The MIT Faculty Newsletter

Vol. VII No. 4 **May/June 1995**

Reengineering MIT's Administrative Processes

Isaac M. Colbert

External and Internal Pressures

Some unpleasant external realities are challenging MIT's ability to sustain its leadership in teaching, research, and national service. In the few years since the end of the Cold War, MIT, along with the other great research universities of the nation, has been faced with the real prospect of declining revenues from federally sponsored research as the government reorders its spending priorities. Until recently, MIT's research volume grew at about the rate of inflation. Current signals from Washington, however, indicate that at best that volume will likely decline relative to inflation, and at worse will be reduced sharply in the struggle to balance the federal budget by early in the coming century. It is unlikely that revenues from industrial and business sponsors will compensate for anticipated losses or that those sponsors will support the costs and uncertain returns of basic research activities. At the same time we have seen a marked increase in the competition for available research dollars[1] [endnotes are on page 13], and less willingness by federal sponsors to reimburse for indirect costs associated with the research enterprise. Thus, for the foreseeable future, declining research revenues will cover a decreasing percentage of institutional costs.

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This issue of the *Faculty Newsletter* focuses on the ongoing process of reengineering MIT. In addition to this article provided by Dean Colbert at our request, please see additional views, beginning on Page 3.

Bacow Assumes Faculty Chair

A Lawyer and Sailor

Newsletter Staff

The new chair of the faculty for a two-year term beginning June 15th is Lawrence S. Bacow, professor of Law and Environmental Policy.

Bacow grew up in Pontiac, Michigan where he spent his time entering science fairs, building ham radios, and sailing. He was drawn to MIT at least as much for its nationally ranked sailing team as he was for its academic reputation. He entered MIT as a freshman in 1969 and graduated three years later with a B.S. in economics. He received a J.D. from Harvard Law School in 1976, and a Masters and Ph.D. in Public Policy from Harvard's Kennedy School of Government in 1976 and 1978, respectively.

Bacow joined the MIT faculty in the Department of Urban Studies and Planning in 1977. His research focuses on developing non-adjudicatory mechanisms for resolving environmental conflict. He frequently advises both state and federal regulatory agencies on environmental issues. He currently is working on his fifth book, which explores the relationship between trade policy and the environment.

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Editorial

For Whom The Bell Tolls

Dear fellow MIT friends and faculty members: If you want to register support for the following sentiments you can make your thoughts and feelings known (contact the *Faculty Newsletter* by mail, fax, telephone, or e-mail):

An escalation of violence and polarization seems to be tearing our society apart. On May 10, we learned that some person or party has sent at least one life-threatening letter to a distinguished member of the MIT faculty. This is an unacceptably violent attack on us both as individuals and as a community (scientific, academic, professional, etc.), and we denounce and condemn those responsible for inspiring and perpetrating it.

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Let's face it: we are living through another of those singular moments of history of which Max Planck spoke when he wrote about "living...in a moment of crisis in the literal sense of that term."

This is a time in which paradigms keep rapidly changing, a time that provides many opportunities to learn the truth of Einstein's remarks that our accustomed ways of defining and dealing with problems "[do] not suffice when it comes to solving the problems of our social life..." and that "We need a new way of thinking, if humanity is to survive."

Bringing it all back home

It appears our MIT community has reached a watershed. Significant new economic constraints (imposed both from without and from within) have necessitated a reevaluation of some of our core beliefs and practices. The administration has embarked on a "reengineering" of MIT. Certainly many changes need to be made in the way administrative business currently gets done. But legitimate questions have been raised about the way information was gathered and the MIT community informed about this process. We need to question what these proposed changes mean for us as MIT faculty members; what our rights and responsibilities are in this time of profound change at the local, national, and international level.

As longtime members of the MIT community, we are deeply concerned at what we see happening to this institution. We certainly agree with the administration that its own activities regarding "the ongoing reengineering effort at MIT" can and should be "focused on delivering the best possible services to faculty and students as efficiently as possible" (*Tech Talk*, May 1, 1995).

But what is "best" in this context? And who is to say? How are the intended efficiencies to be attained? At what costs, and to whom? How are the results to be measured? For instance, how can we measure whether or not increasing "efficiency" compromises academic excellence? Can the quality teaching and research programs we are known for survive the present frenzy of cost-cutting? Which programs can we afford to lose?

How such questions are answered (and by whom) will largely determine whether or not MIT manages to emerge from a bad situation with its well-earned reputation for academic and professional excellence intact. In our view, no sustainable resolution of the present administrative crisis can be achieved without a great deal of real cooperation between the MIT faculty and administration.

And make no mistake about it; whether, and, if so, how, MIT is going to survive into the next century will depend, at least in part, on the manner in which we approach and negotiate our way through the present moment of crisis. As we proceed, we also need to be mindful that what is happening here has been brought on by a combination of events, including some unfolding in the wider society beyond our institutional borders.

The role of the faculty?

Certain members of the MIT faculty pioneered concepts of reengineering, total quality management, and other organizational management concepts and methods. It is therefore curious that an outside firm, CRC Index, with what appears to us to be a less experienced staff, had to be hired to guide MIT in its reengineering efforts. CRC Index has not, in fact, completed a reengineering project for an educational institution; much of its methodology is based on corporate models (it is currently involved with implementing a reengineering project similar to MIT's at the University of Toronto). And regardless of the question of experience, an approach that fails to consult important segments of its target population in a serious and sustained way (i.e., faculty, students, and large segments of support and service staff) is deeply flawed.

Everything we know about institutional change tells us that the best and most effective way for organizations to negotiate a fundamental change process is to make every effort to involve all foreseeable stakeholders in negotiating (defining, implementing, and dealing with) the change process. Everyone working in this place, from the highest to the lowest paid, at all levels in the institutional hierarchy, in all disciplines, job categories, and fields of endeavor (including all realms of academic inquiry and professional activity in all fields and sub fields of science, technology, and management) needs to be given the opportunity to participate in the process, and to be treated with equal kindness, respect, and fairness. For organizations that fail to proceed in this way, the cost in morale and loss of community cohesiveness can be overwhelming.

In the process so far, students and faculty, rather than being substantially involved and consulted, have simply been informed of findings and decisions. Reengineering is being done from the top down instead of from the bottom up. But

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it seems to us that in order to work, precisely *because* its goal is to significantly improve services as well as to cut costs, reengineering must involve everyone. The administration projects that the equivalent of 675 jobs will be eliminated, and yet interaction with support staff and other workers has been minimal.

Perception

At the May 3 "Town Meeting" to discuss reengineering with the MIT community, President Vest, Provost Wrighton, Vice-President Dickson, and Vice-President Bruce (with Director of Physical Plant Sirianni serving as moderator) attempted to assuage the community's fears and further delineate the processes of reengineering. The meeting appeared to be attended predominantly by building service workers and support staff; precious few faculty members were present. In addition to the "Special Reengineering Edition" of *Tech Talk*, Provost Wrighton's MEMORANDUM "To: Members of the Faculty and other Research Principal Investigators." was distributed at the door. The memo, entitled "Indirect Cost Rate, Reengineering Expenses, Fringe Benefits Rate," says, in pertinent part, that the Indirect Cost Rate for *on-campus* research will be going up 6.5% (from 52% in FY95 to 58.5% in FY96). [See MIT Numbers, Page 24.] At the same time, the *off-campus* rate will be decreasing. More importantly, approximately $9 million of the expenses that the administration has incurred "associated with reengineering in FY95 (current year) and FY96 combined" which will amount to some $30 million, with "(m)ajor expenses (including) fees for consultants, cost of software and hardware...and training" are to be borne by the overhead increases.

In addition, that day's *Tech Talk* announced an increase in parking fees from $20/year to $300/year, regardless of one's salary or wage. Some faculty may argue that an increase in parking fees are in order, but the differential impact on lower paid employees, and the timing of the announcement, are serious causes for concern. Given these kinds of actions, it is hardly surprising that workers are expressing fear and resistance. Custodial staff has questioned the overall "team" plan and ask the fundamental question, "If there aren't going to be any layoffs, as we've been told, how is the Institute going to save money?" Both custodial and mail personnel are most concerned about down-the-road: "We've seen reengineering elsewhere. After a year or so when it doesn't work as expected, the workers are blamed and then the layoffs begin."

What is to be done?

By all accounts, those administrators involved in reengineering have gone through a "TQM learning experience" costing $6.5 million, during which they solidly bonded with one another and outside consultants [see "Just Trying to be Helpful," P. 5]. No doubt they emerged from the process feeling that the time and money was well spent, and believing that they now saw more clearly what it would mean to "[deliver] the best possible services to faculty and students as efficiently as possible." [*Tech Talk*, May 1, 1995.] But how serious and sustained has been the effort to include the rest of the MIT community in this learning process? The point is that we, the faculty, (who along with our students comprise the academic core of this institution) need to be included more fully in the process of defining the needs and determining the overall shape and texture of the kind of organization that might best and most sustainably be developed to meet them.

The $6.5 million that has already been spent can be seen as another case of outsourcing. In this case, what is being outsourced are the rights and responsibilities that properly belong to us by virtue of our membership in the MIT community – especially given the expertise found among us.

As all serious students of social change will readily attest, the organizations, institutions, and corporations that survive, and thus have a chance of prospering in the years ahead, are made up of people who have somehow come to share a common vision of a more cohesive, constructive (and, perhaps, therefore more generally competitive) organizational future. The lesson is clear: If MIT is to change in ways that will enable it to retain its excellence as a place of higher learning, it must become a better and higher quality version of what our colleague, Peter Senge, has called a "learning organization." Making MIT a better learning organization means, in part, restoring an atmosphere of collegiality and trust between and among its various constituencies. Relations between the faculty and administration need to be guided by shared meaning and common purpose. To put it another way, we and they must become genuinely mutually supportive partners, equally committed to a common and consensually valid view of institutional excellence. And we must be ready, willing, and able to work together to attain that vision.

Sadly, much of the responsibility for our current dilemma lies with ourselves, the faculty, for we have relinquished our leadership, allowed collegiality to disintegrate, and permitted the fostering of alienation. Reengineering, as it is currently being implemented, is promoting cynicism and demoralization. Rather than just standing by and letting it happen, rather than retreating into our comfortable cocoons happy to be "allowed" to do teaching and research, we need to be building solidarity among the faculty and restoring the collegiality and the administration/faculty balance that traditionally constituted the academic environment and made MIT great.

MIT is still Number One in most areas, but much of this reputation is based on past performance, when MIT was much more a collegial assembly of scholars who ran their own institution. And now there is a serious question of whether the Institute can maintain its reputation – with declining faculty roles in decision-making, collegiality, and solidarity. It is up to us to stand up and be counted. No one can do it for us.

Editorial Committee

Just Trying to be Helpful

Lawrence M. Lidsky

I've just looked up from my lonely pursuit of excellence to find that my Institute has spent $6.5 million on "technical and management consultants" and will charge $9 million of reengineering costs to research overhead. Since reengineering is a community project, and since I seemed somehow to have missed my chance to contribute to the process, I've chosen the *Faculty Newsletter* for these suggestions in the hope of inspiring my colleagues to join this process which seems to be passing us by.

Reasons to hush it up

1. It might make our colleagues in the Sloan School feel somewhat neglected.

2. It might make others wonder why we neglected our colleagues in the Sloan School.

3. It might make our research sponsors uneasy to learn they are being requested to pay now for benefits MIT will derive in the future.

Things we could have done with $6.5 million

1. Buy each of the 250 members of the reengineering task force $26,000 worth of reengineering books and videos. There are enough available to avoid duplication.

2. Give each of the 250 members of the reengineering task force two months of individual personal consultant-trainers. Enough are available to avoid duplication.

3. Give $10,000 cash to each of the employees who will be fired in the envelope with the pink slip.

4. Spend $500,000 on a summer short-course for the reengineering task force and put $6 million in the bank.

How to avoid the overhead hit

1. Explain to any reasonably astute banker that our investment in reengineering will pay for itself in only two years! Borrow the money and pay it back from our savings.

2. Borrow it from ourselves and cut out the middleman.

[We are sure that the MIT faculty can come up with other helpful suggestions. Please send them to fnl@athena.mit.edu. The subject line should read "just trying to be helpful." The best suggestions will appear in the next issue of the FNL and the Grand Prize winner will receive a copy of **Reengineering The Corporation: A Manifesto For Business Revolution**, by Michael Hammer and James Champy, retail value $13.00, 20% discount at New England Mobile Book Fair – also available at Dewey Library.]✣

Newsletter Founder Kistiakowsky Retires

The MIT Faculty Newsletter was founded in 1988, following the precipitous disbanding of the Department of Applied Biological Sciences. The person most responsible for creating the *Newsletter*, Professor of Physics emerita Vera Kistiakowsky, has announced her retirement.

At a recent party in her honor, several speakers noted the importance of her many contributions to the life of the Institute during her many years as a faculty member. In his remarks, the Reverend Scott Paradise, former Episcopal Chaplain at MIT, read the following pertinent lines:

In a room
where people unanimously
maintain
a conspiracy of silence,
one word of truth
sounds like a pistol shot.

Czeslaw Milosz

Vera, we wish you well....

Editorial Committee

Reengineering MIT's Administrative Processes

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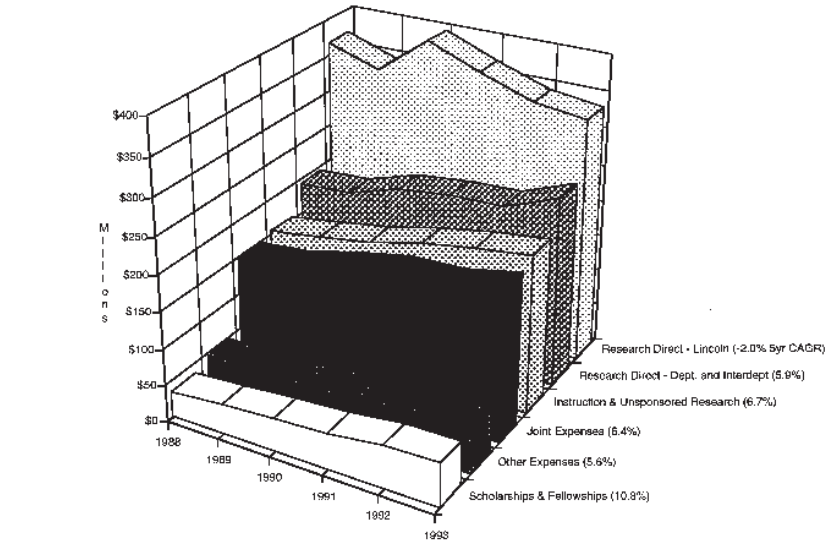
This aggressive downward pressure on both research income and overhead recovery forces MIT to examine all activities and attempt to maintain excellence while reducing operational costs.

In the past, MIT has been able to maintain annual tuition increases at nearly 4% above the rate of inflation. From 1988 to 1993, tuition and related income grew by 47%, from about $126 million to $184 million. However, in the same period, net outlays for undergraduate scholarships (i.e., student aid from agencies and foundations) grew by 58%, from $21 million to $32 million. These increased scholarship outlays have slowed net tuition growth, but rising public concern about the cost of higher education, in a national context of general anxiety about cost containment, has also forced moderation in tuition rate increases. With future increases held to within 1% or 2% of inflation, large tuition increases will no longer be a major income resource. At the same time, government support for undergraduate and graduate tuition costs is eroding rapidly, placing more pressure on MIT to commit internal resources to maintain its need-blind undergraduate admissions policy and internal resources to encourage faculty to train graduate students.

Fundamentally, all the rules governing the relationship between the federal government and universities are changing rapidly and in ways disadvantageous to the Institute. At the same time, public concerns about value, cost, and integrity have called into question the once unshakable respect for higher education and its role in the national welfare.

Finally, internal growth in expenses has created a pressing financial situation. Data from annual Reports of the Treasurer have shown that while direct research expenses at Lincoln Lab have declined since 1988, all other Institute expenses have grown steadily (Fig. 1). From 1988 to 1993, revenues grew at a compound annual growth rate of 3.4%, while expenses grew faster, at 3.6% and climbing (Figs. 2,3). Over the same period, the operating gap increased from an annual average of $4 million, experienced from 1975 through 1988, to $12 million annually. Projections indicated that this persistent gap was expected to grow to an average of $15 million annually from FY1994 to FY2000 (Fig. 4). Since 1988, the Institute has used more than $64 million of unrestricted gifts and funds functioning as endowment to fund these operating gaps. These are the only two sources of revenue to address this problem. Therefore, the dangerous trend of spending funds that should be invested for future needs presses the issue of reducing operating expenses. Doing so requires reducing the operating budget by $40 million gross, with a net impact of $25 million after recovery of overhead.

While Direct Research Expenses at Lincoln Have Declined, All Other Expenses Have Grown Steadily



Source: MIT Treasurer's Reports

Figure 1

The Range of Actions to Reign In Costs

In response to the financial and related trends, a broad range of initiatives was developed. In academic areas, the Provost Wrighton initiated a three-year program of 2% budget reductions for FY1994-1996. Similar cuts were mandated for administrative areas. Additionally, the School of Management implemented reorganization of its administrative functions into a matrix, to reduce duplication and improve effectiveness. Similarly, the Schools of Architecture and Humanities moved to consolidate administrative functions within their areas. Also, a committee was established to evaluate MIT's relationships with industrial sponsors of research and to recommend how those ties might be enhanced. And finally, a high-level panel was authorized to review

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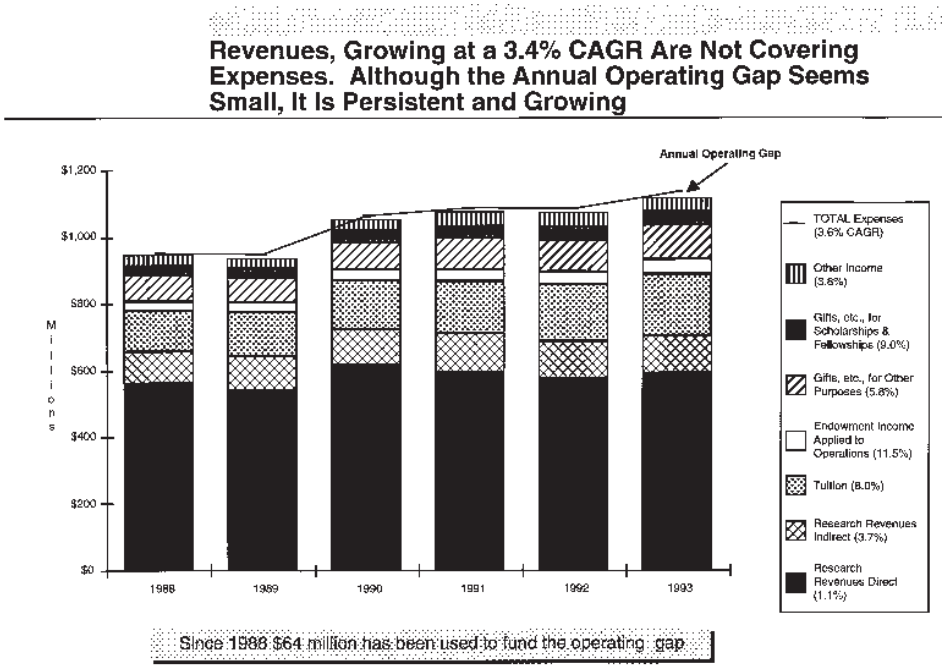

Figure 2

health care options available at MIT and to recommend the best ways to fund and provide medical services. Its membership is currently being finalized, and the panel is expected to begin work soon.

Throughout the Institute, salary growth has been restrained to the rate of inflation. However, a significant cost-reduction initiative was begun to dramatically simplify administrative work at MIT, eliminating unneeded tasks, reducing process costs, and improving services. The methodology known as "Business Process Reengineering" was selected for this purpose.

The Choice of "Reengineering"

About 15 years ago, scrutiny of underlying causes of the recurring operating gap suggested rapid growth in the Institute's administrative operations. Thus, early in the decade of the 1980s, MIT attempted to address this growth by reducing headcount in a series of three annual 5% reductions in administrative areas and more modest budget reductions in academic areas. Ten years later, administrative operations have recovered their numbers, although approximately 66% of that growth has occurred in departments, labs, and centers rather than in central administrative areas. Why? The earlier reductions occurred without an examination of how administrative work was done at MIT. Headcount was reduced, especially in central areas, but the work remained essentially unchanged, prompting departments to enhance local resources to provide needed services in support of their academic and research programs.[2] With that lesson in mind, a reprise of across-the-board headcount reductions did not promise a long-term solution to a persistent problem. Rather, the growing pressures for changes reviewed above suggested that MIT must develop more efficient ways to handle its administrative work and must examine and restructure business processes that were designed many years ago.

In the fall of 1993, President Vest and senior officers of the Institute considered alternative means of addressing this issue. Although many operations throughout MIT were already engaged in efforts to achieve incremental improvements using the Total Quality Management (TQM) approach, that methodology did not address administrative processes that were widely viewed as cumbersome and outdated.[3] The decision was made to use the methodology of business process reengineering. Used extensively in the corporate world, this methodology focuses on processes rather than functional organizations and questions about how work would be done if it could be redesigned from the ground up.[4] Many faculty have criticized the business orientation of reengineering, arguing that it is an inappropriate match for an educational and research enterprise. Yet many of MIT's administrative processes operate very much like their corporate counterparts: acquiring goods and services, maintaining physical facilities, and many aspects of accounting and financial monitoring. Moreover, business has reported some success in using this methodology to achieve fast, dramatic simplification of processes similar to those at MIT.

It was recognized that the Institute would need help to apply the reengineering methodology. Using an external consultant firm was seen as advantageous, since it would bring to the Institute the unfiltered perspective of the external world; had access to best-practice examples from other reengineering projects; would be relatively immune from our internal culture; and could prod the project towards aggressive deadlines to show results relatively quickly.[5] Although some faculty were consulted about the

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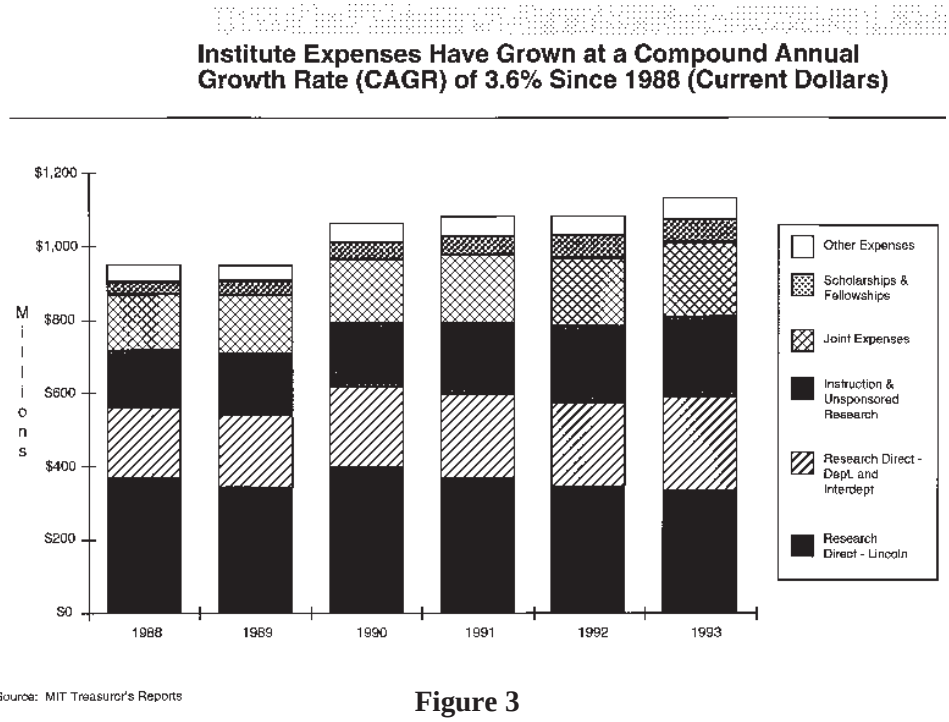

Figure 3

impending project, there was little initial interest and perhaps some sense of *deja vu* following implementation of TQM and a number of marginally effective management efforts over the years to improve administrative services. After considering a number of external consultant organizations that could provide the assistance, CSC Index was selected in early February, 1994. The consulting firm has extensive experience in business and industry and many Institute graduates in its ranks, several of whom were assigned to the project.

President Vest designated vice-president Dickson as the "Program Sponsor" and Prof. James Bruce, vice-president for Information Systems, as the overall Program Manager. Dickson appointed a Steering Committee comprised of the other administrative vice-presidents, the executive vice-president of the Alumni Association, and Dean Joel Moses of the School of Engineering.[6] In early March, Dickson then appointed a seven-member Core Team to work with Prof. Bruce in a high-level analysis of MIT's administrative processes leading to recommendations of a set for initial reengineering.[7] The team began its work on March 17, 1994, and reported its results and recommendations nine weeks later.

In its work, the Core Team identified a total administrative process cost base of about $435 million, but only $227 million of that was deemed "within scope" of the project. Another $208 million in areas such as education administration, revenue enhancement activities, and a variety of other processes were deemed "out of scope" because they did not represent significant costs or were deemed highly risky to undertake in the first round of reengineering. Recommendations were made in the areas of student services, facilities maintenance, buy-pay, research proposal preparation, and management reporting.[8] Based on its rough analysis of costs associated with these processes, the Core Team estimated that redesigning all of the recommended processes might reduce administrative costs by approximately $43 million gross.

The Core Team also recognized that each process is composed of various components or sub-processes, each of which might require one or more teams to develop and evaluate redesigns. Furthermore, processes are not independent of one another. An example is the buy-pay process, which was viewed as having two primary components: buy-pay administration, which encompasses the informational aspects of acquiring goods and services (i.e., obtaining all the relevant data and assembling it into useful information about the process); and supplier consolidation, which addresses reducing the base of vendors supplying goods and services. Administrative aspects of buy-pay are closely aligned with concerns in the management reporting area. Similarly, components of the facilities management process (design and construction, repair and maintenance, custodial services) might be addressed separately. Thus, in presenting its own recommendations, the Core Team acknowledged that various other options could be considered.

The Steering Committee evaluated recommendations and considered alternatives during the Summer Term, 1994. By early July, they returned with approval to begin redesigns of a more limited scope, but mostly within the recommended areas. Redesign of Student Services was delayed, because of resources needed to complete development of the new Student Information System scheduled to go on-line in November, 1994. In August, teams were established to examine and simplify processes in the custodial

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services component of facilities management, mail, appointments, the supplier consolidation component of buy-pay, and management reporting. In February, 1995, a team was appointed to begin redesign of the repair and maintenance component of facilities management. Figure 5 summarizes the structure of the reengineering program as of March, 1995.[9]

The Methodology

The corporate oriented language of reengineering, while distasteful to some, provides a useful lens through which MIT's administrative processes can be viewed. The notions that support services should be strongly "customer" focused, that certain tasks add little or no "value" to a process, or that a persuasive "business case" must precede investment in a reengineering project are ideas that are both reasonable and applicable within MIT.

The methodology feels counter-cultural, considering how projects typically proceed here. It is generally expected that a group (or individual) will be designated to go off and examine an issue exhaustively, consider reasonable scenarios and related issues, then draft detailed plans or recommendations. The evaluation and draft output are then presented for scrutiny, further refinement, and eventual consensus by colleagues that the proposed solution is appropriate. The Dean of Architecture and Planning views this approach as analogous to the deliberate, highly consultative methods used by architects as they work with clients to develop consensus on a design. Research teams operate similarly. There is usually the impression of a slow, deliberate process of study and consultation.

In contrast, reengineering is a fast moving, iterative, staged methodology.

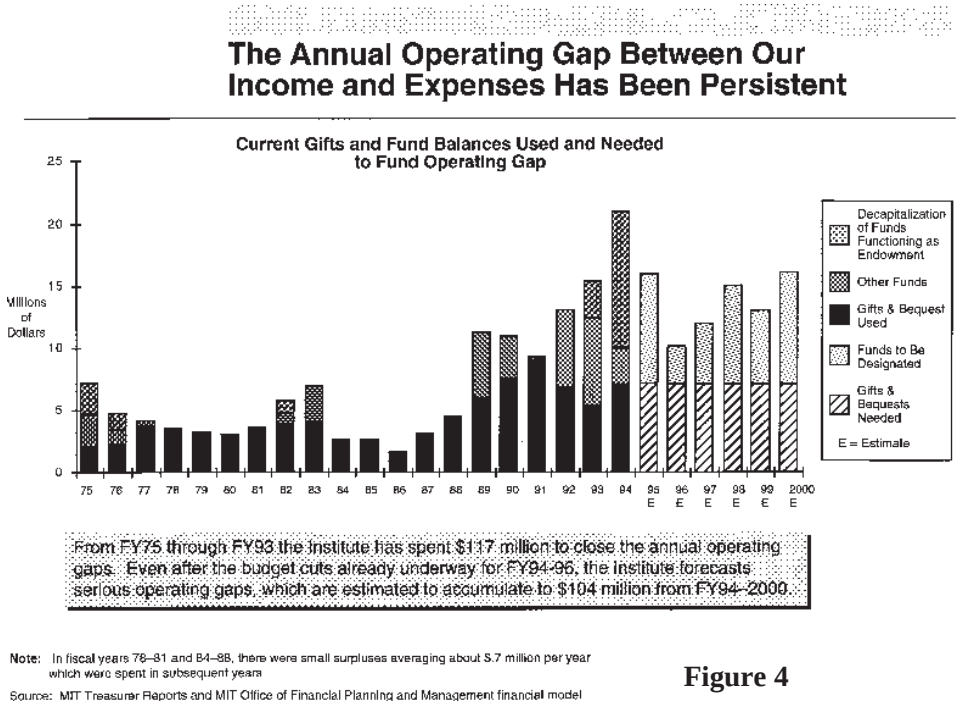

Figure 4

A cross-functional team knowledgeable about the process being considered is assembled to articulate within a brief time a vision of the simplified process (the redesign) and its implications for jobs, skills, organizational changes, technology needs, and cultural impacts. For projects currently underway, this phase was completed in eight weeks or less. Operational details of the redesign are then developed in several iterations, as a second group prototypes the solution in a controlled environment (lab), modifying the redesign to conform more closely to reality. Input to these changes comes from experienced staff, who are invited into the lab environment to test the redesign and offer specific recommendations. This phase is quite similar to the consultations and collegial scrutiny that are customary here, but it occurs more quickly. Once the lab produces a refined solution, the redesign is further validated and modified in a small-scale pilot in a real-world environment before it is deployed systematically into full-scale operation. Aggressive deadlines, rapid movement, and risk management characterize this process. A high tolerance for ambiguity is necessary, since the details are incorporated along the way rather than being worked through in advance.

The Financial Investment

Corporations and businesses that have successfully reengineered have reported spending a one-time dollar for each recurring dollar saved. If true, then MIT can expect to invest $40-43 million to find and remove the cost of work that is no longer integral to the services being provided. Overall, the effort is expected to yield at least the same amount in net annual savings by FY1999.

Figure 6 shows the substantial investment costs associated with current and anticipated redesigns, as well as anticipated returns and ongoing costs. By the end of FY1996, approximately $28 million will have been invested. $14 million will have been committed

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by the end of the current fiscal year, primarily for computer hardware and software and for technical and management support. Components of the $28 million include:

(1) Consultant costs for technical and management consultation, estimated at $6-7 million. By the end of the calendar year, the program expects to have fulfilled its need for further intensive management consulting from Index for process redesign and evaluation labs. By then, many of the current team captains will have completed an entire reengineering cycle, and should be experienced enough to act as consultants for new redesign teams. Still, technical consultants will continue to be needed for assistance in software implementation.

(2) Costs associated with layoffs, estimated at $6-7 million. While this figure may seem high, the Institute has a generous layoff policy that helps affected staff leave with dignity and with a reasonable financial cushion for longer service employees.[10] Costs associated with layoff are typically charged to organizational budgets; however, their estimate has been included to present a more complete picture of the financial impact of reengineering.

(3) $2-3 million allocated for training for those who will be using the redesigned processes. This includes technical instruction in how to use new computer systems supporting the redesigns, as well as training in how to accomplish work in the redesigned process and/or organization. These costs are expected to be ongoing at about the same level, as additional processes are redesigned and their training implications understood.

(4) $10-12 million, budgeted for hardware and software acquisition to support the redesigns. Substantial costs this year are associated with implementation of the SAP integrated financial system, which will supplant or tie together the Institute's central, legacy systems.[11]

The costs of reengineering are carried as operational expenses. Thus, it would not seem reasonable to further decapitalize funds functioning as endowment or to spend unrestricted gifts to fund the program. Rather, it was determined that MIT's research sponsors will benefit down the line from reduced direct costs of research resulting from lower operational costs and should, therefore, share in the investment costs. Thus, of the $28 million in reengineering expenditures anticipated by the end of FY1996, $18-19 million are considered to be shared costs. Of this, 45%, or nearly $9 million[12] will be charged to research overhead. For the average faculty member, this has translated into the recently announced increase in the overhead rate from 52% this year to 58.5% for FY1996...painful and certainly unexpected, but not entirely unreasonable.

REENGINEERING PROGRAM ORGANIZATION

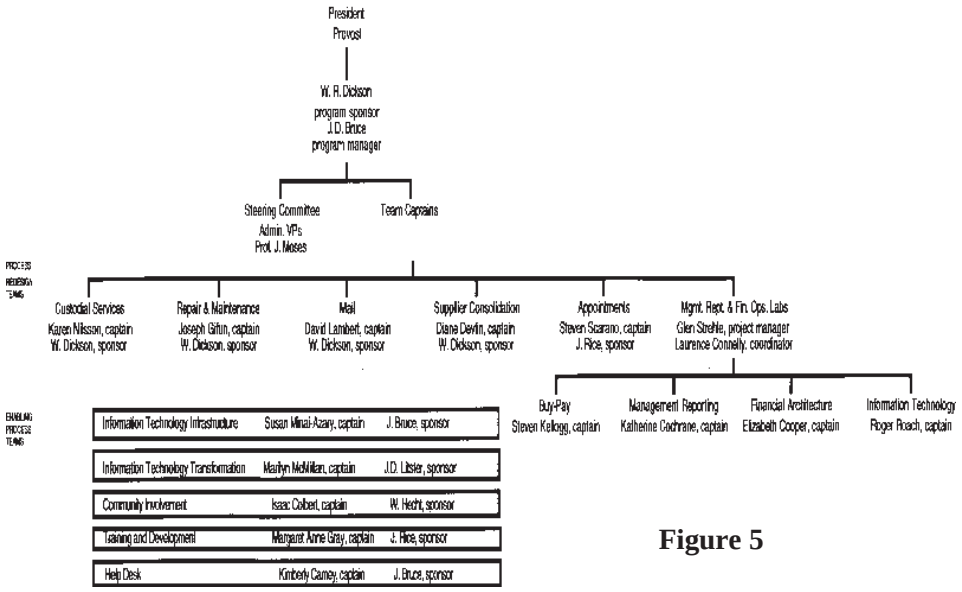

Figure 5

How Savings Will Be Realized

If anticipated gains from reengineering are realized over the next three or four years, then faculty, staff, students, and other customers of MIT's administrative processes should see a number of benefits. Services will be faster, less cumbersome, less paper-intensive, more customer oriented, with fewer approvals and at lower cost than they are today. Duplicate data entry and excessive reconciliation will be dramatically reduced or eliminated. Integration of financial systems and access to data in a so-called data warehouse will broaden data access and facilitate planning, budgeting, and decision making. The overhead rate should be reduced by 6-8 points, to about the 45% range. Direct costs of research should be reduced, since the cost of goods and services should decrease. And administration will be considerably smaller than it is today.

Removing unnecessary work from processes will produce cleaner, more

(Continued on next page)

Reengineering MIT's Administrative Processes

Colbert, from preceding page

cost-effective ways of doing things, but will ultimately cost jobs and painful transitions. Because all of the changes will not happen suddenly, normal workforce attrition should account for some of the savings, perhaps as much as one-third. Nevertheless, layoffs will become necessary in some areas, as redesigns are implemented Institute-wide.[13]

It is difficult to know or to project precisely at this point where layoffs will actually occur. The reason lies in the way that reengineering looks at people and work. Analyses preceding the redesigns identified process steps and their estimated costs, in order to highlight the non-productive activities (multiple approvals, waiting for a response, duplicate data entry, excessive error correction, reconciliation, etc.). In a series of focus group sessions involving a cross section of staff knowledgeable about each process, the process description, estimated numbers and levels of staff involved at each step, the estimated time required for each step, and transaction volume estimates were validated. Because much of the work identified as being of questionable value constitutes fractional portions of a staff member's effort, the data were summed and expressed as the number of Effective Full-Time Staff (EFTs) involved. Therefore, the precise impact on people and jobs in any given organization can be determined only as redesigns are implemented across the Institute.[14] As the tools are provided to simplify tasks and reduce work, managers will very likely reorganize their administrative operations to take advantage of savings. There are various options here, depending on the size and complexity of the administrative structure. These include reassignment of fractional portions of administrators' efforts to other tasks,

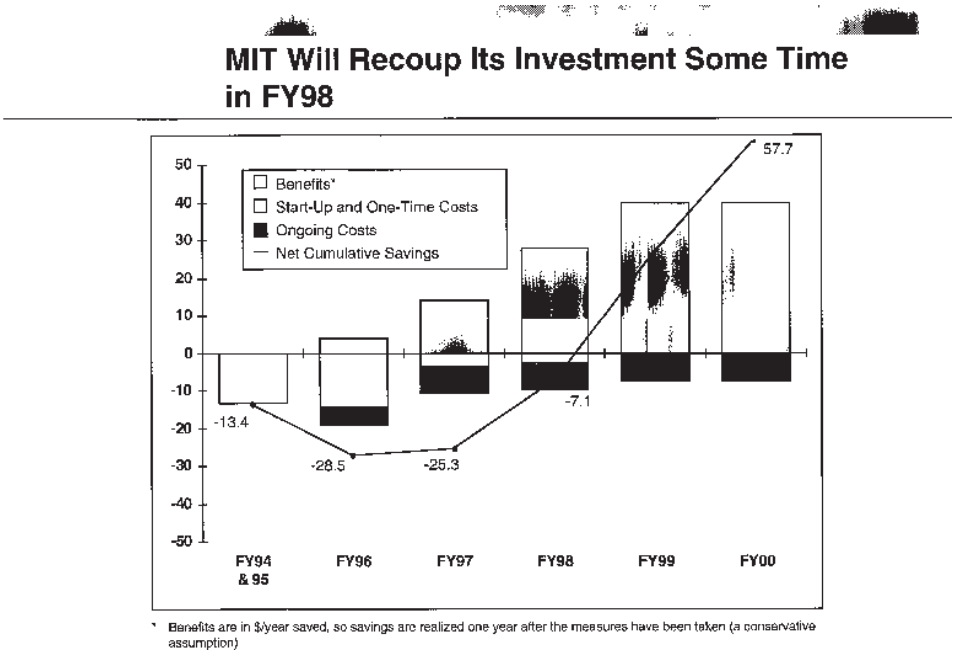

Figure 6

outright reductions in headcount, encouraging part-time working arrangements and sharing of administrative resources with related groups.[15]

The table [Page 12] summarizes projections of EFT reductions for current projects, including Student Services, and Figure 7 shows how they are expected to be distributed across staff classifications. These projections will almost certainly change, as redesigns are implemented and the specific staffing implications become clear. Again, since most of the staffing increments since 1983 occurred outside of central administrative areas, most of the reductions are expected to occur there as well. Understandably, the continued uncertainty as people await clarification about their individual circumstances is stressful for many, including those who are participating in redesign activities.

It is also worth mentioning that activities other than reengineering will affect staffing levels in non-administrative areas. The graduate research staff will begin to decrease near the end of the decade, as the cost of tuition is once again charged as a direct cost of research. Also, the planned decrease in the size of the faculty, by approximately 50 by the end of the decade, continues its implementation.

Positive Implications

Methodology, rationale, and implementing details aside, how can faculty expect to be affected by the reengineering projects underway today?

- The costs of goods, services, and other operations will drop, making the cost of research cheaper through lower overhead.
- Administrative services of all types will be far more user-friendly.
- Budgeting, planning for, and managing finances will be vastly simpler than it is today, since data for these functions will exist in one place.
- Hiring, promoting, and completing a variety of staff related actions will be consistent, straight forward, and paperless.

(Continued on next page)

Reengineering MIT's Administrative Processes

Colbert, from preceding page

Projected EFT Reductions from Administrative Reengineering

Management Reporting and Student Services	468
Supplier Consolidation and Corporate Credit Cards	141
Mail, Custodial Services, and Repair/Maintenance	66
TOTAL	**675**

• Acquiring goods and services will be a cheaper, flexible, and paper-free process supported by purchasing cards, electronic catalogues, and customer oriented vendors.

• Maintenance and repair requests will be handled in less time, with less paperwork and with more generalists who can perform a broad scope of non-trade-specific repair work.

• Making travel arrangements and reporting related costs will be simpler and paper-free.

• Some faculty who were accustomed to having incoming mail delivered directly to their desks will have to collect mail at a distributed center.

However, services such as drop-off and collection of overnight mail, correct handling of overseas mail, and reduction in volume of unwanted mail should offset the inconvenience.

• Obtaining help about administrative workstation problems or problems related to an administrative process will be far easier than it is today.

Final Word

This article has attempted to lay out some of the history, rationale and implementation plans for a very large and far-reaching program to reduce the complexity and cost of administrative processes at MIT. When all is said and done, those who remain here should find this a more satisfying place to work and administrative tasks significantly more pleasant and effective. Faculty should find the administration to be smaller and more cost-effective, and their interface easier. I have outlined some of the long-term financial benefits as well as some of the improvement in service quality that are anticipated as a result of the effort. Others can perhaps do a better job of explicating the anticipated positive outcomes, and I would hope that they are invited to do so in this publication.

Perhaps too little has been said here about the many hard working employees who will be leaving as cost reduction objectives are realized. We care about them, recognize their dedicated service to MIT, and find it difficult to talk about the more painful ramifications for them of the major changes underway. It is worth another article to review the programs that are in place or being developed to address the needs of those who will be leaving, as well as strategies for informing and involving members of the Institute community in the ongoing effort. Hopefully, everyone shares in the overarching objective to help MIT maintain its strength and its unique contribution to the nation and the world. The national economy, industrial restructuring for global competition, changing technology, and changing national priorities have led MIT into difficult times. Our challenge is to emerge stronger and more competitive. We must succeed.✣

Where the Projected EFT Reductions Will Occur

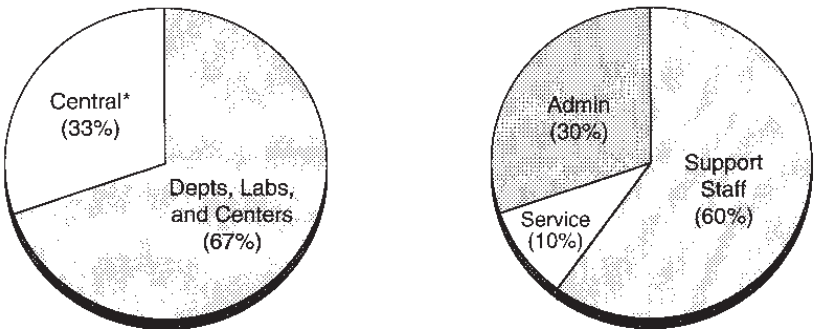

Figure 7

*Includes service staff (union)

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Reengineering MIT's Administrative Processes

Colbert, from preceding page

ENDNOTES

[1]A healthy portion of this competition is attributable to MIT's success in producing well trained engineers and scientists, who have initiated their own excellent programs elsewhere and compete for increasingly scarce resources.

[2]During that decade, proliferation of government regulations and increased reporting requirements also contributed to the need for more administration, to ensure compliance and to maintain adequate records.

[3]Frequently cited examples included MIT's paper driven registration process; and financial systems that do not share data, track purchasing commitments, allow encumbrances for anticipated expenses, or provide timely reports.

[4]According to the founders of reengineering, Hammer and Champy, TQM asks the questions "Where is the work done and who does it?" while the reengineering approach asks "What is the work and how is it done?" Once work has been fundamentally redesigned and simplified, they contend, TQM methods must be applied to ensure continued improvement.

[5]Also, at some point, consultants go away...by design or choice.

[6]With the death of Constantine Simonides last Spring, two new administrative vice presidents were appointed and have joined the Steering Committee. Currently, the group consists of James Culliton, vice-president for administration; William Hecht, executive director of the Alumni Association; J. David Litster, vice-president and dean for research; Joel Moses, dean of the School of Engineering; Joan Rice, vice-president for human resources; Barbara Stowe, vice-president for resource development; and Glen Strehle, vice-president for financial operations and treasurer.

[7]Members of the team included Katherine Cochrane, director of Alumni Information Services and Resources; Isaac Colbert, associate dean of the Graduate School; Marilyn McMillan, planning director for Information Systems; Pamela Phillips, administrative officerof EAPS; Shirley Picardi, bursar; Steven Scarano, assistant for information systems, Office of the President; and Anne Whealan, assistant director of finance.

[8]Student Services refers to all student co-curricular needs, including registration, bursary functions, financial aid, housing and dining, etc. Facilities Maintenance relates to construction, repair and maintenance, and custodial services of the Institute's physical facilities. Buy-Pay starts with identifying needs for goods and services and ends with acquiring and paying for them. Research Proposal Preparation is composed of the administrative aspects of preparing proposals for research funding. Management Reporting refers to the process of assembling information needed to manage projects, programs, and operations of the Institute.

[9] In preparation for the Town Meeting held on May 3, each team prepared a one-page summary of its objectives, activities, and progress to date. They were published on May 1 as a special edition of *Tech Talk*, and the reader is referred to that edition for descriptions of current projects. Updated summaries will be published sometime this coming fall, when further progress can be reported.

[10]In the recently announced discontinuation of the Office of Laboratory Supplies, staff affected by the layoff have periods ranging from eight weeks for recently hired employees to 43 weeks of notice for long-service personnel.

[11]SAP is one of the leading integrated financial software packages on the market. (Its major competitor is Oracle.) It was selected because of its superior Macintosh-like user interface, its client server technology, and the company's willingness to partner with MIT in configuring the package for effective use in research university environments. While SAP has an open and flexible technology, the translation from its configuration for profit making businesses to the way MIT organizes financial matters is challenging. However, the main design objective is to make it simple and easy for faculty and staff to maintain financial information.

[12]This assumes an aggregate recovery rate of 45% for central and departmental administrative expenses, and approximately $1.5 million per overhead point.

[13]Where layoffs must occur, they will be planned in close consultation with the area management and with the cognizant Senior Officer, and existing policies will apply.

[14]Estimated EFT reductions are, at best, a third-order derivative (if cost and staffing estimates are accurate and if redesigns are implemented fully and if EFTs are harvested fully, then we might reap all the projected savings).

[15]Where local managers have small numbers of staff and can reassign fractional savings to other tasks, it is not clear how to capture the value of the saved effort.✣

TEACH TALK

The Jigsaw Puzzle of Teaching

Lori Breslow

One of the best pieces of advice I've heard recently on teaching came from one of our senior faculty members. The two of us were attending a workshop for graduate students who had been chosen to lead recitations in his department the following semester. It was the last day of the three-day workshop, and we had already sat through a dozen or so attempts on the part of the new recruits to present 10 to 15 minutes of their best teaching. As was to be expected with these first tries at flying solo in front of a class, we had seen our share of aborted take-offs, spin-outs, and even a couple of crash landings. Finally, on that third day, as we sat through one more explanation of a problem whose purpose and method were not as clear as they might have been, this professor's patience must have worn thin for he gruffly admonished the group as a whole, "Don't turn the lessons you teach into mystery stories."

Mysteries, of course, can be terrifically engaging. They can pull their readers/viewers/listeners into a web, keeping them guessing about what will happen next, or where the next twist or turn will be. A mystery is mysterious precisely because information is doled out in measured amounts; gaps are purposely created; crucial elements of the story are withheld. Mystery makers challenge their audience to see if they can outrun or second-guess them, fitting the clues together before the surprise at the end is finally revealed. But this, I believe, is not the best model for what should happen in the classroom as we try to teach complex ideas.

In the classes I've watched, often (although unfortunately not always) the instructor starts well by announcing what the subject of the day will be: the harmonic oscillator, Markov chains, two-dimensional momentum transport processes. If the topic gets written on the board as well as being announced, all the better. Here is a good way to begin to inoculate students against the creeping inroads that the mysterious can make.

Then the class launches into the day's work. Very often, this means problems are introduced, examples offered, or proofs presented. Numbers fill the board, equations abound, calculations accumulate. This level of detail is rightly at the heart of what should go on in many MIT classes; it is fundamental to the work of the scientist, mathematician, and engineer. The danger is that both instructor and student can become so absorbed by these details that they lose sight of what I call the "picture on the box."

Sometimes I think teaching a class is akin to working a jigsaw puzzle. In order to put together a jigsaw puzzle, you need to alternate between the details – all those hundreds of pieces of oddly shaped cardboard – and the picture on the box, which provides the overall design for how the pieces go together. As I've said, the individual pieces – the problems, the equations, the calculations – are important in their own right. They are the building blocks of the lessons we teach. But there is a danger that the details can be so delightful in and of themselves, that the larger picture, the "why are we doing this" somehow gets lost. Observing MIT classes, I've sometimes felt as if I were watching a movie in which the director begins with a fabulous

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As I've said, the individual pieces – the problems, the equations, the calculations – are important in their own right. They are the building blocks of the lessons we teach. But there is a danger that the details can be so delightful in and of themselves, that the larger picture, the "why are we doing this" somehow gets lost.

TEACH TALK

The Jigsaw Puzzle of Teaching

Breslow, from preceding page

panoramic view – perhaps of the skyline of New York or windswept rocks overlooking a vast expanse of ocean – and then gives the audience nothing for the next two hours but close-ups of the leading man's nose. Without the long shot, without some context, much is lost.

The good news is that this is a simple problem to remedy. Every once in a while (maybe every 15 minutes), all you need do is pull back the lens and survey the territory. It isn't enough to simply announce the topic at the beginning of class; students, like most of us, have short attention spans. Research into the information processing capabilities of members of an audience shows that attention is greatest at the beginning and end of a presentation, with a substantial dip in the middle. (One study found that students' attention begins to wane after 10 minutes!) So continually remind your students why you're solving the equation, what the problem exemplifies, how the calculation furthers an understanding of the topic at hand.

Transitional statements help, too. How does subpoint A relate to the theme of the day's lesson? How does subpoint B relate to subpoint A? Does one idea further the next, or is it a contrast? Is subpoint C a consequence of subpoint A and B? Why did you need to talk about A and B before you presented C, anyhow? Provide clear, explicit signposts along the way reminding students where you started, where you are in the process at a particular point in time, and where you expect to end up.

What all this means, of course, is that you need a unifying thread that will weave itself throughout the class. Patrick Winston, in a handout entitled "Lecturing Heuristics," which accompanies his not to be missed IAP presentation, "How to Speak," writes of the "central, exciting question" that forms the basis of any good lecture. The faculty member mentioned at the beginning of this column talks of the need to identify and articulate the "important problem" that must motivate every class period. The question that students need answered for them is, "Why are we learning what we are learning?" What is the key viewpoint, the fundamental insight that propels the rest of the day's material? What does the picture on the box look like, anyway? Studies on what makes lectures successful identify two basic components: a simple organizational plan and a number of germane examples. Both elements are necessary, for the effectiveness of the lecture will be weakened if either is missing.

As I've observed classes here over the past year, I have been extraordinarily impressed at the ability of those I've watched to manipulate the symbols that build the examples, the problems, and the proofs. Sometimes I feel as if I am being treated to amazing feats of underwater endurance; as the instructor fills the board from one end to the other, it is as if I'm watching a swimmer glide effortlessly lap after lap on a single breath. But it is important to come up for air regularly, to look around, to check where you've been and where you're headed. I would like to suggest that that is good pedagogy, because it helps students figure out how the pieces come together not only so they can duplicate the picture on the box, but ultimately so they will have the confidence to create their own.

Sometimes I feel as if I am being treated to amazing feats of underwater endurance; as the instructor fills the board from one end to the other, it is as if I'm watching a swimmer glide effortlessly lap after lap on a single breath. But it is important to come up for air regularly, to look around, to check where you've been and where you're headed.

UROP Opens a Door to Industry

Norma G. McGavern

This month a brochure will be mailed to hundreds of corporate members of the Industrial Liaison Program about a joint enterprise called the Undergraduate Corporate Research Fellows Program. The program is essentially a version of UROP designed specifically for corporate sponsorship and support. Both UROP and ILP hope the Undergraduate Corporate Research Fellows Program will increase the number of opportunities available for undergraduates to do interesting research. It will help corporations make more direct connections with undergraduates than they can now within the typical UROP framework.

There are two options for companies in this program: They may propose a specific project with a particular design or product outcome in mind; or they can propose exploratory research within a broad area of science or engineering. In either case, the project is expected to meet regular UROP guidelines for credit-worthiness in the supervising faculty member's academic department.

The first option allows a company to propose a specific project that faculty having expertise in the appropriate area will be asked to review and eventually supervise. A willingness to supervise will bring with it a modest amount of money to cover the project's materials and services costs and a UROPer's stipend paid for an entire academic year (fall term, IAP, and spring term), with overhead and employee benefits included. Total cost to the company will be $9,475. The student may be a junior or senior and possibly a sophomore if he or she has sufficient expertise or research experience. The choice of student will be up to individual faculty. At the end of the spring semester the student will be expected to report directly to the company and may be invited to work at the company on-site during the summer. Faculty member and student will be asked by the UROP office to evaluate the work accomplished in the usual manner.

The second option offers money for materials and services and an academic year stipend for a UROPer working for a faculty member with research interests in the general area in which the company has an interest. The cost to the company will be $8,260. Faculty will be able to define projects of their own choosing within the given research area. Here, too, the usual academic standards for UROP projects apply: that they must be credit worthy, appropriate to a student working part-time, approximately 10 to 15 hours a week, and supervised by a faculty member.

Getting involved in research has long been a highly valued aspect of an MIT undergraduate's education. Half the undergraduate student body has been involved in ongoing research with faculty in recent years, and these kinds of research opportunities have been advanced because of UROP, which has been around since the fall of 1969. But there are far more students interested in having a research experience than there are available opportunities – especially paid opportunities. Changes in federal regulations having to do with indirect costs affected UROP greatly and have limited the money available to support undergraduate research stipends. This new program may help make it possible to expand those opportunities with corporate support and, at the same time, make it easier for corporations to tap student creativity and selectively recruit.

The Undergraduate Corporate Research Fellows Program is not an entirely new idea. Bringing corporations into closer contact with undergraduate research was discussed and planned by a committee put together by the School of Engineering several years ago. Competing concerns kept UROP from moving the program forward at the time. In the 1970s UROP had a successful "off campus" program that involved several hundred students working for local industry, government agencies, and not-for-profit organizations. These students had off-site corporate supervisors and MIT faculty supervisors. As internship opportunities at MIT grew and UROP funding from faculty-sponsored research became more readily available during the 1980s, interest in research outside MIT began to fade. During the past year or so this interest, both on the part of students and area companies, has revived. We at UROP hope the Undergraduate Corporate Research Fellows Program will help fill this desire for increased research opportunities and stimulate corporate-undergraduate interaction.✣

There are two options for companies in this program: They may propose a specific project with a particular design or product outcome in mind; or they can propose exploratory research within a broad area of science or engineering. In either case, the project is expected to meet regular UROP guidelines for credit-worthiness in the supervising faculty member's academic department.

Some Thoughts From A Departing Dean

Arthur C. Smith

This July, Art Smith will be stepping down as Dean of Undergraduate Education and Student Affairs. Dean Smith, who joined the Institute as a Professor of Electrical Engineering on January 1, 1959, provided the following brief memoir in response to a request by the Faculty Newsletter.

As I have thought about writing this article (an activity which has been a substitute for actually writing it for some time), I concluded that a well-organized memoir should contain a little wisdom, some description of what the Dean does, a look back at accomplishments or experiences, and a look forward, perhaps setting some impossible goals for my successor. However, the duties of being Dean have taken the time that could have been spent in writing about being Dean, so this is not the well-organized memoir I had hoped to write but rather is simply a collection of observations.

The first day that I was officially the Dean for Student Affairs I received an alumni magazine from my undergraduate university which had an article by a retiring dean in which he tried to give some sense of what it had meant to be a dean. I found this interesting and thought it must have acquired some cosmic significance by arriving on such an appropriate day. I didn't save the article, but I did note his three principles of deaning and I have found them to be applicable in many situations. In case they might be useful to others, I reproduce them here:

1) Much that comes to a dean's desk is best handled by doing nothing at all; innumerable other matters are better handled slowly than promptly.

2) Never attribute to malice what can be explained by incompetence.

3) Always remember that it's much easier to get forgiveness than permission.

In addition to such guides to action, I have accumulated some factual observations about deaning as a result of five years of hands-on experience, for example:

- Deans get more junk mail than most faculty. The world is full of people and organizations that are willing to do my job, make my job easier, tell me how to do my job, etc., for a suitable price. None of them have seemed particularly relevant to deaning at MIT.
- Faculty status ("one of us") gets suspended immediately on becoming a dean ("one of them"). I can only hope the reverse process takes place at the same rate, a sort of detailed balance theorem of faculty-administration transitions.
- Students generally are completely unaware that deans exist until they run into one. These encounters may be social, academic, economic, or disciplinary; they play an important role in keeping deans appropriately humble regarding their place in the universe.

As I have prepared to leave the Dean's office, a number of people have had positive things to say about my tenure in the job and in particular about my attitude toward and relations with students. If I had to give a single piece of advice to my successor, it would be one I heard long ago (source unknown) and which I have tried to follow with my children as well as with students:

- Treat them as if they *already are* what you hope they will *become.*

I have assumed that we want our students to emerge from MIT as intelligent, capable, independent adults with exceptional capabilities for work and real understanding of the foundations of their intended professions. I have taken that to imply that it is my job to increase the number and variety of opportunities in all aspects of student life and give them the power to choose among them. I have had modest success – there is plenty more for my successor to do.

One of the tasks given to deans and other highly placed administrators is to write one sentence mission statements which are supposed to encapsulate the essence of large and complex undertakings which are poorly understood and constantly changing. Faced with this necessity, I devised the following description of the role of the office of the Dean for Undergraduate Education and Student Affairs:

- It is our role to make it more likely that students will succeed in achieving what they came to MIT for.

There are many other possible mission statements but I like this one.

There are aspects of being Dean that I won't miss (preparing budgets, dealing with tragedy, too many meetings, and too little time to do real work) but overall it has been a fascinating and satisfying experience. As with all worthwhile activities, there is never a good time to leave – there are things begun and not finished, commitments to people that are not complete, opportunities unknown over the horizon – and I feel real regret at the prospect. However, my personal experience has been that the next phase is often better than the one just completed and that moving forward with enthusiasm is a good idea. One reason for enthusiasm is that I hope to have the time to think about some of the things I have learned as Dean and perhaps write them down. If that happens, I may submit an amended and expanded version of this memoir but until then these will have to stand as the thoughts of a departing dean.✣

Office of Corporate Relations

Voices of Industry and MIT

Thomas R. Moebus

In 1994, the Office of Corporate Relations launched two studies – dubbed Voice of Industry and Voice of the Faculty – designed to take the pulse of individuals on both sides of the university/industry partnership. What expectations do they bring to the table? How do faculty members and business leaders view themselves, their organizations, one another, university/industry collaborations, and finally, Corporate Relations and the ILP?

The Voice of Industry and Voice of the Faculty studies are part of a larger effort within Corporate Relations to redesign the organization and update the services of the Liaison Program to address the needs of industry and the faculty into the latter part of the '90s. The results of the Industry and Faculty studies, based on extensive interviews with representatives from both groups, cannot only provide the basis for changes initiated as part of this larger improvement effort, called IQ^ (Innovation and Quality), but can contribute to a greater understanding of the needs of both the university and industry and perhaps, to some degree, provide the basis for more mutually rewarding collaborations.

Survey Process

Subjects for the Voice of Industry interviews were selected to provide a rich mix of industry opinion. Scheduled throughout 1994, the interviews included individuals from over 30 companies and organizations representing a variety of industries, from aerospace to the service sector. Participants were drawn from companies large and small and from diverse locations. The group included representatives from active and relatively inactive ILP member organizations, former corporate members, and companies that have never participated in the Liaison Program.

ILP interviewers posed open-ended questions designed to elicit responses reflecting their subjects' fundamental business concerns. For example, interviewers asked subjects to comment on the important forces at work shaping their organizations, specific problems they and their own businesses face, and changes in the way R&D has been conducted in the last five years. The study's participants also discussed their definitions of success, their competition, and the strengths and tools they need to remain competitive. Finally, after obtaining input on the business environment, interviewers asked questions relating more specifically to collaborative R&D efforts, university/industry cooperation, participants' impressions of MIT and, if applicable, their experiences working with the ILP and the Institute.

Twenty-six faculty members, drawn from all of MIT's Schools, participated in the Voice of the Faculty study. Participants included new and senior faculty members, academic administrators, those who have worked routinely with industry and others with little industry involvement. Questions for faculty members, like those addressed to industry participants, were selected to provide a very broad field of discussion. The aim was to focus not only on day-to-day challenges and opportunities for improvement, but especially on longer-range issues facing faculty personally as members of the MIT community. Faculty members were asked to comment, for example, on the mission of MIT, their professional environment, the issues facing the Institute, the role of industry connections, and the potentials for improvement within the ILP and the Office of Corporate Relations (including Development).

Through its Voice of the Faculty and Voice of Industry interviews, Corporation Relations succeeded in amassing a generous body of subjective impressions. Tackling the information gathered for each study separately, and working under the guidance of the Center for Quality Management in Cambridge, the ILP team then used a Total Quality Management, "KJ" process – named after Dr. Jiro Kawakita, the Japanese professor credited with its development – to sift through subjects' comments, methodically extracting higher-level, systemic issues from a sea of input. In this way, the team was able to identify a core of shared concerns among the impressions recorded from each study group.

Mounting Pressures in Industry

Downsizing. Dwindling profits. The demise of middle management. All are by now familiar symbols of a changing economy. As expected, industrial representatives as a group reported that the current business environment is extremely competitive, and that profit margins have indeed narrowed. Most businesses are still struggling to adapt to massive disruptions triggered by the economic downturn, they said.

Many organizations are now operating with a smaller workforce than they did a few years back. And the work pace is accelerating. That is, competition has heightened internal and external pressures to produce more quickly, while clients and consumers concurrently demand more value for their money.

(Continued on next page)

Voices of Industry and MIT

Moebus, from preceding page

"Sale is the only reward," baldly stated the CEO of a biotech firm.

And how do business leaders, for their part, define their missions and gauge the health of their organizations? Most businesses find crafting an effective strategy for success in this intensely competitive marketplace an ongoing challenge. Many industrialists reported that establishing a position of technology leadership in their industries is key to maintaining competitive advantage. "Our mission is to deliver new technology to the marketplace as affordably as possible," indicated one California-based research manager. But for many firms, this goal is growing more elusive.

Many companies have cut basic research to the bone. With funding now largely limited to product development, opportunities for achieving major technological breakthroughs and identifying new product categories are dwindling. Businesses that would have engaged in basic research efforts, given a climate of greater economic certainty, may now be cut off from sources of future product ideas. This is perceived as a future problem by many of the business leaders surveyed who report that they define success in terms of their company's ability to profit from new revenue sources.

Cutting basic research has also impacted company hiring processes. A VP of a large conglomerate noted, "We are not hiring Ph.D.s, and sometimes don't know what to do with the ones we have." The lack of hiring came up in many of our conversations, and appears to have deeply affected the nature of university/industry interactions, since student recruiting has traditionally been a pillar of the relationship.

Increasing Collaboration

Because there is no room in industry at present for basic research, industry leaders have a growing interest in establishing collaborative relationships with outside research groups. Many are worried about their vulnerability down the line, when the fruits of longer term research would pay off. They look at universities as a place where they hope to buy research they would have conducted internally in the past. A director of Technology Planning for a communications firm noted, though, that "commissioned research will be funded by industry not for the research itself, but for the strategic intelligence it provides on business opportunities and threats."

Most firms are searching out "focused or targeted" research engagements with universities. Some resent MIT and other elite universities selling them "academic" research projects, instead of working with industry to develop research ideas more germane to real industrial problems. Intellectual property disposition has become more of a bone of contention in discussions with universities, MIT included, because of the demand that company's get a fully usable "deliverable" as a result of the research project.

There is a push to find networking opportunities that will enable their companies to identify and pursue potential collaborative arrangements. Most firms are searching out "focused or targeted" research engagements with universities. Some resent MIT and other elite universities selling them "academic" research projects, instead of working with industry to develop research ideas more germane to real industrial problems. Intellectual property disposition has become more of a bone of contention in discussions with universities, MIT included, because of the demand that companies get a fully usable "deliverable" as a result of the research project. Companies which seek to invest in research in order to gain competitive advantage oftentimes find themselves at odds with faculty members interested in publishing the results of sponsored research. The two parties must find a way to compromise on intellectual property issues if collaborations are to be mutually rewarding, the ILP studies suggest.

Networking is also valued as a means of expanding a company's intellectual resources. "We want to pick somebody's brain to enhance our own mission," noted an executive from a West Coast biotech firm. Many of the ILP study's participants view their companies as knowledge-based communities, dependent for economic survival on their ability to continue to learn and grow. Because they cannot get all of the information they need through their own internal sources, companies need to establish knowledge networks, they said.

(Continued on next page)

Voices of Industry and MIT

Moebus, from preceding page

"But, we don't have time to build the network," claimed the same executive. A manufacturing company VP concurred, "We are running lean and mean, and have eliminated middle management. These people were the communicators with universities and others."

University/industry interactions offer opportunities to both supplement a company's limited research efforts and expand its knowledge base. "Universities can be our window on the world, can anticipate our competitors, where they will emerge," said the director of Advanced Materials of a defense firm. Interaction with MIT in particular is valued, in part because of the Institute's internationally-recognized leadership in the areas of science and technology, and because of the university's ties with U.S. policy makers. Some respondents mentioned the value of MIT's access and influence over government policies and plans.

Companies turn to MIT to keep abreast of leading-edge technology, and the Voice of Industry study's participants indicated that they look to MIT for information about technology developments, not only at MIT, but around the globe. Familiarity with these developments helps corporate strategic planning efforts, they said. Furthermore, the business community views MIT as an important intellectual hub that can serve as a knowledge resource in a wide variety of disciplines. Many respondents were drawn to MIT's management expertise. Others mentioned that MIT could boost their knowledge of environmental issues impacting industry.

MIT's Faculty Speak

Faculty members report a host of pressures of their own. They worry about impending or potential federal cutbacks, and about increasing demands from current or potential industrial sponsors. But perhaps the greatest of their worries is the constant pressure to raise the resources needed to sustain their research efforts. Devoting time to the ongoing effort is difficult, given the need to spend time on teaching, research, and related administrative activities. And, as some pointed out, faculty members aren't trained fundraisers. Although some fundraising assistance is available from within MIT, these efforts are loosely coordinated, faculty members said.

While MIT researchers have always competed with their counterparts at other universities for outside funding, they now face increasing competition from national labs. It isn't an even playing field, some say. "I can't compete with them because they have people who do nothing but write proposals," one harried faculty member said. "I have to do it all myself."

Junior faculty members are the most stressed, as acknowledged both by them directly, and by observation of the senior faculty. They are the first to feel the effects of tightening budgets. And, in addition to other pressures, they must compete with one another for tenure. The need to compete tends to discourage collaboration among faculty members, because individuals working in a team may not be recognized for their individual contributions. The tenure system can tend to deprive faculty members of the benefits they might derive by pooling their resources, some said.

A Clear Mission

The ILP's Voice of Faculty interviews reveal almost unanimous agreement among the faculty on the Institute's overriding mission: to strive for academic excellence. The goal, one faculty member said, is to become "the premier educational institution on the planet in our areas of activity." And the best way to gauge our success as educators is to look at students and graduates, the study's participants said. Are students recognized worldwide? Are graduates moving on to good jobs, assuming influential teaching, research, and policy-making positions? Do they leave MIT as capable problem solvers and confident researchers?

Second only to MIT's educational mission is its research mission, many faculty members said. MIT should tackle long-term, high-risk research projects that push the limits of knowledge, they said. Some stressed that MIT's educational and research missions are inextricably intertwined. Research isn't undertaken primarily to gain new knowledge, but to teach others how to do research. As one faculty member put it, "Our goal is not to win the Nobel Prize, but to do good research; to provide very good examples of research." One respondent said faculty members should actually do more research and less teaching, implying that students and teachers alike learn more doing research than they do pondering abstractions in a classroom.

Faculty members judge their personal success by their ability to assume leadership roles in their chosen fields. Having ideas and accomplishments that are taken seriously by others in the field is important. Some respondents also mentioned the desire to contribute to basic science. Others looked for tangible products – including inventions, devices, and publications – to attest to their success. But the most disturbing professional failure, for many faculty members, is to fail in one's role as a teacher. In addition to the responsibility to educate students and conduct useful research, the Institute should help to establish national priorities, some faculty members said. MIT faculty, students and alums should play a role in shaping public policy and in helping to determine how we will provide for the welfare of future generations.

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Voices of Industry and MIT

Moebus, from preceding page

Faculty members, in turn, expressed – although not in large numbers – an interest in learning from industry. Collaborating with industrial partners can open up a new world of knowledge. Exposure to this world can be particularly helpful for students. Some faculty members look to industry to provide them with real-world problems to tackle: "We provide the framework. They provide the problem."

Others wonder whether it is even possible for an MIT researcher to step into a business associate's shoes. "I have a lot of doubt about whether even the best engineer from MIT can get [a] feel for a company and for the way in which a product has to be developed and what it takes to push it through the production process for marketing," one faculty member said. But spending some time working in a company's research and operating division – in their facilities or on the shop floor – can help faculty members familiarize themselves with a world that would otherwise be foreign to them, others suggest.

Some Misgivings

Both the business and faculty representatives interviewed by the ILP have some reservations about university/industry interactions. Not surprisingly, both sides feel that their concerns are not adequately understood by the other. Departing attendees at a recent high-level meeting of industrialists and MIT faculty leaders were heard to say, "They just aren't listening," in referring to members of the other group.

To collaborate with businesses effectively, universities including MIT must make a greater effort to understand the challenges facing industry and to adjust their expectations accordingly, participants in the Voice of Industry study suggest. For example, compared to the pace at which most industries have learned to operate, the pace of university research is leisurely. While the university and industry have always worked under different time constraints, the current, very competitive economic climate tends to exaggerate the difference. MIT must address industry's need to complete some research within a short time frame, respondents said.

Faculty interviews revealed that many MIT faculty members are, in fact, less-than-intimately acquainted with the vast changes taking place in industry. And many agree that, as a whole, MIT isn't sufficiently tuned in to industry needs. MIT must demonstrate respect, interest, and concern for the challenges facing industry, they say. However, others feel that industry's needs may diverge too radically from the university's, and worry that too great an interest in accommodating commercial interests may therefore jeopardize the Institute's basic mission. The Institute can't be all things to all people, and in our haste to attract potential industrial partners, we may compromise our strengths, they warn. Because the goals of industry and the university are not identical, differences extend beyond the pace of work to the nature of the work itself. Given current economic pressures, industry interest is increasingly focused on the rapid development of deliverables, while universities maintain a greater interest in long-term research and in furthering intellectual progress in a variety of disciplines. Industrial partners often grow disenchanted if their research investments do not result in tangible, applicable results. "We give money for something specific but get something general back," one industrialist lamented.

Some faculty members say the university must teach industry to appreciate the value of basic research. A long-term perspective yields the biggest payoff, they say, but it is hard to convey that notion to business associates. It is true that CEOs and other high-level executives generally have a broader perspective than the individuals working under them, but may not have the requested longer-term horizons, some faculty members say. "We need sophisticated techno-political perspectives," noted an executive of a multinational electronics firm. But unlike their employees, higher-ups don't always appreciate the complexities of a technical problem.

There are faculty members who believe that instead of (or along with) convincing sponsors of the merits of long-term research, MIT ought to consider spending up to 10 percent of its efforts on what some might call development. MIT needs to rethink traditional definitions of appropriate research, they say. Others emphatically state that product development cannot be part of the university agenda. A head of International Development for a major communications firm cautioned, "Some universities are getting into the product development phase, and it's a waste of time. What's happening in the product development world is different – it's the sum of all technologies. It's looking at the cross fertilization of technologies, to generate a new set of applications for society and new markets."

Some participants in the Voice of Industry study complain they have encountered arrogance on the part of some faculty members and ILP representatives. To work together, MIT and industry need to collaborate on an equal footing, they say. Before attempting to respond to industry's needs, MIT must first work with industry to better understand those needs. "You should learn more about our company," said a VP of a financial services firm. Faculty members must understand the individual business as well as the overall

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Voices of Industry and MIT

Moebus, from preceding page

business climate, and customize the industry/university relationship to meet a company's unique requirements. "ILP must understand the meaning of decentralization in industry; must introduce MIT to the rest of the corporation," indicated a head of Research for a materials firm.

Faculty members also had some complaints about the quality of their interactions with industry. Specifically, many faculty members felt that it is becoming quite difficult to work with large companies, in part because corporate hierarchies are cumbersome and getting anything done is a challenge. "Fortune 500 companies are all walking dinosaurs. The vigorous part of society will be the small entrepreneurs' companies and the mobile personnel within them," said one faculty member, who had himself started a small company. Echoing this sentiment, a chairman of a nearby instrumentation firm said "All MIT (founded) companies are small to medium, yet MIT programs are geared to large companies. In a way MIT is ignoring its heritage."

MIT and Industry: A Tradition and the Future

Most of the industrialists surveyed were highly complimentary of MIT's overall efforts to work with industry. Having noted the cultural mismatches between university and industry, many of those surveyed agreed with one comment that "MIT was most successful at matching impedance between industry and MIT."

The Industrial Liaison Program can be instrumental in facilitating access to MIT resources, the survey's participants said. Although company leaders perceive there is a vast wealth of knowledge and information at MIT, they find it hard to get a handle on those resources. "ILP functions as an interpreter between different cultures," expressed the head of a materials laboratory. To many outsiders, the Institute is like a "vast canvas covered with blotches of paint," with no connection between them. The lack of interconnectivity between the various departments and centers at MIT makes it time-consuming to work with any university. By focusing on clients' needs, the ILP can help its members locate the information and expertise they require more efficiently. "ILP should be interacting at the holistic level, getting us to think across the white spaces in the organization" said a project manager of a chemicals firm.

MIT faculty members agree that communication within the Institute needs improvement. Insufficient mechanisms exist for communicating across departments, they say. Even faculty members use the ILP to learn what's happening at the Institute. "I learn more from ILP visits about other people at MIT than through any other mechanism," one faculty member said. Harking back to the comments about the need for more knowledge about industry, faculty encourage Corporate Relations to "focus less on membership," "act like a bird-dog to identify and qualify prospects, determine a match between a firm's need and the MIT product," "identify opportunities in companies and focus them onto faculty who will be interested in doing those things."

Strengthening company relationships is the central aim of our survey, and is enigmatic in this time of change. Many companies claim to want to increase university relationships, and make demands on MIT to behave more like their development labs. In an era of cutbacks, broad-based programs, like ILPs or affiliate programs, often face elimination as a matter of internal corporate policy. While R&D has been a satisfactory customer in the past, the changed topology of industry generally requires us to seek other, more product-oriented customers with the money to fund research and knowledge programs. This creates a shift in the locus of interaction from a scientist whose interests might easily parallel those of an MIT faculty member, to a product manager who is looking at an upcoming bottom line.

Through its Voice of Industry and Voice of the Faculty studies, the ILP has made a proactive effort to understand the environment and needs of its customers, and is now using that understanding to redesign its products and services. ILP conferences now feature more industrial content, and are formatted to allow for a greater amount of networking among the attendees and with faculty and students. The traditional publications continue to be revised to segment and match customer needs. A *Guide to Industry Programs* provides a higher-level view of MIT industry programs to encourage greater sponsorship by the industry community. *MIT Report* is being modified to provide a more strategic view of technology, while *MITbits* is being added to provide punchy updates on technology topics. A CR faculty newsletter is being prototyped now to provide useful info on industry to members of the faculty. ILP has just launched an effort to connect junior faculty with firms in the New England area. We have just completed a collaboration with UROP [see Page 16] to launch Undergraduate Corporate Research Fellows, to link the undergraduate classroom with industry practice.

It is hoped that sharing the results of our survey with the faculty can contribute to a broader dialogue on campus about the present and future of MIT's relationships with industry, and may help to bridge the culture gap which can inhibit the most fruitful exchange of knowledge and resources.✣

Letters

To The Faculty Newsletter:

I enjoyed your new column [Teach Talk] in the *Faculty Newsletter* a lot and I am looking forward to see it continued in future issues. I am not sure that it will be easy for the Professor Xs among us (which include myself) to change their classroom style (since some of it is presumably personality), but it helps to be reminded of the Professor Ys around and learn what they do.

Steve Pischke
Department of Economics

[Ed. Note: See this issue's Teach Talk beginning on Page 14.]

To The Faculty Newsletter:

The last thing I need is more electronic mail or another bulletin board or Worldwide Web page to peruse. I accomplish my reading on the MBTA which has yet to install internet ports. Often the topics in the *Newsletter*, e.g. retirement plan news, are important items for my spouse to read as well. Going electronic might be a step forward toward the future, but a step backward in actual utility.

(name withheld upon request)

[Ed. Note: This letter was received via e-mail.]

Electronic Newsletter Won't Abandon Hard Copy

As plans for electronic distribution of the *Faculty Newsletter* and a faculty electronic bulletin board proceed, readers who enjoy the traditional hard copy can take heart. The *Newsletter* Editorial Board has no intention of eliminating the paper edition.

Board members suggest the intent of the electronic version is to increase the accessibility of the *Newsletter*, allow easy access to past issues, and add features now unavailable. One such addition would be a planned search feature that would allow retrieval of articles from past issues based on author or topic.✣

Bacow Assumes Faculty Chair

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Larry's undergraduate experience inspired a deep and abiding interest in undergraduate life at the Institute. He has served on the Committee on the Undergraduate Program, the Committee on the Humanities Arts and Social Sciences Distribution Requirement, the Pre-Professional Advisory Committee, the Nominations Committee, and the IAP Policy Committee which he also chaired. Larry was uniquely suited to this last task – IAP was created during his sophomore year, and he recalls vividly how this change in the calendar influenced life on campus.

In 1982, Bacow chaired the faculty effort that led to the creation of both the Center for Real Estate, and the nation's first graduate degree program in real estate development. Sheparding this program through the Institute's committee structure provided Bacow with an important lesson in faculty governance. This interdisciplinary program spans five departments and four schools, and has inspired more than 20 similar programs at universities throughout the world. From 1990 through 1992, Bacow served as the director of the Center, having served previously as its Director of Education and Director of Research.

Larry lives in Newton with his wife Adele (MCP '77) and their two teenage sons, Jay and Kenny. He remains a passionate sailor, and spends the summers cruising with his family on Buzzards Bay, Vineyard Sound, as well as the coast of Maine.✣

M.I.T. Numbers

Indirect Cost and Fringe Benefit Rates

	FY95 (current)	FY96	FY97	FY98
INDIRECT COSTS				
(MTDC base)				
On-campus	52.0%	58.5%	60.0%	61.0%
Off-campus	12.05%	9.0%	9.5%	10.0%
EMPLOYEE BENEFITS				
(S&W base)				
General	37.7%	39.0%	40.0%	41.0%
On-campus	43.1%	44.5%	45.5%	46.5%
Off-campus	46.3%	47.7%	48.7%	49.7%
UROP	6.5%	6.5%	6.5%	6.5%

Source: Office of the Provost