sensitive matters: student records, letters of recommendation for graduate school and tenure reviews, etc. The open mail room is a potential security hole.

What has been done in this situation is not economizing, but shifting expenses from one set of pockets to another. It reduces the expense paid by physical plant for the mail delivery people, but increases (by a much larger amount) expenses paid by the departments and by sponsored research accounts.

One suspects that the Reengineering people had one more thing in mind, which is to squeeze just a bit more work out of each of us. They may not value the time of the administrative and research staff very much, and perhaps they even rationalized that faculty, most of whom have secretaries, would not be inconvenienced very much by this. But, particularly in view of the fact that secretaries are being stretched out over more faculty and staff, there is really no more effort left to be had.

In his very interesting article on the Reengineering process in the May/June *Faculty Newsletter*, Isaac Colbert pointed out that an earlier effort (about 15 years ago) to reduce administrative expense by arbitrarily reducing headcount had not achieved its goal. While central administration did get smaller, offsetting growth in administrative people in departments, labs and centers caused the total of administrative operations to "recover." This was caused, as Colbert says, because the reductions were made "without an examination of how

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administrative work was done at MIT." From the point of view of the faculty, there probably is a need to reduce the size and expense of the administration. The Reengineering process quite properly seeks to understand how administrative work is done, to identify what that work should do, and to try to design ways of making that administrative work function more smoothly and economically.

One might get the impression, from what we faculty see of what is happening, that the Reengineering team has limited its view to expenses of administration and has not considered the more global issue of how the Institute as a whole operates. In this, it may be repeating the mistakes of 15 years ago. Reduction of total expense may not be achieved by simply reducing certain elements (e.g., administration) of expense. A broad look

at the implications of each of the measures contemplated should be taken.

A second example is the elimination of Lab Supplies. There is no denying that there were problems there. Lab Supplies was not a very effective provider of many things required in the laboratory. Semiconductors, for example, always required going outside MIT. So simply eliminating the operation and its charges to overhead and use of space seems to make sense. Outside suppliers appear willing to make deliveries to campus frequently. So maybe this is an appropriate change.

Look again. Many of the things we use in the laboratory are in fact fairly standard and don't represent high technology (the stuff that Lab Supplies wasn't good at). An example is things like batteries, glass tubing, syringes, etc. When in the past I needed a nine volt battery or a piece of glass tubing I could just run down the hall and pick it up. If we need to deal with another layer of service providers and wait for the stuff to arrive, we are much more likely to buy two or three so the next time we need one we will have it in a drawer or on the shelf. This will lead to more substantial inventories of

Penny Wise and Pound Foolish: Re-Engineering Reengineering
Kirtley, from preceding page

stuff stashed in labs all over the Institute. It is my guess that individual laboratories, departments, and centers will establish their own stockrooms and methods of charging accounts for commonly used supplies. This will lead to the equivalent of lots of little lab supply operations all over MIT (exactly what was described as happening by Colbert with administrative process 15 year ago). Will this be more or less efficient than a central operation?

One more example with slightly different ramifications is parking. In a move that appears not only to reduce expenses to MIT but also to be "environmentally correct," MIT has decided to charge a non-trivial fee for parking. This eliminates a "perk" and constitutes a reduction in pay for everyone who commutes to MIT by automobile. This measure, in addition to shifting costs from the General and Overhead accounts to the employees, satisfies the itch felt by some to punish those who use those polluting automobiles (as opposed, one would suppose, to the very clean and environmentally friendly buses operated by the MBTA).

On the surface it would appear to be right to charge users of a service for that service. To the extent that parking is viewed as simply a convenience and a service to the employees that might be correct. But is that right? Car pools and bus schedules restrict time flexibility of faculty and staff. Pushing people into them would inevitably reduce the amount of time and availability of people for activities here at the Institute. There really is a reason for providing parking for employees.

Most of us won't be coerced into depending on public transportation. Even those of us who ordinarily commute by bicycle in fair weather will continue to want a parking place for when we need the car (as to transport research sponsors to the airport or in case of inclement weather). For this crowd (and I suspect it includes almost all of the faculty) this parking fee is nothing more than a salary reduction. This may be OK. After all, MIT needs the money.

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The problem is that this is not a rational way to reduce expenses. It is, to be sure, possible to view the imposition of a parking fee as a selective salary reduction, but it is necessary to recognize that at the same time it changes a before-tax perk into an after-tax expense.

Some amount of what MIT pays each of us will come right back in the form of a parking fee. Associated with that recycling of money is the part that goes to the state and federal governments for income tax. Someone with a combined state and federal marginal tax rate of 25% would find that $300 parking fee translates to $400 of actual income lost. (That is, $400 of salary is split, $300 going to MIT for the parking sticker and $100 going to pay income tax.) Thus one impact of this parking fee (if viewed as a salary reduction) is to transfer a substantial amount of money to the state and local governments. If MIT wanted to reduce the salary of each of its employees by, say, $300, it would be better to be honest about it and simply do it, rather than hide it in a parking fee.

The Editorial in the May/June issue of this newsletter is certainly right. The problem is that the Reengineering process is being carried out by a group of inexperienced consultants with insufficient input from the MIT community. The problem is that they have focused on expenses rather than on the processes which generate those expenses.

Mail delivery is, to be sure, an expense, but it is something that is necessary to the functioning of this organization. Other administrative functions, such as mass mailings of repetitive memoranda from high institute officials related to rulings of OMB, EPA, or EEC might be curtailed with reduction of expense and little or no impact on MIT's basic functioning.

We are faced now with this problem: Reengineering is not working well. It has spent several millions of dollars and has produced a dysfunctional mail system and a bunch of promises.✤

Chinese Internships Offer Unique Opportunity
Berger, from Page 7

few students to Japan as interns, and today has hundreds of enrollments in language and social science subjects and sends 50-60 trained students after graduation to Japan each year to companies and laboratories.

For students entering the MIT-Japan Program in the early years, much of the appeal lay in the notion of becoming deeply enough involved in Japanese companies that were world-leaders to be able to bring new strengths and credentials back home after the internship year. For the MISTI/China program, the incentives for involvement both for the Institute and for individual students are somewhat different. The tremendous dynamism and growth of the Chinese economy and the emergence of China as a major power in the international system pose a host of challenges to American society that our students will confront throughout their lives as professionals and citizens. Even if today there are very few Chinese research or manufacturing establishments that match those of the best in the US, Japan, or Europe, the trajectory of change seems very steep. MIT faculty who have visited labs at Tsinghua, Fudan, Peking Universities and the Academies of Science as well as MIT corporate sponsors who are rapidly expanding their Chinese manufacturing and R&D activities, all report finding there a growing sophistication based on close monitoring of work at the cutting edge in Western countries, the acquisition of recent equipment, a level of endeavor within striking range of that at home, and a creativity that

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This is a unique opportunity for MIT students in their own areas of expertise to develop a concrete feel for the characteristics of Chinese science, technology, and organizations. As the tremendous strengths and potential of Chinese research and development efforts begin to deliver on their promise, our students will need to understand them in order to be competent in their own fields. As Provost Joel Moses said, in a speech that opened an MIT meeting on environment and development in China last July, "The point is that we need to teach our students and ourselves to include the business and organizational context, the needs and desires of customers, and the social, cultural, political, and economic

environmental context into the specifications of the problem. Working on reconciling the imperatives of development with the imperatives of environment in a country like China is, therefore, one

of the most challenging and valuable experiences we can imagine for our scientists and engineers."

The experiences in a China-based internship will be building blocks in our students' professional education as well as in their grasp of a new globalized economy. To be prepared, the students need the kind of deep understanding of a foreign society that requires language, culture, politics, and history classes at MIT and then, hands-on experience in public and private sector institutions and research centers in China. They also need encouragement to think through and discuss the moral and political issues at stake in working in China. Students who have undertaken

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this arduous preparation for acquiring skills to understand science, technology and management issues in China will bring back new strengths to American society. They will bring not only their talents and education as scientists, engineers, and managers, but also a concrete sense of the dilemmas of development and democratization, of economic growth and social justice, of promoting industrialization while trying to do least harm to the environment. As professionals they will learn what it takes to carry out projects in China. We know that students who have learned to understand one foreign society well acquire a set of skills for learning to operate in other countries as well, so the China-competent graduate of the MISTI/China program will be an internationally-trained professional with an ability to move between his or her own country and the rest of the world.

The first two MIT interns started work in China this summer. One man, who had just completed an EE MS, is working in the CIMs laboratory at Tsinghua University; the other, a woman with a TPP MS, is located in the State Science and Technology Commission's Agenda 21 office, an agency responsible for environment and development planning. Some 30 other students have signed up and are now taking the two years of Chinese language, history, and intern training classes required for the program. There are commitments from Chinese institutions and companies and from US and international business to hire these students for periods of up to a year in China in settings that range from power plant construction near Mongolia to Motorola research labs in Beijing to financial consulting in Hong Kong. Private companies will pay the interns on a scale commensurate with their own

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employees; students going to public institutions will be funded by MISTI, with seed funds from the Provost's Office and the generous support of an MIT alumnus, Dr. Ge Y. Chu (EE '49).

The first large-scale effort to bring MIT faculty and students into research collaborations with Chinese scientists and technologists was a workshop held July 12-14, 1995 in Beijing on Sustainable Development and Environment, co-sponsored by MIT, China's Agenda 21 office, and Tsinghua University. Provost Joel Moses headed a faculty group (Alice Amsden, Urban Studies; Suzanne Berger, Political Science; Rafael Bras, Civil Engineering; David Marks, Civil Engineering; Gregory McRae, Chemical Engineering; Chiang Mei, Civil Engineering; Mario Molina, EAPS: Kenneth Oye, Political Science; Adel Sarofim, Chemical Engineering; Jeffrey Steinfeld, Chemistry; David Wallace, Mechanical Engineering) that over a week fanned out into visits to laboratories working on development and environment and then reconvened for the conference. With MISTI and some NSF traineeship funding, each of the faculty members brought along one graduate student. Although far short of a full-scale China education, the group did meet several times before and during the trip for presentations ranging from lectures by Professor Peter Perdue on Chinese history and Professor Kenneth Lieberthal (University of Michigan) on Chinese foreign policy to presentation of the moral, political, and technological issues involved in the Three Gorges Dam project, to briefings by top officials at the US Embassy in Beijing on current US-China relations.

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Much of the MIT research presented at the July meeting is work in progress under the aegis of the new Alliance on Global Sustainability, a collaboration among MIT, the Swiss Federal Institutes of Technology (ETH) and the University of Tokyo. Swiss and Japanese collaborators from these projects also participated in the meeting and the laboratory visits. In each of the areas, Chinese researchers presented current work as well, and by the end of the week, planning was well underway for collaboration in areas of clean coal combustion, remote sensing, river basin pollution remediation, air pollution monitoring, and economic development.

Seven corporations that have been long-term sponsors of research at MIT also participated fully in the meeting: Asea Brown Boveri, AT&T, Ford, GM, IBM, Norsk Hydro, and Raytheon; and several of them pledged support for the projects that developed out of the meeting. Chinese interest in the continuance of these projects seemed high. Deng Nan opened the meeting in the Great Hall of the People, and the leaders of the group along with the corporate representatives met with Dr. Song Jian, head of the State Science and Technology Commission and State Councillor.

While the July workshop may have been the largest single commitment of faculty time to exploring collaborations in China, there are a number of other ongoing efforts. President Charles Vest visited China last June, meeting with top university and government officials during his stay. Tsinghau University, the "MIT of China" and MIT have plans to collaborate in a number of areas. The School of Architecture and Planning has sponsored a design studio activity at Tsinghua University that has, over the years, brought dozens of MIT students to China in the summer. Professor Lester Thurow and Professor Ernst Frankel are organizing an MIT-China Infrastructure Conference with Fudan University in Shanghai in November 1995. The Sloan School of Management has developed new relationships with Tsinghua and Fudan to work on managerial education. At MIT there are many students from mainland China: in 1995, some 194, of whom six were undergraduates and 188 were graduate students. Thirty percent were women.

Many of these projects are in early days, and much remains to be done at MIT if we are to offer students and faculty the resources needed for understanding of Chinese institutions and society. Chinese language subjects are new at MIT and are too few to accommodate student demand. There are few subject offerings outside of history and political science. A new lecture series – China Forum – that brings distinguished scholars from across the country to talk about issues in Chinese society and development

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is only a small step towards establishing the rich set of regular curricular offerings on China that MIT students ought to be able to tap.

MIT has set itself the goal of creating a world-class center of learning about China at the Institute. In this period of financial stringency, additions to the Institute can be justified only when they strengthen our pursuit of core purposes and attract resources from outside, because they visibly contribute to meeting new social needs. The internationalization of research and education is such an innovation. It enhances our other objectives by rebuilding the foundations of leadership, as we teach our students and ourselves how to contribute to our own society by engagement in the world. ✤

Economic Development Propels Chinese Growth

Thurow, from Page 7

these areas. Unless this problem can be solved, China's economic development may implode. Unfortunately, anything that has anything to do with plants is one of the few areas where MIT has almost no expertise to offer, except in the area of production plans.

Fortunately, the other area which may stop economic development is an area where MIT does have something to offer. It is an area which indirectly helps solve some of the problems in rural China. It is the area of infrastructure. Because of history (no colonialists built infrastructure in China as they did in India) and because of the ideology (Chairman Mao believed in regional self-sufficiency and discouraged cross-regional infrastructure) China has less infrastructure than countries much poorer and much smaller than itself.

Current economic development is focused on the coastal provinces since they need the least economic infrastructure to function. The areas near Hong Kong boom since they can use Hong Kong's infrastructure. But here again, to prevent a huge income gap from emerging between coastal and central China, China needs to roll its economic boom west. This can only be done if the necessary infrastructure is in place.

Infrastructure helps agricultural incomes since better transportation and communication allow the farmers to get a bigger part of the purchase price (less needs to go to those who transport goods to the right places) and have the knowledge necessary to grow the crops that are most in demand and yield the highest net return.

Decentralized yet coordinated cross regional infrastructure planning is a great Chinese weakness, since it was not a set of skills and institutions that were developed in a centralized communist state. The current system is essentially a system of regional economic war lords where everyone is attempting to build infrastructure that will help their own region to develop but be inaccessible to everyone else. No one knows how to put regional facilities together. How investment costs are shared and profits split is a giant black hole.

If one looks at what the Chinese have said needs to be built to sustain economic development, there isn't enough money

When it comes to decentralized coordination, cross regional infrastructure investments, economic incentives, and adapting new technologies to new environments, MIT has much to offer. MIT also has much to learn from China about using technology in very different environments to accelerate economic development, about the effectiveness of economic incentives in different cultures, and about decentralized coordination in very different institutional environments.

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in the world to build it. Using economic incentives to avoid the need to build so much infrastructure without slowing economic growth is also an approach that falls outside of the traditional communist ways of doing things.

What should be done technically often isn't clear. If one looks at new technologies in an area such as telecommunication, the issues in China are very different from those in the United States. Here the new technologies (fiber optics, satellites, wireless loops) are going to be layered on top of literally billions of miles of copper wires. In China those billions of miles of wires do not exist. What China should do is probably very different than what the United States, Japan, or Germany should do.

For all of these reasons, Professor Ernst Frankel and I are coordinating a conference on infrastructure development in central China along the Yangtze River Basin, from November 8th to the 11th in Shanghai. The conference will focus on financing, planning, constructing, and operating land, air, and water transport, energy generation and distribution projects, telecommunications systems, and water supplies.

The idea is to come out of the conference not just having had a useful conference but to come out of the conference, with a set of researchable topics that would be of interest to people here and there and be a set of topics where people here and there might like

Economic Development Propels Chinese Growth

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to work together on understanding them and then using this understanding to help China more efficiently build, operate, and maintain its infrastructure. In order to accomplish this, two days of technical meetings will follow the main conference.

On the Chinese side our prime partner is Fudan University in Shanghai, but co-sponsors include all of the major universities, political groups and economic organizations along the river. We are excited about the prospects and the potential outcomes.

Given the drumbeat in this summer's newspapers, no one could avoid thinking about human rights issues, but it also doesn't take such high intensity publicity to make us think seriously about the issues. There are issues.

China is a big country where one can see and find almost anything one wants to find. In China there are good and bad orphanages just as in the United States there are good and bad nursing homes. There are undoubtedly abuses in the Chinese prison system, but who would want to argue that there are no abuses in the American prison system? Is making people work while in prison better or worse than not letting them work while in prison? Someone who has given up their Chinese citizenship, who writes about prison abuses, and who then enters China via Kazakhstan and Xinjiang seems suspicious to Chinese officials. I suspect that someone who gave up their American citizenship, who wrote about American prison abuses, and who entered the United States via Alberta and North

Dakota would similarly raise some suspicions among American officials.

Without doubt there are some dissidents in China who are not treated the way we would treat dissidents. At the same time, 1.2 billion Chinese have more personal freedom, political freedom, and economic freedom than they have had for thousands of years. One cannot freely advocate changing the entire political system in Beijing, but one can freely advocate changing the personnel or leadership in any local government office.

In the end one has to balance the conflicting truths, attempt to determine where the center of gravity lies, and the directions in which the currents of human rights are moving. To those of us that are participating in this venture, they seem to be moving in the right direction. ❖

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Sustainable Development of the Yellow River Delta

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open city in 1983, and efforts have been ongoing to support development of environmentally sound agriculture, chemicals, and energy.

The three teams working on the YRD project are: (1) River Harnessing and Water Resources, (2) Environmental, Land Use, and Geographic Information Systems (GIS), and (3) Economic Development. Members of each team are working closely with the local counterparts in Dongying, helping to augment the capacity of local staff.

The River Harnessing and Water Resource team are investigating feasible means within the next five years to "harness" the mouth of the Yellow River, which has made 10 major shifts over a 100 kilometer radius during the past 100 years. To control the swing, they are

looking at the potential of additional dikes, channels, dredging, and other measures near the mouth. They are also considering the physical impacts of dams being built, agriculture and industry being developed, and soil conservation efforts being undertaken upstream.

The Environmental, Land Use, and GIS team are studying the evolution of the coastal zone, the environment, land use, and resources in the YRD, and the ways to achieve environmentally sound agriculture. They are designing an environmental data base for a GIS for the region.

Professors Lin and I are part of the economic development team for the project, conducting industrial and agricultural development, input-output, and transportation analyses as part of a comprehensive economic development

plan for the region. They are working closely with 12 high-ranking economic analysts from the China Petroleum and Gas Industry Corporation and the State Council, including the Development Research Center and the State Planning Commission (Institute of Economic Research, Institute of Comprehensive Transportation, and Institute of Spatial Planning and Regional Economy).

The project is currently funded by the U.N. Development Programme, Netherlands Government, national agencies participating in the project, and the Dongying Municipal Government from the YRD. The initial stage of the project, which officially started in the spring of 1995, will continue through December 1996. ❖

Revolutionary Times Require Revolutionary Goals
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our own tale of two cities: Cambridge and Washington, D.C. The guillotine may not be set up in front of the US Capitol, but it may seem so to those whose research funds have been chopped with swift brutality. What is even worse than the financial crunch is the larger loss of respect for our mission that these budget cuts seem to portend. Are we going the way of the French aristocracy? Is authoritarian populism going to hijack democracy? Will we see more terrorism from the likes of the Oklahoma City bombers or the unabomber, who, like a violent Jean-Jacques Rousseau, contends that what most of us consider civilization has in fact increased human misery?

For MIT, this is truly a revolutionary period. Life is not the same for any of us, and it never will be the same again.

That is the bad news. It is also the good news. Now we have to think hard about what we are doing and what our goals – our goals – should be.

MIT has always been characterized by an unusually strong and direct sense of civic responsibility. This has been true from its founding, when William Barton Rogers set out to invent a new kind of American university, one that (in his view) would be far more responsive than existing models to the needs of an emerging democratic and industrial society. The sense of civic responsibility was reaffirmed and substantially redirected in the twentieth century, and especially during the last half century. During World War II, MIT did much to help the nation attain a decisive military advantage over formidable adversaries. As the Second World War mutated into the Cold War, MIT's commitment to national defense continued, while military and

economic goals became increasingly intermixed.

MIT's strong sense of civic responsibility has always been a great source of strength to the Institute as well as to the nation. It has also been, at times, a source of weakness when MIT

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has allowed outside institutions to exert undue influence over its educational program. For example, in the early part of MIT's history, some areas of the curriculum were defined by the narrow vocational training needs of industry. In more recent decades, much research funding has been linked to agendas motivated primarily by Cold War politics. It is likely that MIT will continue to confront economic and political pressures that come from all over the ideological map and that are all intended to affect our mission.

We have to pay attention to these pressures without caving in to them. It is a fine line to negotiate. When things were coming our way – and a lot has come our way over the past half-century – it was easy to assume that MIT's educational purpose would always dovetail nicely with the national purpose. During this half century, we have made great improvements in the content and quality of undergraduate

education, notably through the creation of the School of Humanities and Social Science in 1950 and the revamping of the core curriculum in the 1960s. Throughout this period, however, some basic assumptions remained unchanged. In the words of Robert K. Weatherall (director of Career Services and Preprofessional Advising), "six articles of faith" were accepted "explicitly or implicitly": "that there was always an unmet demand for scientists and engineers"; that "Uncle Sam was science and engineering's most important patron," directly or indirectly; that "the role of the engineer was purely technical"; that the R&D tide was "ever rising"; "that the natural habitat of the engineer was the large corporation"; and "that the natural habitat of scientists and engineers was where material things were studied, mined, manufactured, or put to use." [Robert Weatherall, "New Realities of Scientific and Engineering Employment: The College Placement Perspective," Career Consultant (September 1994), pp. 8-9. Presentation at the Annual Meeting of the Commission on Professionals in Science & Technology, December 14, 1993.]

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In the post-Cold War world, all these assumptions have to be questioned. We know that the old order is passing, giving way to the new – but the shape of the new civic order is still unclear. Despite this lack of clarity – indeed, precisely because of it – we at MIT have to define our civic responsibility for ourselves in a way that we are willing to honor through thick or thin, in the worst of times as well as the best. Our values as a community may not coincide with those of the state; our sense of social duty may not always coincide with the political agendas of the moment; but if we rearticulate our dedication to the life of the mind, to the pursuit of truth and understanding, we will honorably fulfill our institutional mission.

In the realm of undergraduate education, we have both the challenge and the opportunity to reconsider the assumptions on which we have operated for so long. Let me suggest two fundamental principles that might help us in this reconsideration. The first principle involves the role of scientific and technical education in general education. Although we are always right to stress the utilitarian value of the education MIT offers – its value, for example, in maintaining a robust economy and healthy environment, and in delivering good medical care – we should not frame this argument too narrowly.

In the first place, we must recognize that economic, environmental, and medical objectives (and others equally desirable) will never be attained only through scientific and technical knowledge. To be effective, that knowledge must be linked with social organization and cultural motivation.

That is why an MIT education must encompass the social and cultural dimensions of professional practice and more generally of human experience.

Furthermore, those of us who teach here at MIT know that the deepest

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sources of our commitment to our work are not narrowly utilitarian. We might not all go so far as Jerry Lettvin, who (in introducing himself to prospective participants in his freshman seminar) states that "the role of education is purely hedonistic – namely, to show the most interesting ways of enjoying living and thinking." But I do think we would all agree that – to quote from the 1949 Committee on Educational Survey (The Lewis Commission), convened after World War II to consider the postwar directions of MIT education –"Although service to the community is most certainly a function of every university, it must fulfill that function primarily through education and extension of the basic fields of knowledge" (p. 62). Our personal reasons for getting involved with education and research arise from our devotion to this core mission.

It is often said that MIT is special because it is "polarized around science and technology"– but just what do we mean by that phrase? Why do we believe so deeply in the educational value of these areas of inquiry? For many of us, it is not just that such an education leads to useful professions, but also because it provides an excellent basis for educating individuals in thinking clearly and creatively and analytically. The conviction that professional and general education could be united inspired William Barton Rogers, and as a result the MIT education has always been an integrated one. Science and engineering are woven in from the start, not added later as a "professional" layer on top of, and for the most part separate from, a preceding general education. To quote again from the report of the Committee on Educational Survey, "We ask for more than a mechanical mixture of the conventional literary and technical cultures. We ask for an integration of general and professional education suitable for the MIT environment."

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A second principle of MIT education is closely connected to this first one: the integrated education we offer is also intended to be a democratic one. Even today, when tuitions are higher than anyone wants to see, MIT still provides an upward route of social mobility. Unlike "layered" educations that require several years of graduate school on top of undergraduate education, an integrated MIT education can be completed in four or five years. To borrow the slogan of the French revolutionaries, many technically-based professions are still "careers open to talents." If you look at the entering Class of 1999, you will see a vastly different ethnic, racial, and gender mix from that of a generation ago. When you look at the jobs that the graduating Class of 1995 entered, you again see a vastly different array of opportunities than was offered to the preceding generation. What has not changed is the opportunity MIT provides to some of the brightest, most motivated young people of the country and increasingly of the world.

If we rearticulate these first principles of an integrated, democratic education, we are well on our way to seeing this institution through these revolutionary times. As dean of Undergraduate Education and (for the time being, at least) of Student Affairs, one of my responsibilities is to insist that we all confront some basic questions involving our educational mission. It will take us all some time to develop the appropriate mechanisms for doing this, but the questions themselves are already evident.

First, what are we teaching? Is it the right mix given the students who are entering MIT, the world they will be entering, and our own convictions about higher education? Another set of questions involves how we are teaching. Are our methods effective, efficient, and enjoyable (given that while some

> Another set of questions involves how we are teaching. Are our methods effective, efficient, and enjoyable (given that while some stress fosters learning, too high a level of anxiety and displeasure is an obstacle to it)? Are we taking full advantage of new digitally-based methods of education, so that they enhance the personal teacher-student relationship that is at the core of the university experience?

stress fosters learning, too high a level of anxiety and displeasure is an obstacle to it)? Are we taking full advantage of new digitally-based methods of education, so that they enhance the personal teacher-student relationship that is at the core of the university experience? A third set of questions involves the relationship between student life and student learning. How might we improve the educational dimensions of life outside the classroom – for example, in regarding the ethnic, national, and racial diversity of our students not as a social problem but as an educational opportunity?

At MIT, academic departments always have been and always should be primary sites for initiating and implementing creative academic efforts. At the present moment, many departments are undertaking just such efforts, often on an extraordinarily ambitious scale. During the coming year I will be making a series of visits to departments to educate myself about these efforts. As dean, my job involves nurturing such initiatives and making sure they are well-coordinated with overarching institutional goals. Departments must communicate their initiatives with each other, not only to negotiate boundary disputes, but even more importantly to seize boundary opportunities.

Just a few weeks ago, the last class to graduate from MIT in the twentieth century arrived on campus. In order to educate them for a lifetime of civic responsibility – as opposed to simply training them for a job – we must rethink our intellectual responsibilities for the post-Cold War era. We are all experts in our special disciplines. When it comes to framing larger educational policy, we are all generalists and should all participate in a general discussion. By talking with each other and with the administration, staff, and students, the MIT faculty can and must arrive at a common direction for undergraduate education that makes sense for these revolutionary times – our winter of despair, and also our spring of hope.✣

*C*enter for *A*dvanced *E*ducational *S*ervices Evolves from Old CAES

As part of its mission to facilitate the use of the new technologies for educational purposes, CAES will include an applied "research arm," the Center for Educational Computing Initiatives (CECI). The goal of CECI is to carry out research linking the emerging technologies to education, facilitating both the creation and the distribution of educational products and services. The research will be focused both on the technologies per se and on the effectiveness of alternative educational uses of the technologies. CECI's research is intended directly to assist CAES in creating new educational products and services. In conjunction with its research aims, CECI will advise industry and industrial consortia on its findings and recommendations regarding the new technologies in education. This advice may include recommendations related to standards or protocols in creation and transmission of multimedia program content over various delivery mechanisms.

CAES will assist in the creation of Institute-wide policies, procedures, and operations related to MIT's "virtual campus," i.e., MIT's implementation of "distance learning" offerings. Policy/procedure topics to be addressed include electronic cross registration of subjects, distance degree programs, policies regarding public as well as tuition-based distribution of MIT subjects, and guidelines for the presence of on-scene teaching support. The associated operational topics are complex, involving virtually all MIT schools and several MIT support functions. CAES is prepared to coordinate the development of both the physical and intellectual infrastructure required to build MIT's distance learning capabilities to world class standards.

The educational offerings created by CAES will build upon MIT's leadership in science and engineering, management, economics, humanities, and architecture and planning. The potential audiences for CAES products and services are broadly distributed, by age, geographical location, and educational interest. Examples include engineers currently working in industry who require additional technical knowledge; high school seniors in the inner city who may wish to study physics using MIT's new virtual campus; preschoolers being offered "early science" projects; government personnel in emerging countries learning about clean water distribution; students of literature using an indexed database of Shakespearean plays on film to create a multimedia "term paper."

2. CAES Reporting Procedures

CAES has a director who reports to the provost via an active CAES Standing Committee. The Standing Committee – being formed at this time – will have representation from each of the five MIT Schools and also from MIT centers and laboratories, as the provost deems appropriate. The CAES director and the CECI director will sit on the Standing Committee. The chair of the Standing Committee will be appointed by the provost.

The Standing Committee will review plans and progress of CAES as reported by the director. Each member will offer advise on the participation of her/his respective school or center in the creation and distribution of CAES distance educational products and services.

3. Change CAES "Technology Mix"

The former CAES has a long and industry-respected tradition in producing videotape courses. These courses range from short demonstrations of scientific measurements and experiments to multi-semester, complete programs in calculus, systems analysis, and digital signal processing. Recent courses emphasize management principles as well as the more traditional engineering/science offerings. CAES has a world class video production studio and editing suite, together with very knowledgeable and capable producers of TV educational products.

Videotapes remain one of the most utilized technologies for delivering multimedia educational products at an industrial or home location. However, more rapidly growing technologies include CD-ROM multimedia offerings – now available for use with most desk-top computers – and the Internet and its World Wide Web. This technology is about to be expanded to allow over two hours of video on one CD-ROM, the new "videodisk." Also emerging are interactive video and "video on demand," a prototype of which is currently being used at CAES. To capitalize on the emerging technologies, CAES will shift its mix of technologies to become more inclusive and less reliant solely on videotape. Particularly exciting will be educational products and services that utilize a combination of technological ingredients, including videotape, Internet, the WWW, CD-ROMS, videodisks, etc. Perhaps the "optimal combination of ingredients" – by educational market segment and content category – could be an active research topic.

4. Inventing Technologies for Education

The "combination of ingredients" described above could lead to new and exciting research. For example, – especially for you creative folks in the

Media Lab and in AI – consider this as an "invention challenge": invent an affordable technology that allows the ease of use and in-class visibility of the blackboard and that simultaneously allows high technology videotape editing and links to computer-based multimedia and indexing. That is, we would like to have a lecturer presentation mechanism that goes well beyond "chalk talk" as experienced by the distant learner, yet that requires not much more effort than chalk talk for the lecturer; required follow-on work could be done in the multimedia editing suite.

5. Getting You, the Faculty, Involved

In the past only a small fraction of MIT's faculty were involved with CAES, usually in the creation of semester-length video courses. We hope to change that, by offering you a variety of interesting and we hope useful services.

As an example, CAES is planning to establish three separate ways in which you the faculty member can make and distribute one-shot 60 minute videotapes at CAES. By the end of this semester we hope to launch these efforts:

1. an MIT Distinguished Lecturer Series
2. an Expert Lecturer series
3. a Visiting Lecturer series

The potential audiences for these series would include ILP-affiliated companies, organizations supporting CAES fellows in its Advanced Study Program, and perhaps other corporate affiliates. Additional potential audiences include MIT alumni and friends, other universities, and perhaps even K-12 classes.

The goals of the Distinguished Lecturer Series are several:

(1) to present current MIT-based research and education content in a timely manner before an interested and targeted audience;

State-of-the-art Editing Suite

(2) to "test market" lecturers and content for perhaps larger CAES investment in creation of longer "courses" via videotape and other technologies;

(3) to enhance MIT's general media presence, perhaps leading to primary news coverage by TV networks and/or major newspapers.

There are many lecture series currently offered at MIT and they could provide the basis for launching the effort. By subscription fees, either direct or wrapped as part of a larger MIT affiliation package, the Distinguished Lecturer Series should be self-supporting. MIT's Industrial Liaison Program has already expressed interest in supporting this effort. Other potential subscribers include the MIT Enterprise Forum, companies that have sponsored in-residence fellows in the CAES Advanced Study Program, and other corporate affiliates of centers and laboratories throughout MIT.

The Visiting Lecturer Series would recognize that each year many MIT faculty are invited off campus to present a visiting lecture in their research or teaching area of interest at another university or perhaps a firm or nonprofit organization. These lectures are almost always well received, creating goodwill for both MIT and for the lecturer. However, each such presentation requires one to three days of a faculty member's time away from the MIT campus and costs the requesting organization hundreds of dollars in transportation reimbursement costs. By videotaping such lectures on the MIT campus, the videotapes could be sent to a far larger number of schools and organizations and at significantly lower costs in MIT faculty time and travel. We are not suggesting that the existence of the videotapes would replace all personal presentations of visiting lectures; we believe that the videotapes would augment and magnify the currently existing visiting lectures. To make the program economically viable, the

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organizations receiving the videotapes would have to pay a small fee (usually less than the transportation costs involved with getting the faculty member on site). More study of this possibility, including market analysis, would be required prior to making any implementation decision. Your suggestions are welcome. Would you be interested in participating in such an effort, say videotaping the one presentation that you would present "most often" during the current academic year?

The Expert Lecturer Series would allow a teacher elsewhere to "bring into the classroom" via videotape (or CD-ROM) an MIT faculty member at an appropriate time during the giving of a regular course. For instance, the teacher of multivariate regression in a statistics course may wish to have an MIT Expert Lecturer present her overview of the topic, with successful applications and potential pitfalls. Or, the teacher of advanced placement calculus to a class of high school seniors may wish expert augmentation of teaching in multivariate integration or differentiation of trigonometric functions; this could be provided by videotaped lectures from the Expert Lecturer Series. Likewise, MIT experts can be provided in Shakespeare, economics, architecture, earthquakes, etc., etc. We hope to test this idea with limited cost. CAES currently has an impressive catalogue of full length video courses, some of which (e.g., calculus) may be suitable for segmenting into Expert Lecturer components. We plan to examine the entire CAES video catalogue with such partitioning in mind. For those of you who have produced video courses with us before, we welcome your ideas about the feasibility and desirability of such partitioning. We hope to obtain student

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involvement (perhaps from the Sloan School) in assessing the potential market for such Expert Lectures. If you know of any interested students who may wish to study this with us, please have them contact us at (rclarson@mit.edu).

We recognize that the categories of Distinguished Lecture, Visiting Lecture, and Expert Lecture are not mutually exclusive, and that one videotaped lecture may in fact serve two (or perhaps even three) purposes. The benefits of creating a family of one lecture video lectures are multiple:

(1) an increasingly large fraction of MIT faculty members become involved in distance learning, without intrusive multi-semester commitments;

(2) MIT's presence is magnified in a variety of important off-campus settings;

(3) positive revenue is likely to flow from the activity;

(4) promising faculty candidates for longer video programs can be easily identified;

(5) the utilization of CAES video facilities and personnel can be increased and smoothed.

We still plan to produce with you longer full semester video and multimedia courses. And, we hope to play a major role in distributing off campus MIT regular courses now taught in the classroom to our on-campus students. Please contact us if you are potentially interested in either or both of these possibilities.

6. Identify and Serve New Markets

There are many MIT faculty, students and staff who feel that the Institute should leverage its internationally recognized strengths in sciences and engineering to reach new educational targets. These possible audiences include pre-schoolers, K-12, alumni, students at other universities, professionals at firms requiring new knowledge, etc. CAES currently serves primarily only the industrial markets. There is much that MIT can do in the other areas. And there is no need to restrict our offerings to science and technology, as MIT is recognized for world class strengths in so many other areas as well.

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CAES will seek to identify individuals at MIT and elsewhere who wish to examine these "outreach" possibilities. Your participation is important! CAES is already exploring the possible production of a videotape series focused on science for preschoolers. CECI is currently releasing a wonderful CD-ROM on Doc Edgerton, with middle schools and high schools as primary target audiences. One might view these efforts as the launch of a major initiative in both the preschool and K-12 areas. Regarding delivery mechanisms, videotapes as well as CD-ROMs can be augmented by Internet presence and various WWW offerings, many available at no expense to the user and some requiring a fee. Does your laboratory or center have offerings that could couple with our objectives in this area?

7. Establish the Virtual Campus

The exponentially growing presence of networked multimedia delivery mechanisms is creating fundamental changes in business practice. The "virtual company" and the "virtual office" are current buzz words describing some of the new changes. We are beginning to see analogous changes in the practice of education, including higher education, K-12, and other venues.

Institutionally, change is not coming that rapidly. The uniquely valuable experience of a Cambridge-based on-campus MIT education is not likely to be replaced by technology any time soon, if ever. As many faculty have pointed out, the total experience of a campus-based education includes a complex and only partially understood combination of formal knowledge acquisition together with acculturation and socialization. The act of "growing up" within a world class educational and research environment is something that technology enthusiasts

CD-ROM Production

can only hope to replicate partially in the years ahead.

But the world does not offer only a binary choice: either totally on campus or totally off in a virtual campus. There exists a full spectrum of possibilities between the two extremes. With our current CAES offerings and MIT's other technology-leveraged activities (e.g., on the WWW), MIT is already operating between the two extreme points. The strategic policy question is this: What is the optimal combination of on-campus and off-campus offerings? Once that is settled, either by explicit policy decision or – more likely – by the collective outcomes of decisions by many different parts of the Institute, there are operational concerns that have to be addressed. These include policies and procedures for electronic crossregistration of subjects, off-campus credit for subjects, the granting of degrees to off-campus students, protection of intellectual property rights, the need for on-site support staff, etc. The totality of these

issues is immense; the issues are complex and are bound to provide fertile ground for informed and impassioned faculty debate. CAES desires to be an active participant in these discussions and will offer to structure and coordinate them, if assigned to do so.

The creation of a fundamental distance learning capability at MIT also requires enormous coordinated investment in supporting infrastructure, both physical and intellectual. The physical infrastructure includes compatible "electronic classrooms" equipped with video-conferencing, television, computer and multimedia technologies suitable for recording and perhaps transmitting the class off campus. We all will be having to address issues of future investments: investments in "brick and mortar" infrastructure versus investments in advanced technologies that could greatly leverage and multiply what we do on campus to points throughout the world.

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Intellectual infrastructure in support of distance learning focuses primarily on the MIT faculty. The building of this infrastructure involves myriad issues, some only partially understood at this time. It ranges from operational issues such as presentation styles and skills to the creation of alternative teaching/learning paradigms within a distance learning environment. First and foremost, the faculty must decide their level of enthusiastic participation in the new distance learning initiatives. CAES plans to offer workshops in distance teaching skills to inform the faculty about teaching in this new domain. Join our e-mail distribution list and announcements will be routinely sent to you.

CAES, leveraging synergies with CECI, will continue to offer and maintain state-of-the-art facilities including the latest in multi-media digital technologies. These facilities will enable us to train faculty in the new technologies, expand our range of services to the MIT community, and produce multi-media educational programs on CD-ROM and/or via the Web to industry and academia. These services and facilities will include:

• Interactive multi-media authoring and development - using a variety of authoring tools including CECI's AthenaMuse II
• high quality real-time video digitization/compression
• CD-ROM mastering
• Web page creation and HTML writing
• Web page development training workshops
• high quality image scanning
• digital still image acquisition

• non-linear editing
• digital server space access
• distance learning teleconferencing

The foundation to provide these services is already in place. CAES will need to acquire some additional digital hardware and software in order to match our existing excellent analog facilities.

8. In Conclusion

In order for MIT to become involved in a major way in distance learning, we the faculty must become enthusiastically committed. I know that some are now already involved, teaching courses jointly in the classroom and over the World Wide Web, or creating your next text via CD-ROM technology, or delivering your next visiting lecture via teleconferencing. Others are still resistant to e-mail! (With its volume and junk mail content, I personally am sympathetic with that feeling!) We have a wide spectrum of opinion, promising active and vital discussions of what could be a major paradigm shift for MIT over the next decade.

As many of you know, MIT is not known now to be a major participant in the distant learning arena. Other universities have been actively involved for many years, including several that are nationally ranked at the same high levels as MIT. But we could use our late start to an advantage. First, we are not now tied to any given technology for creation and/or distribution of educational products; this means we can select among all available technologies without having to fear loss of investment in an implemented but obsolete technology. Second, MIT is the source of invention of many of the technologies that will be

used in the coming years for distance learning; thus, we are building from state of the art in-house technical expertise. Third, and most important, MIT is, well, MIT. If we do it right, there should be many distant learners eager to experience MIT's offerings.

By focusing here on off campus educational initiatives, we want to make clear that we are not equating the off-campus and on-campus MIT experiences. They will be different. For some students (e.g., K-12, professionals working far from Cambridge) the on-campus alternative will not be feasible. For traditional undergraduates, one can argue that there is no substitute for the present Cambridge-based experience. For continuing education of our alumni, perhaps there is no alternative other than distance learning. For the foreseeable future, it is likely that the on-campus alternative will be the dominant choice for under-graduates.

However, trends are in place that will lead many if not most institutions of higher learning to offer educational experiences via distance learning. We have a major opportunity for leveraging our unique and scarce resources for worldwide impact. Investments in infrastructure at this time should, it can be argued, be prioritized toward distance learning infrastructure, not traditional brick and mortar.

CAES welcomes the opportunity to play a leadership role at MIT in this major initiative into the twenty-first century. Please e-mail us your comments, your suggestions, your criticisms! Thank you.✣

Final EVAT Report Available on the World Wide Web

What We Looked At

Advances in electronics technology have given us faster, more powerful computers with more memory and more disk space, in smaller packages. Advances of this sort, however important, were not what interested the committee. Instead, we looked at technologies that improved communications, connectivity, or flexibility. The principal example today is the World Wide Web, but the committee recognized that it will not be long before the Web is "old" technology, and something better takes its place.

Accessing the Report

The report is available in three forms. It is recommended that you read the master copy on the World Wide Web, at the URL http://www-evat.mit.edu/report/. The report is also available on floppy disks for either Macintosh or Windows computers, whether or not connected to the Internet (internal hyperlinks work fine, but external links, to other sites on the Web, will work only if your computer is connected to the Internet). A printed copy is also available, but it does not let you use either the internal or external links (even so, printed copies are more convenient in some ways).

To get a printed copy or a disk containing the report, contact the EVAT Committee support staff, Ms. Vera Sayzew, [x3-4624 or vera@eecs.mit.edu]. The disk explains how to view the report, and how to get a Web browser if you need one.

The rest of this article is from various sections of the report.

The World Wide Web

The features that make the Web (and related technologies) interesting for educational purposes include that it is pervasive, fast, convenient,

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versatile, popular, and interactive. Of these features, interactivity, although not well understood at this time, is probably of the greatest importance for educational applications.

The Internet today is used for many purposes, and the Web is one of them. Usage of the Web is growing dramatically. There seem to be two noneducational uses of the Web. One is a form of public relations: an organization publishes Web pages to tell its story to the public. The other is for more directed communications: to suppliers, customers, partners, and (especially) to internal members of the organization. Educational uses of the Web are much more limited at present, and seem to fall into three categories: interaction, e.g., for simulation of various kinds of

systems; delivery of intellectual resources to students; and delivery of administrative information (handouts, problem sets, solutions, etc.).

There is much talk about distance education being enabled by the Web and other advanced technologies. The Committee is divided in its opinion about the effectiveness of distance education today.

MIT

The many things that make MIT a special and exciting place do not necessarily confer upon MIT any advantage in dealing with advanced technologies. Indeed, the Web and other technologies are known to all universities. Students at all universities will be as familiar with these technologies as MIT students. Authoring tools will be widely available. Many universities will have facilities, including computer networks, the equal of ours. And we are not off to a rapid start – other

Final EVAT Report Available on the World Wide Web

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universities have either announced or actually implemented educational activities that make use of the Web.

One can imagine many possible futures for MIT, depending on the extent to which MIT is able to use advanced technologies to support and extend its educational mission. It is likely that the computing environment will evolve, either rapidly or slowly, toward one in which almost all students own computers, and MIT supplies the network and the necessary infrastructure, including print servers, Web servers, data storage, e-mail service, and specialized computers and other equipment.

At the same time, the advanced technologies of concern to the Committee will be evolving. One way of describing these changes is to note that each advance in technology has the effect of making more convenient a student's access to the vast and growing reservoir of information on the Internet. Also, the information available is becoming more reliable and broader in scope. Probably within a few years half of all MIT subjects will make significant use of Web-based resources, and a few subjects will be radically changed in the process. The Committee views with favor use of advanced technologies to permit students to access intellectual resources of all sorts.

It is tempting to think of using the advanced technologies to export MIT education beyond the campus. We have identified three possible new markets: newly admitted students before they arrive on campus; our own students temporarily off campus; and our alumni/ae. However, there are reasons why MIT may not be

> **It is tempting to think of using the advanced technologies to export MIT education beyond the campus. We have identified three possible new markets: newly admitted students before they arrive on campus; our own students temporarily off campus; and our alumni/ae. However, there are reasons why MIT may not be well equipped or well situated to compete with other higher educational institutions in reaching students besides those with an affiliation already established.**

well equipped or well situated to compete with other higher educational institutions in reaching students besides those with an affiliation already established.

Of all the possible futures for MIT, the most disturbing is the one in which others find out how to offer distance education using advanced technologies, and MIT either does not learn how, or elects not to offer it. The economic strength of MIT could be seriously undercut by competition as a result.

Recommendations

The Committee recommends that some short-range actions be taken to insure that all participants in the educational mission have convenient access to the World Wide Web, and opportunity to use it as a routine part of daily life. It is also recommended

that a regular faculty committee be charged with oversight of academic computing.

The Committee recommends several medium-range actions. It calls for a high-level Institute-wide competition for support of technology-related curriculum development. It suggests a specific set of initiatives in distance education, designed to gain experience. It advocates a program of electronic connectivity for alumni/ae. It also recommends procedures by which all MIT subjects make at least administrative use of the Web, and it advocates development of a variety of administrative uses of the Web.

Finally, the Committee recommends that long-range studies should be made of the opportunities and risks associated with new educational markets, as enabled by advanced technologies. The most plausible such new markets are our own alumni/ae and bright high school seniors. ❖

Letters

To The Faculty Newsletter:

A point in your recent editorial "For Whom The Bell Tolls" [Vol. VI, No. 4] seems misleading. While the editorial focuses on the role (or lack thereof) of the faculty in the re-engineering process, the examples don't seem to support the argument. The article implies that the increase in the on-campus indirect cost rate, from 52% in FY95 to 58.5% in FT96, is a sign of problem with the process. In fact, it is largely unrelated; the current indirect cost rate is being held artificially low while the Institute reimburses the federal government for past overbilling. The rate will increase because the reimbursment period will end in FY96, as Provost Wrighton explained at the May 3 "Town Meeting."

Jeremy Hylton
The Tech

To The Faculty Newsletter:

I just wanted to tell you that I enjoyed this month's [May/June 1995] *Faculty Newsletter*. Especially the Editorial, and the article by Larry Lidsky "Just trying to be helpful." I'm glad you ran those articles because I hadn't heard about the $6.5 million in consultant fees. And the ever increasing overhead rate is outrageous, and no one complains.

Leanna Harada
Robotics & Computer-Integrated
Manufacturing Journal

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Benefits Office To Begin
Open Enrollment Period

This year's Benefit's open enrollment period will run from Saturday, October 28th through Monday, November 13th. During open enrollment, faculty (and other eligible plan members) may make changes in their health, dental, and life insurance coverages and enroll in the Medical-Dental and Dependent Care Expense Accounts. In addition, eligible faculty will be able to enroll in the Supplemental 401(k) Plan or to increase their participation up to the 5% maximum.

Open enrollment elections will be made on *BenChoice*, the Benefits Office interactive telephone enrollment system. Elections may be made 24 hours a day, 7 days a week. *Personal Enrollment Guides* will provide instructions for making changes to these benefit elections for 1996 and will be sent as a part of an open enrollment package the week of October 23rd. Confirmation statements will be sent to those who enroll in FRAP or make changes in their current elections.

The Benefits Office will sponsor fairs to assist members of the community in making decisions about their benefit elections. Representatives from each of the health plans, the dental plan, and the life insurance plan will be available at the Benefit fairs to answer questions. Members of the Benefits Office staff will also be in attendance at the fairs to answer other benefits questions.

The following health screenings will be offered at the benefit fairs: blood pressure, cholesterol, sun damage, stress profile, and body fat analysis. Fair locations and times are: Tuesday, October 24, 10:00 am - 4:00 pm, Sala de Puerto Rico, Stratton Student Center; Thursday, October 26, 10:00 am - 11:30 am, Conference Room A, Haystack Observatory; Thursday, October 26, 2:30 pm - 4:00 pm, Cafeteria, Bates Linear Accelerator; Friday, October 27, 10:00 am - 4:00 pm, Room S2-180, Lincoln Laboratory.

In conjunction with the Campus Benefits Fair, 30 minute breakout sessions will be offered on the flexible reimbursement account plan (FRAP) at 11:00 am and 1:00 pm in the Mezzanine Lounge, the life insurance plan at 12:00 noon and 2:00 pm in the West Lounge, and the 401(k) plan at 12:00 noon and 1 pm in the Twenty Chimneys Lounge.

If enrollment materials are not received by October 30th, please call the Benefits Office on Campus at x3-0500, or at Lincoln Laboratory, x7060.✣

M.I.T. Numbers

Freshman Enrollment
1994 & 1995

	<u>1994</u>	<u>1995</u>	<u>Change</u>	<u>% Change</u>
Freshman Applications	7135	7958	823	12%
Freshman Accepted	2165	2113	-52	-2%
Freshman Enrolled	1098	1117	19	2%
Percentage Enrolled	51%	53%		
Male	665	647	-18	-3%
Female	433	470	37	9%
Percentage of Women in Class	39%	42%		
International	88	81	-7	-8%
Afro American	73	66	-7	
Mexican American	60	58	-2	
Native American	10	5	-5	
Puerto Rican	23	27	4	
Totai of Four Groups Above	166	156	-10	-6%
Percentage of Four Groups in Class	15%	14%		
Asian American	315	316	1	0%
Percentage of Those Ranked Who Were Valedictorians	32%	35%		
Percentage of Those Ranked Who Were in Top 5%	84%	87%		
SAT-I Verbal Mean	636	636	0	
SAT-II Math Mean	737	744	7	
Percentage Indicating an Intention of				
Concentrating in EECS	20%	22%		
Concentrating in Biology	12%	14%		

Source: Office of Admissions