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Collection/Office of Origin: Science and Technology Policy, Office of (OSTP)
Series: Bromley, D. Allan, Files
Subseries: International Files

OA/ID Number: 62062
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Folder Title:
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"CORRESPONDENCE TRACKING"

TYPE: INFORMATION

DOCUMENT NUMBER: 9121653

ORIGINATOR: 02

STATUS C

DIRECTORATE STATUS

FROM: SKOVHOLT, Glen J.: HONEYWELL

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 06/04/91

SUBJECT: TESTIMONY TO BE DELIVERED 06/04/91 BY DR. REINER
BEFORE THE HOUSE WAYS & MEANS COMMITTEE HEARING ON
U.S. INTERNATIONAL COMPETITIVENESS.

DIRECTORATE STAFF
ASSIGNED: ASSIGNED:

ACTION STAFF
REQUIRED: ACTION:

SENDER'S DUE DATE:
OSTP DUE DATE: STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT:

COPIES TO: INTERNATIONAL/POLICY
INDUSTRIAL
D. Allan Bromley

WHITE HOUSE TRACKING #: CONTACT PERSON:
REMARKS: PHONE: EXT:

OSTP RECEIVED: 06/07/91
DEPT RECEIVED:

FILE: *International*

*Please draft
brief advance material
DAB*

Glen J. Skovholt
Acting Director
Federal Affairs
Corporate Public Affairs

Honeywell Inc.
1100 Connecticut Avenue
Washington, DC 20036
202 872-0495
202 223-5782 Fax

RECEIVED

91 JUN 7 A 8:49

OFFICE OF THE
DIRECTOR

June 4, 1991

The Honorable Allan Bromley
Assistant to the President
for Science and Technology
Old Executive Office Bldg.
17th & Pennsylvania Ave., N.W.
Washington, D.C. 20506

Dear Dr. Bromley:

Knowing of your keen interest in these issues, I wanted to call to your attention this testimony to be delivered today by Dr. Renier before the House Ways & Means Committee hearing on U.S. International Competitiveness.

We appreciate the interest you have shown in Honeywell's views in these matters and look forward to speaking with you next week.

Sincerely,



GJS/gb

DR. JAMES J. RENIER
CHAIRMAN AND CEO, HONEYWELL INC.

Statement before the
COMMITTEE ON WAYS AND MEANS
U.S. HOUSE OF REPRESENTATIVES

June 4, 1991

Mr. Chairman, I appreciate the opportunity to testify on the ability of American companies to compete successfully in world commerce. I appear in two capacities: as the Chairman and CEO of one of those companies, Honeywell, headquartered in Minneapolis; and as a Vice Chairman of the Committee on Economic Development and Chairman of its Subcommittee on Education and Child Development.

I can speak for a broad segment of business in thanking the committee for taking up this critical issue. You have observed, Mr. Chairman, that there was a time when "there was little reason to focus on opening foreign markets and encouraging domestic firms to sell abroad." But, as you said, "Those days are gone forever."

Speaking for Honeywell, we are a stronger international competitor today as a result of fundamental restructuring that began in 1986. But we are concerned about the strength of American industry in general. In my own industry, for example, domestic competition has changed considerably. Bailey Controls is now owned by IRI, an Italian firm. Robertshaw, Foxboro and Barber-Coleman have been acquired by Siebe of the U.K. And others are now owned by foreign

interests.

My education and much of my business experience is in technology, and I can best contribute to the Committee's investigation by offering some observations on the function of technology in international competition.

Global competitors, like Honeywell, depend on at least five leverage points: cost of capital, productivity, scale of production, global distribution and technology. Our ability to compete in terms of capital and production relies heavily on our ability to take a long-term view of the development, protection and utilization of technology.

Let me begin with utilization. America is still a world leader in computer-aided engineering, artificial intelligence, software engineering, computer-integrated manufacturing. These technologies, and others, can produce competitive gains if we utilize them effectively. That requires skilled people who can work in this high-tech environment.

Today's jobs require a median of 12.5 years of education. But jobs created during this decade will require 13.5 years. And by the year 2000 a third of all jobs will require a college degree. The Committee is well aware that we are falling short

of these requirements, and that the data -- with few exceptions -- promises slight chance of competing with the well-educated Asians and Europeans.

Earlier this year, the subcommittee I chair on the Committee for Economic Development published a report on U.S. education titled The Unfinished Agenda. It sounded a warning: The education goals of the president and the nation's governors will not be reached unless we first solve serious social problems that face our children and our schools. Too many of our children are sent to school too hungry, too ill, too angry and too frightened to even think about learning. If you take poverty, neglect, living environment and minority status together, almost 40 percent of the nation's children go to school with a disadvantage that may have them beaten before they start.

Teachers say they can teach only when children are ready to learn. Before they can start the academic program, they have to help their students work through the learning handicaps of poor health, meager social development, low emotional stability and a lack of curiosity.

In Minnesota, we think our education is pretty good. But even there, we see the same problems as the rest of the country. We have more children living in poverty than we had 10 years ago, more children born to single parents, more children subject to

abuse and neglect. Teachers say they are forced to deal with "unsettling and sometimes chaotic family situations".

The result is that Minnesota education is taking the national trend. Our dropout rate has been climbing for a decade and our ACT scores and SAT scores have been going down. It has reached the point where business is genuinely worried. In the past 10 years, we have doubled state spending on education. But today less than half of Minnesota business people think education now meets their needs. And in high-tech companies only about 25 percent of them are even somewhat satisfied.

Today, when you go into a school in Minnesota and schools all across the country, you see them struggling with new social responsibilities that have been thrust upon them.

Teachers have to spend too much of their time dealing with social problems rather than teaching. And this means that neither the social nor the academic needs of the children are being adequately met. One superintendent told me of 52 services which schools must provide: drug education, day care, training for teenage parents, suicide prevention and others. Many of these are mandated by law and many are unfunded.

In Minnesota we have the additional problem that our school year is among the shortest in the country. So with the schools'

social responsibilities and students' social activities, there is even less time for learning.

We often hear the phrase "restructuring the nation's schools." But in my state and the other 49, the schools have already been restructured once; the plight of poor families has forced public schools to accept a new mission. Schools used to exist almost solely to provide an academic education. Now they have also become institutions for administering social services. They no longer have time to deliver a sufficient curriculum.

We have an ad hoc system that is too preoccupied with filling students' personal needs to do a good job of teaching -- but lacks the resources, the staff and the administrative flexibility to carry out the social mission successfully.

The change in the schools has been caused by a change in the family. The traditional, cohesive family unit now represents only eight percent of American families. Today, the typical family is a looser, laxer arrangement that is too often unable to provide adequate learning readiness. Unless we recognize the way we have distorted the traditional school system to meet this change, and unless we redesign the school system to meet both the academic and social agendas, we are asking for trouble. If we want the schools to become surrogate families, and take on the responsibility of preparing children to learn -- in addition

to taking them through the learning process -- then we must design a school system that can carry out this mission.

Unless we are prepared to do that I doubt that we will have the workforce to support our technical goals. I doubt we can compete effectively with the better educated and single minded workers in many other leading industrial countries.

In the final analysis, the success of our education program rests with our states and communities. But federal programs such as Head Start and the Supplemental Food Program for Women, Infants and Children can make an important contribution to learning readiness. Programs like these, along with the educational R&D programs announced by President Bush, are a proper function -- what I would call the corporate role -- for the federal government. The business and community leaders I talk with appreciate the support Congress has given these programs. And we would urge the Congress to work toward giving them full funding. At CED we estimate the cost at an additional \$10 billion in new federal, state and local funding. This is slightly more than double present federal funding, and will have to be phased in over several years.

But it is an investment that should not be postponed. Head Start was begun in 1965, but has never had funding to serve all eligible youngsters. If the program had been available to all

eligible children, today, 25 years later, we would have a full generation of young adults more likely to be self-sufficient, participative citizens, making important contributions to productivity and to the competitive strength of the United States.

Our public education system is the bedrock of future competitiveness. We must not let ignorance or denial of the new social realities lead to its destruction.

I want to move now to the necessity of protecting the U.S. technology base. Long-term, risky and expensive investments in technology developments are made on the assumption that, if successful, investors will enjoy a long-term return on the investment, and build on its initial success.

But sizeable investments can be jeopardized by patent infringements and other violations of intellectual property rights, as I can personally attest. Patent infringements have cost our company many millions of dollars. When suit is brought, it may be years before it goes to trial. And under these circumstances, it is possible for technologies to become obsolete before disputes are resolved.

Given this experience, Honeywell places a premium on establishing effective, enforceable intellectual property rules

through the Uruguay Round and other trade negotiations. It is important, however, that the negotiations do not result in a weakening of the protection now provided by Section 337 of U.S. trade law.

Another protection issue is whether our international competitiveness is affected by foreign investments in high technology companies. Overall, foreign investment is a positive force in our economy and Honeywell supports the open investment policies which have been maintained by the government.

We should be especially alert, however, to the long-term potential risks associated with foreign control or ownership of critical technologies. It is simply responsible to consider the implications. Will foreign investment increase our vulnerability in these technologies? Will the commitment to these technologies be sustained by the new owners? Will the loss of some firms affect our ability to sustain a viable critical technology base?

The interagency Committee on Foreign Investment in the United States (CFIUS), in concept at least, performs a valuable review function. But are we satisfied that they have been stringent enough?

I understand the Committee has been notified of 540 foreign

investment cases since 1988, that only 12 cases have undergone a formal investigation and that only one was blocked. The Committee does not make its deliberations public -- but it's somewhat surprising that only one-fifth of one percent of these cases had serious national security implications.

As the CEO of a high-tech company, making decisions on technology investments every day, it is important for me to know how concerned Congress is about this issue.

I would like to close with a few words about the development of technology.

Right now, we are congratulating ourselves on the power that U.S. technology exhibited in the Gulf war. But many of these smart weapons were developed in the 1960s and '70s. According to a recent analysis of scientific papers, the quality of American research dropped during the 1980s in key manufacturing technologies. Another analysis reports that while our patent strength has increased by about 30 percent since 1983, Japan's strength has increased 100 percent.

Development of technology cannot be turned off and on like a faucet. It requires a long-term commitment. For example, Honeywell, with the U.S. Navy, began R & D on the Ring Laser Gyro -- a gyro for aircraft navigation that uses laser beams

instead of moving parts -- in 1962. It has since become the standard of the industry, worldwide, but it did not become profitable until 1985.

In the midst of long-term development programs like this, a company is subject to risk. There is always a technical risk; your invention may not work. But we also have to weigh every dollar in R and D against the drain on earnings per share, the other business opportunities lost, and the impact on financial performance.

Yet, these investments are vitally important -- not just to the company, but to the whole nation. The Laser Gyro is part of a superior navigation system, which is part of a superior aircraft. One industry in which the U.S. retains world leadership is aircraft production -- thanks, in part, to two decades of investment in the Laser Gyro. It took a lot of know-how, resources and patience. And frankly, given the present short-term environment, I wonder if we would undertake such a development today.

Mr. Chairman, I would hope you believe as I do that our key technologies are national assets, not just corporate properties, and that they should be treated as such by the nation.

What concerns me is that, just as we have reacted with ad hoc

response to changes in the education area, we seem to be reacting to changes in technological competition in a similar ad hoc fashion. Governments of industrial countries provide support for the development of critical technologies -- support we have historically received in this country from the Department of Defense. Like it or not, much of this nation's electronics and control technology has come from defense R & D programs. This support is likely to decrease, however, with the cost pressures facing the DoD.

Like the utilization and protection of technology, advances in the state of the art will not happen automatically. Industry must see the potential gain in the enterprise, and must be confident that Congress understands and considers industry needs.

I thank the chairman and the committee for the opportunity to express these observations.

"CORRESPONDENCE TRACKING"

TYPE: MEETING REQUEST DOCUMENT NUMBER: 9121699
ORIGINATOR: 02 STATUS I DIRECTORATE STATUS

FROM: ARMACOST, Michael H.: AMBASSADOR OF THE U.S., TOKYO

TO: DR. D.A. BROMLEY

Please set this up.

DATE OF
CORRESPONDENCE: 06/03/91

SUBJECT: REQUEST TO MEET TO DISCUSS THE ISSUE OF FOREIGN
INVESTMENT N U.S. UNIVERSITIES AND THE EMERGENCE OF
A U.S. TECHNOLOGY POLICY & THE MANAGEMENT OF
MEGA-PROJECTS INCLUDING THE SPACE STATION.

DIRECTORATE STAFF
ASSIGNED: D. Allan Bromley ASSIGNED:

ACTION STAFF
REQUIRED: AS NECESSARY ACTION:

SENDER'S DUE DATE:
OSTP DUE DATE: 06/17/91 STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT:

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Ken Yale

WHITE HOUSE TRACKING #: CONTACT PERSON:
PHONE: EXT:
REMARKS:

CLOSED

*7/1/91 - DAB Met w/ Amb. Armacost!
mn*

OSTP RECEIVED: 06/10/91
DEPT RECEIVED:

FILE: P- INTERNATIONAL [REDACTED]



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Withdrawal/Redaction Sheet

(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
01. Letter	To: Allan Bromley From: Michael Armacost Re: U.S Technology Policy (1 pp.)	6/3/91	(b)(1)	

Collection:

Record Group: Bush Presidential Records
Office: Science and Technology Policy, Office of (OSTP)
Series: Bromley, D. Allan, Files
Subseries: International Files
WHORM Cat.:
File Location: International: General [5 of 6] [1991]

Date Closed: 5/3/2010	OA/ID Number: 62062-003
FOIA/SYS Case #: 2005-0336-F	Appeal Case #:
Re-review Case #:	Appeal Disposition:
P-2/P-5 Review Case #:	Disposition Date:
AR Case #:	MR Case #:
AR Disposition:	MR Disposition:
AR Disposition Date:	MR Disposition Date:

RESTRICTION CODES

Presidential Records Act - [44 U.S.C. 2204(a)]

P-1 National Security Classified Information [(a)(1) of the PRA]
P-2 Relating to the appointment to Federal office [(a)(2) of the PRA]
P-3 Release would violate a Federal statute [(a)(3) of the PRA]
P-4 Release would disclose trade secrets or confidential commercial or financial information [(a)(4) of the PRA]
P-5 Release would disclose confidential advice between the President and his advisors, or between such advisors [(a)(5) of the PRA]
P-6 Release would constitute a clearly unwarranted invasion of personal privacy [(a)(6) of the PRA]

C. Closed in accordance with restrictions contained in donor's deed of gift.

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Freedom of Information Act - [5 U.S.C. 552(b)]

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(b)(7) Release would disclose information compiled for law enforcement purposes [(b)(7) of the FOIA]
(b)(8) Release would disclose information concerning the regulation of financial institutions [(b)(8) of the FOIA]
(b)(9) Release would disclose geological or geophysical information

"INVITATION FOR DR. BROMLEY"

TYPE: INVITATION

DOCUMENT NUMBER: 9121637

SPEECH: YES NO

FROM: SALAM, Abdus and Louis Emmerij: THE THIRD WORLD
ACADEMY OF SCIENCES

DATE OF EVENT: 04/22/91

LOCATION OF EVENT:

TIME OF EVENT:

SUBJECT: INVITATION TO THE ROUNDTABLE ON "THE ESSENTIAL ROLE
OF SCIENCE IN TECHNOLOGICAL PROGRESS AND ECONOMIC
DEVELOPMENT" WHICH WAS ORIGINALLY PLANNED FOR
08/29-31/91.

RSVP: 06/19/91

CONTACT PERSON:

CONTACT NUMBER:

INVITATION ACCEPTED?

~~YES~~

NO

COPIES TO: INTERNATIONAL/POL

REMARKS:

DATE OF LETTER: 05/22/91

DATE RECEIVED: 06/05/91

FILE: p- INVITATION*INTERNATIONAL

Withdrawal/Redaction Sheet

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Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
02. Letter	To: Abdus Salam From: Allan Bromley Re: Global change research institute (2 pp.)	6/14/91	(b)(1)	

Collection:

Record Group: Bush Presidential Records
Office: Science and Technology Policy, Office of (OSTP)
Series: Bromley, D. Allan, Files
Subseries: International Files
WHORM Cat.:
File Location: International: General [5 of 6] [1991]

Date Closed: 5/3/2010	OA/ID Number: 62062-003
FOIA/SYS Case #: 2005-0336-F	Appeal Case #:
Re-review Case #:	Appeal Disposition:
P-2/P-5 Review Case #:	Disposition Date:
AR Case #:	MR Case #:
AR Disposition:	MR Disposition:
AR Disposition Date:	MR Disposition Date:

RESTRICTION CODES

Presidential Records Act - [44 U.S.C. 2204(a)]

P-1 National Security Classified Information [(a)(1) of the PRA]
P-2 Relating to the appointment to Federal office [(a)(2) of the PRA]
P-3 Release would violate a Federal statute [(a)(3) of the PRA]
P-4 Release would disclose trade secrets or confidential commercial or financial information [(a)(4) of the PRA]
P-5 Release would disclose confidential advice between the President and his advisors, or between such advisors [(a)(5) of the PRA]
P-6 Release would constitute a clearly unwarranted invasion of personal privacy [(a)(6) of the PRA]

C. Closed in accordance with restrictions contained in donor's deed of gift.

PRM. Removed as a personal record misfile.

Freedom of Information Act - [5 U.S.C. 552(b)]

(b)(1) National security classified information [(b)(1) of the FOIA]
(b)(2) Release would disclose internal personnel rules and practices of an agency [(b)(2) of the FOIA]
(b)(3) Release would violate a Federal statute [(b)(3) of the FOIA]
(b)(4) Release would disclose trade secrets or confidential or financial information [(b)(4) of the FOIA]
(b)(6) Release would constitute a clearly unwarranted invasion of personal privacy [(b)(6) of the FOIA]
(b)(7) Release would disclose information compiled for law enforcement purposes [(b)(7) of the FOIA]
(b)(8) Release would disclose information concerning the regulation of financial institutions [(b)(8) of the FOIA]
(b)(9) Release would disclose geological or geophysical information



THE THIRD WORLD ACADEMY OF SCIENCES

RECEIVED

OFFICE OF THE EXECUTIVE SECRETARY:

INTERNATIONAL CENTRE FOR THEORETICAL PHYSICS 434100 TRIESTE (ITALY) - P.O.B. 586 - MIRAMARE - STRADA COSTIERA 11
TEL.: (040) 2240-1 - CABLE: CENTRATOM ALEX: 40392 ICTP I

OFFICE OF THE
DIRECTOR

22 May 1991

Dear Mr. Bromley,

We are writing to you in connection with our former invitation for the roundtable on 'The Essential Role of Science in Technological Progress and Economic Development', which was planned to take place on the 29,30 and 31 August 1991.

Upon the request of many colleagues, who wanted to attend the roundtable but were unable to come, we have decided to postpone it to next year. The roundtable will take place from the afternoon of the 22 April to the 24 April 1992, (after Easter).

We would therefore like to cordially invite you to this meeting in the hope that the dates will be more suitable to you for your participation. You will find herewith enclosed the background information, as well as the amended draft agenda.

As we previously mentioned your living expenses here in Trieste will be covered by The Third World Academy of Sciences (TWAS) and the International Centre for Theoretical Physics (ICTP). Furthermore, should you or your organisation be unable to cover your travel expenses, we will be happy to do so.

Looking forward to hearing from you soon.

With best regards.

Yours sincerely,

Abdus Salam

Abdus Salam

Director of ICTP, President of TWAS

Louis Emmerij

Louis Emmerij

President of OECD Development Centre

Mr. D. Allan Bromley
Office of Science and Technology Policy
Old Executive Office Building
Washington, D.C. 20506
U.S.A.

THE ESSENTIAL ROLE OF SCIENCE IN TECHNOLOGICAL PROGRESS AND ECONOMIC DEVELOPMENT

I) Objectives

The relationship between economic development and technological progress has been well researched by the economic profession and there is probably not much to add to this debate, except that access to technology, particularly high technology is more crucial than ever in order for countries and enterprises to have access to global markets. What is as yet less well understood, however, is the link between technology and science and hence between economic development and science.

The frequent lack of understanding, and hence co-operation, between scientists and economists is a problem which is often raised. This problem stems partly from the nature of the responsibilities of the two sides: whilst the economists, in particular those involved in governmental decision-making and operating in the business and financial world, live under the strong pressure of short-term, frequently crisis-wrought and profit-orientated conditions, the scientists are involved in more long term activities, frequently searching for solutions to fundamental problems of the world, sometimes with an unpredictable outcome. There has not been sufficient dialogue between economists and scientists and the result has been that scientists have become ivory tower academics and economists have to rediscover human development.

In order to initiate dialogue between scientists and economists, therefore, a meeting is planned, with the following major objectives, placing a special emphasis on the South in order to clarify:

1. The relationships between:
 - a) Technology and the national as well as global economy
 - b) Technology and the science base of a country
2. The role of and co-operation between scientists and economists
3. How developing countries can acquire a scientific and technological basis through centres of excellence, to further economic development and protect the human environment

All participants are expected to play an active role either by preparing papers or as discussants.

The Roundtable will place much emphasis on the role and cooperation between scientists and economists, drawing them all together in a common endeavour towards the development and well-being of the people.

Procedure

The meeting will take place in Trieste at the end of August 1991 for a period of two and a half to three days. It will be co-sponsored by the ICTP, TWAS and the OECD Development Centre in Paris.

The conference will be in the form of a roundtable, with not more than fifty participants, in order to secure an efficient, less formal exchange of views, favouring concrete dialogue rather than "political" speeches.

The composition of the participants may be as follows:

1. Academic economists
2. Applied economists
3. Academic scientists
4. Applied scientists
5. Captains of business (industry and banks)
6. Governmental managers
7. Participants from international organisations

THE ESSENTIAL ROLE OF SCIENCE IN TECHNOLOGICAL PROGRESS AND ECONOMICAL DEVELOPMENT

PROGRAMME OUTLINE

DAY ONE

Wednesday, 22 April 1992

Afternoon opening session

Chair: L. Emmerij, who will give a five minutes opening speech.

Abdus Salam will give a 30 minutes presentation on the missing links between economists and scientists and between economics and science.

Most probably this will be a somewhat provocative statement and will therefore be followed by a series of spontaneous interventions.

At the end of this session two economists who have been warned in advance will sum-up the discussion in a more balanced fashion. This would also and quite neatly lead to the morning session of day 2.

DAY 2

Thursday 23 April 1992

Morning session

This session will be devoted to the topic Technology and Development. Here it will be primarily the economists who must give evidence on gaps and achievements with respect to clarifying the relation between technology and economic development.

Several economists will be asked in advance to introduce this topic. Quite a bit of work has been done in this area and the discussion must therefore be disciplined. This requires therefore an excellent Chairman.

Afternoon session

This will be devoted to the Role and Importance of a Science Base for increasing the technological autonomy of developing countries.

This session will lead us into the main theme of the conference. It should be introduced by two scientists who must be warned in advance.

This session must not only deal with setting out the reasons why a science base is important but must also discuss how such a base can be created.

DAY 3

Friday, 24 April 1992

Morning session

Since this is the last day of the conference, we must start bringing the different threads together. This session will therefore be devoted to the topic Science and Technology for Development to be introduced by one scientist, one economist and one businessman or banker.

On day two, the conference discussed technology and development on the one hand and the importance of a science base on the other. Here on day three we must bring these two discussions together by looking at the inter-relations between science, technology and economic development.

Afternoon session

This will be the concluding session with closing statements by Abdus Salam, an economist and a summary statement by L. Emmerij.

"CORRESPONDENCE TRACKING"

TYPE: INFORMATION

DOCUMENT NUMBER: 9121503

FROM: WRIGHTON, Mark S.: MIT

TO: DR. BROMLEY

DATE OF
CORRESPONDENCE: 05/17/91

SUBJECT: A COPY OF THE REPORT, "THE INTERNATIONAL
RELATIONSHIPS OF MIT IN A TECHNOLOGICALLY
COMPETITIVE WORLD". COMMENTS ARE WELCOME.

ASSIGNED TO:

ACTION REQUIRED:

SENDER'S DUE DATE:

OSTP DUE DATE:

DATE COMPLETED:

COPIES TO: D. Allan Bromley
INTERNATIONAL/POLICY
INDUSTRIAL

WHITE HOUSE TRACKING #:

CONTACT PERSON:

REMARKS:

DATE RECEIVED: 05/23/91

FILE: INTERNATIONAL



OFFICE OF THE PROVOST

MARK S. WRIGHTON
PROVOST
CIBA-GEIGY PROFESSOR OF CHEMISTRY

9121503
RECEIVED
01 MAY 23 811 18
OFFICE OF THE
DIRECTOR
CAMBRIDGE, MASSACHUSETTS 02139
TELEPHONE 617-253-1971
FAX 617-253-8812

May 17, 1991

Dr. D. Allan Bromley
Assistant to the President
Office of Science and Technology Policy
358 Old Executive Office Building
Washington, DC 20506

Dear Dr. Bromley:

Over the past academic year a study group composed principally of M.I.T. faculty has been reviewing M.I.T.'s international relationships and activities. The review was initiated in 1990 to advise the Institute on its policies toward foreign students, industry, and governments in light of the growing scientific and technological capabilities of other nations and of mounting international competition. The relation of our foreign ties to the nation's international economic position, a subject that has received considerable public discussions, was an important stimulus to the review.

In light of your interest in this subject, I thought you might like to see the report that is a product of the review. It has been recently completed and will be released to the press on May 20, 1991. Any comments would of course be welcome, either to me, or to Professor Eugene Skolnikoff who chaired the study.

Sincerely yours,

A handwritten signature in blue ink, reading "Mark S. Wrighton", is written over the typed name.

Mark S. Wrighton

Enclosures

The International Relationships of MIT in a
Technologically Competitive World

Faculty Study Group, Appointed by the MIT Provost, on the
International Relations of MIT

Eugene Skolnikoff, chair
Rudiger Dornbusch
Arnoldo Hax
Nancy Hopkins
Eric Johnson
Arthur Kerman
Philip Khoury
Richard Lester
Nicholas Negroponte
Jack Ruina
Richard Samuels
Kenneth Smith
David Hart, staff

May 1, 1991

The International Relationships of MIT in a
Technologically Competitive World

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**The International Relationships of MIT in a
Technologically Competitive World**

**Faculty Study Group, Appointed by the MIT Provost, on the
International Relations of MIT**

May 1, 1991

I. Introduction

The research universities of America provide education and scholarship of a quality that is the envy of the rest of the world. They have educated generations of students to contribute to industry, government, and to the universities themselves with advanced knowledge and skills; and they have contributed to the leadership of the U.S. in scientific and technological endeavors that have served the nation's economic, security and social purposes.

Today, there are new pressures and opportunities facing research universities. The social, economic and political setting in which they are embedded has changed dramatically, perhaps most strikingly in international affairs, as the scale of interactions among national economies and societies, the change in the security situation, and the worldwide growth of competence in science and technology have altered many traditional relationships. No country, no industry, no institution in society can ignore the effects of those transformations, nor the problems they pose for the wise conduct of affairs. Universities, with the responsibility for education for the future, must be responsive not only to what has already been experienced, but equally to the implications for tomorrow that will significantly affect all aspects of national and international affairs.

In this altered setting, universities must confront compelling new challenges. They must decide how best to prepare students for a world that is very different from that their teachers faced as students, and how to organize scholarship and education, particularly in science and engineering, in a world of intense economic competition among nations that is increasingly driven by the growing strength of science and technology abroad. As the relationship between university research and education and the nation's economic vitality seems to grow ever closer, the research

universities of the U.S. face increased scrutiny from a concerned public and may have to shoulder new and unfamiliar responsibilities. The national and international roles of these universities, in the past seen as mutually supportive, at times have the appearance of being in competition, with questions raised about the appropriate relationships that universities should have with foreign students, scholars, universities, business enterprises, and governments.

At MIT, these questions are particularly important, not only because of this institution's place among research universities, but also because of MIT's long-standing commitment to effective transfer of knowledge to the society at large, its large international student enrollment, and its extensive international ties and activities.

Accordingly, a Faculty Study Group was established in 1990 by the Provost, John Deutch, to examine the issues that are raised by this new situation, to advise the Institute Administration and Faculty on the general principles that should guide MIT's international activities and relationships, and to suggest any revisions in policies and activities that should be considered. We have interpreted our charge to focus primarily on the issues raised by the economic implications of research and education, but recognize that there are other intellectual aspects of the subject deserving attention. In particular, we consider curricular issues, especially with regard to the international dimensions of the undergraduate program, to deserve intensive consideration by the Faculty and Administration.

II. The historic relationships and principles of MIT

To establish the context for consideration of guidelines for the future, it is necessary to start from the past, to identify the important relationships and principles that have guided MIT until now.

From its establishment in 1861, MIT had a broad set of goals that emphasized both education and service to the community. Its focus was to be not only on the preeminent goal of providing the highest quality of training, but also on ensuring that technology be geared to the practical needs of society and made available for use. This stance was expressed in the original vision of MIT's founder, William Barton Rogers, and in its charter as a land-grant institution, which carried certain specific

obligations. Other public and private land-grant institutions (and other colleges as well, particularly those that grew from a religious base) share that explicit commitment to serving social needs.

The Institute recognized from its earliest days the importance of quality in its faculty and research as the key to its success in teaching and in the development of technology. It was this principle that led the Institute to be the originator of several new fields of technology, to be able to develop first-class scientific competence in the 1930s, and to be able to carry out successfully (in response to Government request) the enormous expansion of educational plant and research during the Second World War. The commitment to quality as a governing idea is deeply embedded, and it is expressed in a variety of general procedures designed to ensure the highest possible level for both faculty and students. It contributes as well to the integration of research and teaching, not only at the graduate level, but as part of undergraduate education as well.

In the conviction that open communication of the results of research is central to excellence in education, the functioning of science, and the effective transfer of knowledge, the Institute is committed to publication of all research, and to open access to the work of its laboratories and centers. Proprietary research was occasionally allowed under special circumstances at MIT before World War II, but has long since been prohibited. Classified research on the campus, which was introduced in the large wartime laboratories at the Institute, was accepted in the atmosphere of the Cold War until the 1960s. No classified research has been accepted on the campus since that time.

MIT's interest in practical applications meant that from the start the Institute had close ties to industry, and saw the transfer of knowledge from the laboratory to the world of commerce as an important operational goal. This has led to a variety of policies and activities, such as encouragement of faculty consulting for up to one day a week, faculty and student initiatives in the startup of new companies, industrial support for research, student internship programs with companies, an aggressive patent/licensing activity, the establishment of the Industrial Liaison Program in 1948,

and initiation of other industry-oriented activities.¹ MIT has incubated many institutional experiments and collaborations over the years, and its ability to respond to new problems that cross disciplinary borders often sets it apart from other universities.

The Institute has always strived for an atmosphere of non-discrimination that rejected distinctions other than those based on intellectual grounds. As an American-based institution, MIT naturally had more contacts with American industry and students than with those from other countries. However, until the Second World War, open communications with science and technology abroad, and welcoming of foreign students at MIT, proceeded without any bar. Wartime and postwar conditions altered that situation for a period of time, but recent decades have witnessed an enormous expansion of the international involvements of MIT.²

After the war, Federal funding became an important part of the financing of research at the Institute, as it did at all research universities. This funding was seen not only as a way of sustaining the research base that had been created during the war, but also as a response to the requirements of the Federal Government for research and development on subjects that the Government determined to be in the national interest. Federal support of research in the last two decades has been as high as 86% of the Institute's research budget; it has been gradually decreasing as a proportion of the total, standing at 75% in FY 1990.³ Industrial support of research is rising as a proportion of the whole, reaching about 15% in FY 1990, up from 5% in FY 1974. There is no realistic expectation, however, that industrial support can ever replace more than a portion of Federal support.

¹ A 1989 Bank of Boston study, "MIT: Growing Businesses for the Future," (Economics Department, Bank of Boston), for instance, showed that the 636 Massachusetts businesses founded by MIT-related individuals generated about \$40 billion in annual sales and employed approximately 200,000 people in the state.

² However, even in the wartime and postwar periods, the faculty was internationalized by an influx of European educators and researchers.

³ The total Institute on-campus budget has two major components: research and academic. The academic portion is provided mainly from non-government sources, including tuition, fees, endowment income, and gifts; it was \$338 million in FY 1990. The campus research budget was \$306.4 million that year.

As the postwar Federal relationship grew, MIT's traditional commitment to public service became an even more important element in the Institute's activities. Although the core of that commitment continues to be carried out through the performance of education and research at as high a level of quality as possible, there have been many examples of direct service over the years: programs to revise high school science curricula, to assist universities in developing countries, to give special attention to problems of American industrial productivity, and a wide variety of others. The largest single response to a request from the Government after the war was the agreement to found and manage the Lincoln Laboratory.⁴

III. What has changed?

The environment in which MIT has been functioning has changed in significant ways in recent years, leading to new programs and practices, and in some cases, challenging traditional principles. The most important of these changes can be briefly summarized.

First, the new level of international integration of societies and economies has been accompanied by the globalization of industry, easier and more extensive communication across borders, increased dependence within any country on developments and decisions in others, and growth of issues and technologies with worldwide dimensions. With this higher level of interdependence have come difficult international problems in economic, environmental and security areas, and a wholly new level of interaction in science- and technology-related issues across national borders.

At the same time, the level of competence in science and technology has risen markedly in most industrialized and many developing countries, so that the postwar dominance of the U.S. has significantly eroded. As a result, it is now essential for the health of science and technology in the U.S., as it was not so clearly in the

⁴ MIT continues to operate the Lincoln Laboratory, established in 1951, largely for the Department of Defense. Lincoln is part of MIT, but is outside the academic structure and the campus research budget, and classified research is conducted there. It is located in Lexington, about ten miles from the main campus. Its budget in FY1990 was \$420.1 million.

immediate postwar years, that American researchers have access to and keep abreast of research throughout the world.⁵ It also means that students must be educated to be able to engage in international exchange of knowledge, just as the faculty must have new skills for international interactions. And, it means that other nations are now much better positioned to benefit from research and development done in the U.S.

The presumption of a closer relationship than in the past between the laboratory and the commercial marketplace is another substantial shift. In the U.S., support for science has been predicated in part on the likelihood of economic benefit sometime in the future. Now, shorter product cycles, increased science-dependence of some technologies, and entrepreneurial activity of faculty and students in several fields suggest a closer, more immediate tie. The actual relationship is complex and varies among fields and technologies. Though the promise of quicker economic returns has been a spur to the support of science in the universities, it also has raised the level of concern about who has access to the research and when.

In this global, competitive, technologically-dynamic economy, American industry has not fared as well, with many exceptions, as might once have been expected, and finds itself under severe challenge from foreign industry.⁶ The reasons are complex and disputed, relating to management competence, time horizons on measurement of corporate performance, industrial structure, availability and cost of capital, training of the work force, government policy, and a host of other matters, including in particular the adeptness at translating the ideas of the laboratory into commercial

⁵ In some ways, international scientific and technological parity represents a return to the situation of the earlier decades of this century, when it was necessary to keep up with European developments in order to stay at the forefront of a field.

⁶ The casual use of "American" and "foreign" industry masks the blurring of the distinction between these terms. It is a source of dispute what meaning they have; the definitions may depend on where the primary research and development centers are located, where the maximum value-added takes place, the nationality of ownership, or where the headquarters is located. Notwithstanding the uncertainty, by and large there is still significance in where a firm's top management is located; we will continue to use that definition, recognizing it is an imperfect one. [For discussion, see Robert B. Reich, "Who is Us?," Harvard Business Review (January/February, 1990) and Laura D. Tyson, "They Are Not Us," The American Prospect (Winter, 1991).]

products.⁷

Added to the overall picture is the changing demographic situation in the U.S. that is both reducing the pool of eligible students born in the U.S. who might become engineers and scientists, and increasing the proportion of college-age Americans that come from disadvantaged educational backgrounds. The weakness of K-12 education in many parts of the U.S. has had a significant impact on higher education in science, engineering, and management. These patterns have made American research universities and industry increasingly dependent on students and trained workers from abroad who elect to remain in the country, especially those with graduate degrees. Fortunately, from this perspective, the quality of higher education in the U.S. remains attractive to students from foreign countries who, by remaining here, enhance the intellectual climate and research base.

Finally, the changing financial situation of American universities is significant. The uncertain availability of adequate public resources for research at a time of increasing educational, research, and facilities costs has led universities to mount aggressive fund-raising activities. The decline in Federal support for research equipment and facilities in recent years has increased the need to find resources to supplement, and support, those coming from public sources. For private universities in particular, the availability of resources is a matter of considerable anxiety, with little prospect that the situation will improve in the near future. The result is a continuing search for new and previously untapped sources.

In response to these developments, MIT has itself markedly evolved over recent decades, with greatly expanded international contacts and cooperation, development of research and teaching about foreign countries and international issues, attention to emerging problems of global dimensions, new educational and research programs targeted at problems in the American economy and in the transfer of knowledge, special programs to learn more from the U.S.'s primary competitors, increased efforts in domestic and international fund-raising, and innovative educational programs to prepare students for the altered international environment into which they will

⁷ A major report on this set of issues, Made in America (MIT Press), was published by the MIT Commission on Industrial Productivity (chaired by Professor Michael Dertouzos) in 1989.

graduate.

But, new questions have emerged that have not had to be posed before, or at least for which the answers previously seemed self-evident. They touch on many central, and sensitive, aspects of university life: openness of research, discrimination in access, selection of students, relationships to professional colleagues abroad, responsibility to the surrounding community, and others. All can be subsumed in the question of how, in this changed and changing environment, MIT should respond to any conflicts that may exist between its responsibilities to the nation and its role as a major participant in a worldwide scientific and technological system.

After extensive meetings, discussions and collection of data, we have formed strong views on the various aspects of this question. We have found that the principles that we believe should guide MIT's behavior are reasonably clear and deserve to be vigorously asserted. We have also found, not surprisingly, that general principles often do not give precise guidance in specific situations, or may be in conflict with each other; particular cases present awkward shades of gray, rather than black and white contrasts.

We will present first those general principles that we believe should be the primary guidelines for the international commitments and interactions of MIT. Following that, and constituting the bulk of the report, we look at more detailed aspects of MIT's international relationships, presenting our views of the policies that should govern those relationships. Finally, we offer some recommendations for the policy process at MIT that we believe to be necessary for effective implementation of our other recommendations.

IV. General principles

MIT is a research university committed to fostering education and advancing knowledge for the betterment of the human condition. It is, at the same time, a national institution rooted in American culture and traditions and an integral part of the nation's education and research system. MIT's responsibility to the nation in which it was founded and nurtured is served first and foremost by maintenance of its position as a premier institution in education and research in science and technology.

The commitment to maintain preeminence mandates that quality be a primary criterion for selection of faculty and research staff and admission of students. Compromise in that criterion in personnel decisions on grounds of nationality, source of support or other dimensions, will inescapably lead to decreased intellectual capacity and performance.

To remain a premier institution requires that MIT be thoroughly engaged in international activities in science and technology; the practice of high-quality scientific and technological research implies the ability to interact fully and openly with research wherever it is carried out. Thus, in order to fulfill its basic responsibility to the nation, it is essential that MIT maintain openness of research and education, that the Institute be an active participant in international scientific and technological communities, that faculty and research staff be able to interact freely with colleagues abroad and have ready access to research in other countries.

MIT's commitment to openness and full participation in international activities is also an expression of its responsibility to the international intellectual community that is dedicated to the free and open exchange of ideas.

Yet, many intellectually challenging and socially important problems are national, regional, or local in scope. Among the most significant is the health of the U.S. economy, which, though heavily influenced by developments in the world economy, depends ultimately on actions taken at home. MIT's intellectual focus on science and technology, its traditional commitment to effective transfer of knowledge to industry, its responsibility to the nation, and its own self-interest all dictate a vital concern with the performance of the American economy. At a time when domestic productivity growth is lagging and international economic competition is intensifying, the effective transfer of knowledge to American industry must remain an important aspect of the Institute's mission.⁸ We believe that MIT should intensify its emphasis

⁸ In recent years the Institute has undertaken a number of initiatives with the aim of improving American industrial performance. Some of the more prominent of these are the MIT Commission on Industrial Productivity, the Leaders for Manufacturing program, the MIT-Japan program, the Microsystems Technology Laboratory, the new activities of the Technology Licensing Office, the Biotechnology

on ways to contribute to the health of American industry and the U.S. economy.

Occasionally, there may be major conflicts between national and international roles. In the resolution of such conflicts, we believe the Administration, with the advice of the Faculty, should give primary weight to the general responsibility to the nation.

In carrying out its various missions, MIT must also recognize the principle that the Institute's education and research activities, whether national or international, should be solidly based in faculty interest. As with all universities of quality, it is the scholarly and entrepreneurial enthusiasm that wells up from the faculty that leads to successful programs, not those designed from above or outside. The MIT Administration can create a climate that encourages programs that serve broader societal objectives, but cannot lead the faculty where it has no intellectual interests.

To be able to carry out its missions it is essential that the Institute maintain an adequate resource and funding base, but the conditions under which those resources are raised must be consistent with these principles.

We believe, therefore, that the general principles that should guide MIT's international activities are:

1. MIT is a research university committed to fostering education and advancing knowledge for the betterment of the human condition. It is, at the same time, a national institution rooted in American culture and traditions and an integral part of the nation's education and research system.
2. MIT's responsibility to the nation in which it was founded and nurtured is served first and foremost by maintenance of its position as a premier institution in education and research in science and technology.

Process Engineering Center, and the Laboratory for Manufacturing and Productivity. A new Institute-wide program on productivity and industrial performance will continue the work of the Productivity Commission. For details on many of these initiatives, see section V.D below.

a. To remain a premier institution requires that MIT be thoroughly engaged in international activities in science and technology; it must be a full participant in the world trade in ideas.

b. The commitment to excellence requires that quality be a leading criterion in the selection of faculty and research staff and admission of students, and that solid faculty interest be a prime requirement for the establishment of new programs.

c. Openness of research and publication at MIT must be maintained to enable the most effective conduct of scientific and technological research and education, to permit the faculty to interact fully with colleagues abroad, and to fulfill MIT's responsibility to the international intellectual community that derives from the dedication of that community to the free and open exchange of ideas.

3. In the resolution of major conflicts between MIT's national and international roles, the Administration, with the advice of the Faculty, should give primary weight to the general responsibility to the nation.

4. The traditional commitment of MIT to the transfer of knowledge to the community at large should be intensified, with expanded emphasis on the ways the Institute can contribute to the health of American industry and the U.S. economy.

5. The Institute depends on adequate resources to carry out its activities and execute its programs, but conditions under which those resources are obtained must be consistent with these principles.

V. Specific international relationships

A. International students, alumni, and faculty

We have chosen to address questions raised by the presence of substantial numbers of international students and faculty at MIT (and of alumni abroad) first since education is central to MIT's mission. This is not, however, the area in which the deepest conflicts of principle are likely to arise.

1. Undergraduate students

The primary goal of the undergraduate program is education, although undergraduates also take an active part in research at MIT. International students provide a degree of diversity which we believe is today an essential aspect of the educational experience of MIT undergraduates.

As of December, 1990, international students comprised 8.7% of the undergraduate population.⁹ This proportion is up from 5.2% ten years ago. The undergraduate admissions process establishes a separate category for international applicants. A restricted number of places is allowed for this group of applicants, with a target of about 8% of the incoming class. The competition for admission within this pool is fierce, with less than 5% of these applicants being accepted last year. The target for acceptances is set by the Faculty Committee on Undergraduate Admissions and Financial Aid and has not been revised in recent years. The growth in the proportion of international undergraduates has been within the limits set in the past, but is now pressing these limits.

The debate about the appropriate proportion of international students to admit to the undergraduate population at MIT has a long history. If the number of international students were too small, the undergraduate educational experience would be insufficiently rich to prepare students well for effective participation in an increasingly interdependent world. In addition, too few opportunities might be offered to those with outstanding potential from outside the U.S. who would benefit from an MIT education. On the other hand, if the number of international students were too large, MIT would not be serving the nation as well as it should through the education of American citizens to meet the needs for trained scientists, engineers, managers, and other personnel. "Too few" and "too large" cannot be quantified in any precise fashion, but we believe the proportion of international undergraduates is about right.

⁹ The figure of 8.7% includes Canadian and Mexican citizens, but not permanent foreign residents of the U.S., following the procedures of the MIT International Students Office. However, Canadian and Mexican citizens are included in the domestic pool for undergraduate admissions. There are currently 45 Canadian and 20 Mexican undergraduates.

Undergraduate tuition covers only about one-third of the total cost of education, the remainder being made up from endowment income, fees, and other sources, including some Federal support. We therefore considered the possibility of raising the tuition of those international students who are able to pay, so that they would pay a larger fraction of the true cost of education and not receive an indirect MIT subsidy. Such a policy, however, would have only minor financial effects and would send a strong message abroad that would be likely to deter applications from less well-to-do foreign students. As a result, MIT would lose an important source of the diversity it seeks in recruiting abroad, and the policy of differential tuition would be counterproductive. We therefore rejected this proposal.

At present, financial need is assessed after admission, with all admitted applicants treated identically even though financial need of international students is harder to determine. Aid policies are uniform, except for those Federal assistance programs that are limited to American citizens. We believe that such Federal incentives for Americans to study science and engineering are appropriate, but also that nationality-blind provision of financial aid should be maintained.

Our conclusions are:

- 1. International students provide an essential element of diversity in the undergraduate student body; the present proportion of international undergraduates appears to be about right.**
- 2. Federal assistance programs that are limited to American citizens for undergraduate study are appropriate, but MIT's nationality-blind tuition structure and provision of financial aid should be maintained.**

2. Graduate students

At the graduate level in science and engineering, research and education become essentially indistinguishable. Academic quality, based on preparation and likelihood of contributing to research, should continue to be the overriding criterion for admission.

International students constituted about 33% of MIT's graduate student population at the end of 1990, among the highest in the nation. This proportion compares with about 26% a decade ago. In many areas of study, however, MIT's international population is not unusually large. About 40% of the MIT doctorates awarded in engineering, for instance, are received by students who are not citizens, a figure that is somewhat less than the national average. The distribution of international students across the graduate fields of the Institute is quite uneven. In the sciences, for example, international students make up about 34% of the graduate student population in physics, 55% in math, but only 14% in biology. In engineering, international students comprise 25% of the graduate student population in electrical engineering and computer science (EECS), 50% in nuclear engineering, and 56% in civil engineering.

Unlike undergraduates, graduate students are admitted by a process administered by MIT's academic departments. Procedures for admission of international students vary widely. In some departments (such as biology and EECS), the number of high-quality applicants from both the U.S. and abroad is far greater than the number of places. The graduate admissions process in these cases resembles that for the undergraduate student body, in that limits (formal or informal) on admission of foreign applicants have been in place for a number of years. The proportion of international graduate students in these departments tends to be lower than the Institute average. We believe this is an acceptable means to ensure adequate opportunities for Americans, without violating the criterion of quality.

Financial aid is usually allocated by departments at the time of admission. As with undergraduate financial aid, some graduate financial aid processes tend to favor American students, in part because Federally-funded programs such as NSF fellowships and NIH traineeships are restricted to American citizens. This seems an appropriate partiality in view of the importance of encouraging greater interest among American students in graduate fields of science and technology.

Some of the recent MIT curricular initiatives designed to address American needs, often in collaboration with American industry (such as Leaders for Manufacturing, conducted jointly by the Schools of Engineering and Management), naturally target American students and raise the question of whether students from countries other than the U.S. should be admitted to these programs. We would expect

American students to be predominant among those admitted to such programs, but there should not be a prohibition on participation by international students.

Occasionally, admission of international students to specific fields of study or from particular countries may raise questions extraneous to the academic enterprise, in fields relevant to nuclear proliferation, for example. There should be a clear process in the MIT structure to which these questions can be referred for resolution. International students, as all others, once admitted should not be excluded from research and education activities on the grounds of nationality.

With regard to graduate students, our conclusions and recommendations are:

1. Limiting the proportion of international students in those fields in which the pool of qualified American and foreign applicants is very large is an acceptable policy to ensure adequate opportunities for Americans without violating the criterion of quality.
2. Financial aid policies that favor American citizens, usually mandated in Federal programs, are appropriate as a means to encourage more interest among Americans in graduate programs in science and technology.
3. Some curricular initiatives designed to address American needs, such as Leaders for Manufacturing, naturally target American students. We would expect American students to be predominant among those admitted to these programs, but there should not be a prohibition on participation by international students.
4. Occasional questions of admission of international students to specific fields or from particular countries may emerge because of issues extraneous to the academic enterprise, such as concern about nuclear proliferation. There should be a clear process in the MIT structure to which these questions can be referred for resolution.

3. Alumni

The employment of students upon graduation is a major channel for transfer of knowledge from academia to industry. Thus, MIT alumni, whether U.S. citizens or not, who join industrial firms abroad may become factors in increasing foreign

competition for American firms. Similarly, U.S. firms hire both American and international alumni, who then contribute to American competitiveness. The flow is not balanced, though; a large fraction of international students, especially those from developing countries, elect to stay in the U.S., resulting in a net inflow that is of great importance to American industry and universities and, correspondingly, often of concern to their home countries. A survey of R & D directors of high-technology firms by the National Academy of Engineering, for example, revealed that they believe their industries are dependent upon foreign talent and that this dependency is increasing. Some 60% of foreign doctoral students intend to stay in the U.S. after graduation.¹⁰

Those international students that do return home after graduation from MIT and go into industry tend to rise in their companies, with a substantial proportion becoming high officials or CEOs of their firms. Of the MIT alumni living abroad for whom records are available, some 700 out of 9000 have titles of senior officials of corporations. These individuals typically remain very loyal to MIT and retain a fondness for American life, though they obviously are applying their acquired skills for the fortunes of their firms and the welfare of their nations.

The fact that future scientific, engineering, industrial and governmental leaders of other nations have spent their formative years in this country can provide a variety of benefits to the U.S. in the general advance of science, research collaboration, business relationships, and political interests. Those benefits can be important, but they will not be uniformly realized, and in any case cannot be assured

¹⁰ National Academy of Engineering, Foreign and Foreign-Born Engineers in the U.S. (Washington: NAS, 1988), p. 3. National Research Council, Summary Report 1989: Doctorate Recipients from U.S. Universities (Washington: NAS, 1990), p. 46. The data on the rate at which international students stay in (and American depart from) the U.S. are not very complete, but the available data suggest that there has been no change in the rate over the past decade. There is anecdotal evidence that a few countries, notably Taiwan and Korea, have become better able to attract their former nationals back in recent years by providing a more congenial and productive climate for their work, but this effect may have been counteracted by an increased likelihood that students from other countries (such as China) will stay. See Michael Finn and Sheldon Clark, "Estimating Emigration of Foreign-Born Scientists and Engineers in the U.S.," unpub., Labor and Policy Studies Program, Oak Ridge Associated Universities, January, 1988, and Stephen K. Yoder, "Reverse Brain Drain Helps Asia But Robs US of Scarce Talents," Wall Street Journal, April 18, 1989, p. 1.

or measured in advance.

On balance, we believe the net flow of benefits from the training of students from abroad is strongly in favor of the U.S., particularly reflecting the importance to the American economy of international students who remain in the U.S.

The tendency of foreign students to stay in the U.S. has led to a resurgence of concern about a "brain drain" from developing countries. MIT makes little provision for tailoring its engineering and science education to the needs of those countries, which adds to the likelihood that students from those countries will be dissatisfied if they return home. In effect, MIT's education provides an incentive for them to stay in the U.S.

We do not believe that MIT should change the core of its curriculum to respond to the brain drain. The unique quality of the MIT curriculum depends on its close interaction with the cutting edge of research, which cannot be altered by fiat. In fields in which issues of particular concern to developing countries form important parts of the research agenda, such as urban studies, political science, and civil engineering, MIT does have a focus on those countries and offers relevant courses and research opportunities. But, in the majority of the fields at MIT, the domestic needs of developing countries are not directly addressed. We believe this is an appropriate policy in the light of MIT's primary missions, even though it is one that can have significant effects on developing countries. The brain drain issue is not one that can be dealt with at the level of the university, but requires attention by the U.S. Government and by the countries concerned. This is not intended to rule out special programs at MIT for developing countries as an aspect of MIT's educational and public service roles.

Our conclusions and recommendations with regard to alumni are:

1. **Graduates constitute an important channel for transfer of knowledge from the university to the institutions they join, domestic or foreign. A large fraction of international students elect to stay in the U.S., and have become an essential resource for American industry and universities. Even those who return home provide long-term benefits to the U.S., as well as to their home country. On balance, the net flow**

of benefits from the training of students from abroad is strongly in favor of the U.S.

2. The concern that students coming from developing countries may not return home after graduation is an important one, but we do not believe MIT should modify its curriculum in response. The brain drain is a problem primarily for the students and countries concerned, and for U.S. foreign policy.

4. Faculty

American universities have come to depend on foreign-born staff, especially in science and engineering, proportionally even more than American industry. A national survey of department heads in 1986 found that about 10% of all faculty in science and engineering were non-citizens, and many more were naturalized citizens. In 1985, 47% of junior faculty positions (under 35 years of age) on engineering faculties across the country were held by non-citizens.¹¹ At MIT, some 17% of assistant professors are not citizens or permanent residents; about 30% of all faculty members were born abroad.¹²

MIT hires faculty and senior research staff without discrimination on the basis of nationality, a policy we believe to be essential to fulfill MIT's commitment to preeminence in research. Immigration rules permit MIT to seek permanent resident status for people given faculty and senior research appointments; this status provides a strong incentive for these individuals to remain in the U.S. throughout their careers.¹³

Our conclusion with regard to faculty is succinct:

1. MIT must continue to offer faculty and research positions at the Institute on the

¹¹ National Science Board, Report of the NSB Committee on Foreign Involvement in U.S. Universities, [NSB 89-80] (Washington: National Science Foundation, 1989), p. 10. NAE, op. cit., p. 76.

¹² Indeed, 6 of the 12 members of this study group were born outside the U.S.

¹³ Regulations implementing the new immigration bill may make the employment of non-citizen junior researchers, such as postdoctoral fellows and associates, more difficult. We hope that such limitations are avoided.

basis of quality, without reference to country of origin.

B. Access to research at MIT

Research is a central mission of MIT. The majority of research underway at American universities is funded by the Federal government, and Federal funds have contributed to a considerable portion of the physical plant and research facilities. MIT is no exception. In 1990, for example, Federal funds accounted for 75% of the MIT campus research budget. Should there be, as a consequence, any conditions placed on access to this research on the part of individuals or corporations from abroad who have not contributed to the development of the research base? Some have made that argument, advocating either restrictions on access or special payments to compensate for "cream-skimming."¹⁴ The argument deserves serious consideration.

The investment of Federal funds in American research universities has been of great value to the strength and vitality of the nation. The development of a productive academic education and research system, producing graduates of quality and highly-valued research, is an American success story, which other nations have tried to emulate with mixed success. There can be no doubt that much of the past investment has already paid off handsomely. The challenge is to see that it continues to pay off in the future.

A crucial element of the vitality of the research enterprise at a university is open communication. With the spread of high-quality science and technology around the globe, open communication with foreign colleagues has become even more important. For the investment of the Federal government in university research to continue to be fully productive - and from our perspective for MIT to remain a preeminent research and education institution - openness must be maintained in the U.S. and should characterize relationships with colleagues abroad.

¹⁴ Some of the leading figures in U.S. science and technology policy have used the argument. See, for example, the speech of Frank Press, president of the National Academy of Sciences, entitled "Do the Right Thing," to the annual meeting of the Academy, April 24, 1990, and former NSF Director Erich Bloch's letter to Issues in Science and Technology (Summer, 1990), p. 12.

Along with inputs of knowledge, adequate funding is needed for the past investment in research to continue to be fruitful. MIT finds itself in a demanding financial situation, with research and educational costs increasing and much tighter sources of support, particularly from the Federal government. Compared to other leading universities, MIT is in an especially difficult bind, because its endowment is relatively small in proportion to its scale of activities, and because its emphasis on science and technology means that fields with high and rapidly rising costs are a large percentage of the budget. In this climate, MIT is making an intensive effort to raise additional income.

Other nations have undoubtedly benefited and still benefit economically from the American investment in science and technology. Indeed, their ability to do so was an explicit objective of U.S. foreign policy for many years after World War II. (The U.S., we note, benefited in a similar way from the science and technology investments of European nations made before the war.) As beneficiaries of past investments, we think it appropriate - and indeed necessary - that foreign firms and nations help to ensure that the research base is maintained by adding money as well as knowledge to it.

This is not to mean suggest that most of the economic benefits of MIT research flow abroad. Preliminary results of a recent survey of the faculty and research staff suggest that the preponderance of their formal and informal contacts with industry is with U.S.-based corporations. About three times as many personal contacts were reported with U.S. firms than with either Western European or Japanese firms, for instance.¹⁵ Proximity and cultural factors also help to make the transfer of knowledge in these much more numerous contacts easier and more effective with American firms than with foreign firms, other factors being equal.

Nonetheless, we have no doubt that MIT's international relationships that provide access to research are growing. The implications of those relationships can best be assessed, understood, and responded to by considering the specific characteristics of

¹⁵ This survey was conducted under the auspices of the study group by Professors Richard Samuels and Eleanor Westney with a grant from the Sloan Foundation. Final results will be published in the near future.

each.

1. Visiting faculty, post-docs, and research scientists

A particularly important route for learning about research at MIT is through visits to faculty and laboratories. Visitors not only can gain access to research results in preliminary and prepublished form, they also can learn about the direction of research and about more intangible aspects of processes and techniques.

The most effective transfer of knowledge usually occurs in the course of long-term visits (a semester or more) where the understanding of the subject is equivalent and the MIT and outside researcher are working toward similar goals. Faculty routinely invite long-term visitors to the Institute on the basis of their knowledge and expertise, both to contribute to research projects and to learn from their stay. In some fields, in fact, post-doctoral experience is considered to be an essential qualification for research and academic positions.

Openness in the exchange of knowledge should be a condition for all long-term visits to MIT, and should be especially observed when university research is close to industrial practice. This is not a condition that can be defined with precision, or be fully assured in advance of a visit. Essentially, it means that the host should have a realistic expectation that visitors will participate appropriately in the research underway, be willing to share their own skills and knowledge, offer seminars or other opportunities for presenting work being carried on elsewhere, and in general be full scientific colleagues without constraint.¹⁶

If genuine openness exists, foreign visitors, including those from industry, are a valuable resource both as contributors to research and as sources of knowledge about work outside the U.S. Preliminary results of the faculty survey cited above show that about 25% of the respondents believed that their research benefited from interactions

¹⁶ It is worth noting that American parochialism is a factor that inhibits learning about the work of others outside the U.S. The NIH (not-invented-here) syndrome can still bedevil the acquisition of knowledge from willing visitors, in the outdated belief that research in other countries couldn't be equivalent to that in the U.S.

with companies based in Western Europe; an equal number responded similarly with regard to Japanese corporations. Restrictions on visitor access from abroad would impair this increasingly important source of ideas and skills.

The responsibility for ensuring that the condition of openness is met can only be carried out by individual faculty or laboratories in their selection of visitors, and in the conduct of relationships once they are here. With understanding of this responsibility, which we believe should be reinforced by a statement of policy from the Administration, we do not believe any areas of research at MIT should be prohibited from hosting visitors from abroad if the faculty wish. Acceptance of visitors should always be at the Institute's discretion.

Short-term visits in which the visitor is not deeply versed in the area of interest will not result in a significant transfer of knowledge beyond what is generally available through publications and conferences. Such visits would not be expected to be fully equivalent in the flow of information between the participants. On the other hand, even short visits to a laboratory can elicit considerable detailed technical information of potential commercial value if a visitor is well-qualified and prepared, and interested in specific MIT material; in those cases, faculty should be conscious that it is their prerogative to insist on more than a one-sided conversation.

MIT has many visitors, both short and long-term. Because the Institute is highly decentralized, a complete count of these visitors is not available. The Institute does track those with appointments and those foreign visitors for whom contact with the State Department is necessary. There are 84 visiting professors, for example, of whom 28 (33%) are foreign. Of the roughly 1250 foreign scholars on-campus in the current academic year (including professors, visiting scientists and engineers, post-docs, research affiliates, and others), only 91 were paid fully or partially by foreign industrial firms.

While this indicates that most of the visitors from abroad are not from foreign industry, but from universities, governments, and other organizations, there are

probably more long-term visitors at MIT from foreign than from domestic industry.¹⁷ This is apparently because of a different, and lesser, valuation placed by American industry on the knowledge and skills that can be gained from such extended visits. In our meetings, we heard of a distressing number of unsuccessful efforts by MIT faculty to induce American companies to send staff for extended visits to promising technical programs. Many of these programs then elicited considerable interest from foreign firms. We recommend that the faculty continue to seek American industrial involvement in their laboratories, and we encourage the Administration to explore additional efforts to encourage long-term visitors from American industry.

Industrial sponsors of long-term visitors are often charged a special fee by host laboratories at the Institute; the decision to levy such a charge and determination of its scale are left to the individual laboratories. A standard policy of charging a higher fee to visitors from foreign firms and governments seems to us to be appropriate, except in special circumstances, on the grounds that they are benefiting from current and prior investments made by American sources. In those cases in which it has been difficult to attract visitors from American corporations, there should be a willingness to waive an American company's fee if that would serve to encourage greater response.

At times there may be some research areas, for example those raising concerns over proliferation of weapons, in which the participation of non-American visitors might raise questions that are not strictly related to academic pursuits. These situations are likely to be quite rare, but when they arise should be dealt with through an established Institute procedure.

Our conclusions and recommendations with regard to visitors to MIT are as follows:

- 1. Long-term visitors are normally invited to the Institute to participate in research programs on the basis of their knowledge and expertise relevant to the research objectives of faculty and laboratories. Openness in the exchange of knowledge should**

¹⁷ There is no central apparatus at MIT that tracks the home institution of visitors who are U.S. citizens.

be a condition for all long-term visits, and should be especially observed when university research is close to industrial practice. Acceptance of visitors should always be at the Institute's discretion.

2. The responsibility for ensuring that visitors meet the condition of openness can only be carried out by individual faculty or laboratories in their selection of visitors, and in the conduct of relationships once they are here. With understanding of this responsibility, which should be reinforced by a statement of policy from the Administration, we do not believe any areas of research at MIT should be prohibited from hosting visitors from abroad if the faculty wish.

3. Short-term visits are generally of lesser concern with regard to the transfer of knowledge, but when a visitor is in a good position to gain valuable technical information, the faculty or research staff member has the prerogative to insist on more than a one-sided conversation.

4. A standard policy of charging a higher fee to visitors from foreign firms and governments seems to us to be appropriate, except in special circumstances. The distressing difficulty of stimulating long-term visitors from American corporations may dictate a willingness to waive fees for them. The Administration should consider additional means for encouraging more long-term visitors from American corporations.

5. As with international graduate students, occasional issues extraneous to academic pursuits may arise in specific fields or with regard to visitors from particular countries. There should be a clear process in the MIT structure to which these questions can be referred for resolution.

2. Support of research

MIT undertakes sponsored research that advances the education and research missions of MIT, fulfills the intellectual interests of the faculty, provides an enriching experience for students, and can be freely and openly reported. One of the key elements in the strength of American research universities, by comparison with those in other countries, has been their commitment to the integration of research and education.

In recent years, MIT has attracted research support from a number of foreign-based companies. In 1990, approximately 3% of the campus research budget came from these sponsors.¹⁸ This constitutes about 20% of all industrial funding.

Although industrial support of research is only 15% of research support at MIT, and foreign support of research is only a fraction of that, concern has been raised as to whether foreign support diverts the direction of research to problems defined by foreign, rather than American, industry. There is no doubt that there are complex interactions between the availability of funding and the setting of research objectives. But, as long as (1) the faculty has autonomy in deciding what research has scientific and technological merit, (2) the work has similar conditions of access as other research at the Institute and will be freely and openly reported, and (3) there are no atypical benefits of the results accruing to the sponsor, foreign research support is fully acceptable. In fact, such support provides mutual benefit to all parties for it helps to keep U.S. academic research abreast of the research frontiers of interest to foreign enterprises, provides information in the process about the state of knowledge abroad, and helps to maintain research and education in the U.S.¹⁹

In our view, therefore, foreign sources of support for research are as appropriate as domestic, as long as they satisfy the standards for all research sponsorship; indeed, such support adds to the U.S. research effort. While they may have early access to the results (at the same time as a faculty member's normal communications with colleagues in the same field), sponsors cannot restrict dissemination of research results beyond a brief delay for consideration of protection of intellectual property. Early access to research results may provide a small commercial advantage, but it is rarely decisive, as many cases discussed in Made in America demonstrate. Provision for licensing of any resulting MIT patents are subject to negotiation at the time of the establishment of the research contract. Any such licenses would be subject to

¹⁸ These figures refer only to projects with single sponsors. We estimate that inclusion of multiple-sponsor projects would add 1-2% to the foreign share of all on-campus research sponsorship at MIT.

¹⁹ Many faculty have observed that funding from foreign sources often comes with fewer strings and reporting requirements than does support from U.S. sources.

the "substantial U.S. manufacture provision," as are all MIT licenses (see below).

In all cases, bona fide students at the Institute should be eligible for participation in research, whatever their country of origin, with the research sponsor having no say in their selection. To our knowledge, no foreign sponsors have requested such authority. Long-term visitors to the Institute arranged as part of research support should meet the same conditions as all such visitors.

In the context of MIT's broader responsibilities to the nation, the Administration and Faculty should be particularly sensitive to identifying research opportunities that are responsive to the needs of American industry, and be willing to offer American companies an early chance to invest in particularly promising research ideas. Occasionally, in developing projects intended to contribute to American industrial objectives, consortia of companies are formed to provide research funding that exclude participation of foreign companies. Such programs provide important ways to fulfill MIT's national responsibilities and raise no issues of principle as long as:

- a. other faculty outside the program remain free to pursue their research with any sponsor, even if the subject is similar to, or in competition with, that of the program;
- b. all the resulting research has similar conditions of access as other research at the Institute and will be freely and openly reported; and
- c. there are no restrictions other than academic placed on students who take a part in the research.

Our conclusions and recommendations on the international issues that arise with regard to the support of research are as follows:

1. MIT undertakes sponsored research that advances the central missions of the Institute, fulfills the intellectual interests of the faculty, enriches student experience, and for which results can be freely and openly reported. Foreign sponsorship of research is entirely appropriate and provides mutual benefits, as long as it contributes to MIT's education and research missions and satisfies all other relevant criteria, such

as standard conditions of access to research in progress and open reporting of research results.

2. All bona fide students should be eligible to participate in any MIT research, without reference to country of origin, and with no say in their selection by research sponsors. Long-term visitors to the Institute arranged as part of research support should meet the same conditions as all such visitors.

3. The Administration and Faculty should seek opportunities, consistent with MIT research interests, to engage in research that is responsive to the needs of American industry, and be willing to give American firms an early chance to invest in promising new research ideas. That may at times involve exclusion of foreign firms from research consortia; such programs of limited sponsorship provide important ways to fulfill MIT's national responsibilities and raise no issues of principle, as long as they do not constrain the research interests of other faculty or their freedom to work with other sponsors, and satisfy all other criteria relevant to any research sponsorship.

3. Faculty consulting and off-campus visits

In addition to meeting and working with industrial visitors on-campus, faculty members often visit industrial sites. Their purposes are diverse. Some are consultants, in accordance with the MIT "day-a-week" rule, serving their individual professional goals. Some have been invited because a corporation is supporting a research project, or has donated the chair held by the faculty member. Others are meeting with scientific colleagues to exchange information. Still others may be conducting research.

These visits are a natural aspect of an MIT appointment and serve to stimulate professional development, provide a channel for knowledge transfer to and from industry, and give faculty members new insights into industrial problems. Preliminary survey results indicate that the vast majority (77%) of the consulting contacts of MIT faculty with industry are with American industry. The dominance of domestic firms in these consulting contacts strongly implies that the transfer of knowledge through these visits continues to be mainly to American industry.

Visits to foreign corporations, however, can be valuable to the education and research missions of MIT. For example, a 1987 survey of the faculty found that the most important correlate of faculty interest in Japanese scientific and technical literature - an increasingly important source of information - was a personal visit to Japan.²⁰ Such visits, when conducted as part of a university (rather than private) relationship, should be subject to the same conditions with regard to openness in the exchange of knowledge that apply to meetings with foreign visitors on campus.

In fact, the importance of gaining information about scientific and technological developments in other countries, particularly in industry, leads us to recommend that, whenever possible, reciprocal visits be built into agreements to receive visitors at MIT. This can assist in gaining access to laboratories, such as in Japan, that have often been inaccessible in the past.

Our conclusions and recommendations with regard to visits to industrial laboratories are:

1. Visits by MIT faculty and research staff to corporations in the U.S. and abroad are a frequent occurrence, based on a variety of university and private relationships. The dominance of contacts with American firms strongly implies that the transfer of knowledge through these visits is mainly to American industry. Those visits that are a result of university activity should be subject to the same conditions of open exchange of knowledge that apply to meetings with visitors at MIT.
2. Visits to foreign industrial laboratories and other facilities by MIT faculty and research staff can serve to increase the flow of information from abroad, which is of increasing importance to research objectives; whenever possible, such reciprocal visits should be made part of agreements to accept foreign industrial visitors at MIT.

²⁰ Samuels, Richard, and Westney, Eleanor, "Japanese Scientific and Technical Information at MIT," Center for International Studies, MIT Japan Science and Technology Program #87-01 (1987).

4. Commercialization of results of research

Access to the results of research at the university is just one, and perhaps not the most difficult, step in the commercialization of new processes or products. Of greater importance is the ability of industry to convert new ideas and information into high-quality commercial products rapidly and efficiently. Made in America provided graphic evidence suggesting that American firms in a broad range of industries have been lagging behind their competitors in other countries in this key dimension of performance. The causes are varied and are not confined to industry; universities also share some of the responsibility. MIT, in cooperation with industry, has responded by developing several programs designed to address various facets of the problem. We recommend that the President of MIT consult with industrial leaders to establish a continuing dialogue and mechanism for additional action on this issue.

It is important, however, that weakness in the translation of research to the commercial market, the causes of which in significant part lie outside the university, not be used as a reason to limit openness of university research. Openness is essential to the productivity of the research system. Restrictions on access would ultimately erode the quality of research without producing substantive benefit.

Our recommendations are:

1. **The relative weakness of the U.S. in the ability to translate research to the commercial marketplace is of great importance; the President of MIT should consult with industrial leaders to establish a continuing dialogue and mechanism for additional action on this issue.**
2. **This weakness, the causes of which in significant part lie outside the university, must not be used as a reason to limit openness of university research; that would ultimately erode the quality of that research.**

5. Gifts

The most appropriate way for foreign beneficiaries of American science and technology to contribute to the continued productivity of the research base is through

unrestricted gifts that support the infrastructure of education and research. Gifts reflect a shared vision of MIT as an independent research university and of academic freedom and integrity as major aspects of MIT's ethos. Gifts influence the direction of research in only the most general way, by strengthening a major area of research; donors do not set the problems or goals for MIT research. The Institute expects to develop a relationship, even a close relationship, with its major donors, but not one involving an explicit or implied provision of services as a quid pro quo. Chairholders may make occasional visits to corporations that donate chairs to report on research, but when doing so as a courtesy are not providing information not available to others.

In some cases, MIT has granted ILP membership for a limited period to corporations donating chairs in the hope of developing substantive relationships between faculty and corporations that are technically stimulating and might lead to sponsored research or other additional support. As long as the membership granted on this basis is limited in time, these arrangements seem to us to raise no special concerns.

In a few cases, agreements at the time of receiving major gifts have included a provision for the donor to send a visitor to a laboratory. Such visitors should be required to meet the usual criteria for visitors (as discussed above); in all cases, the acceptance of a proposed visitor should be at the discretion of MIT, and not the donor.

Approximately 30 of the 215 endowed chairs at the Institute have been funded by foreign-based corporations. We believe the emphasis on increasing endowment through the funding of faculty chairs is much to be commended, and see no reason to be concerned about the proportion of chairs funded from abroad as long as the caveats described here apply.

With regard to seeking gifts from foreign sources, therefore:

1. Unrestricted gifts from foreign sources for endowment, chairs, and other purposes are an effective means for foreign beneficiaries of American science and technology to contribute to the continued productivity of the research base from which they have benefited. The relationships that naturally develop with any substantial donor to the

Institute are equally appropriate with foreign donors.

2. Occasional arrangements for sending visitors, foreign or domestic, to the Institute in connection with a major gift raise no grounds for concern as long as the visitors meet the standards for all other visitors.

6. Licensing of MIT patents, start-up companies

As part of its commitment to the transfer of technology to the larger community, MIT has a long tradition of patenting inventions made by its faculty and students and licensing them to entrepreneurs and established industry. This tradition has been reinforced in recent years by changes in Federal policy that clarify ownership of patents for inventions made under Federal research grants. As a result, MIT has given greater attention to protecting and licensing its intellectual property.

Licensing policies can have an influence on the success of commercialization of inventions and on where the benefits are realized. Federal guidelines mandate that licenses for inventions developed with Federal support require "substantial" manufacturing of the licensed product in the United States, if the product is to be sold in the U.S. MIT goes beyond rigorous adherence to these guidelines by requiring that licensees of all MIT inventions, not just those that result from Federal support, be subject to the "substantial" domestic manufacturing provision. The policy is a practical one that increases the prospect of successful commercialization because proximity to the inventor is so important in the process. As a bonus, the policy frees MIT from the administrative headache of having to determine whether or not a given invention was supported by Federal funds in any way. In FY90, 84% of MIT licenses were with U.S. firms, 16% with foreign firms that have U.S. facilities.

Beyond licensing, MIT's Technology Licensing Office also endeavors to help in the establishment of new ventures based on MIT inventions, following the pattern of entrepreneurial activity that has long characterized the ethos of the Institute. Over the years, new companies started by graduates and professors from MIT have contributed substantially to the U.S. economy, especially in high-technology fields. Recent studies of Massachusetts and Silicon Valley attributed some 450,000 jobs

directly to such companies as Raytheon, Digital Equipment, and Hewlett-Packard. The youngest firms tend to be in the most rapidly growing, high-technology fields; for example, individuals related to MIT have started 57 software and 20 biotechnology firms in Massachusetts since 1980.²¹ This program is an important contribution to the American economy that deserves continued emphasis.

Accordingly, we recommend that:

1. The Institute should maintain its attention to protecting and licensing intellectual property. The policy to require substantial production in the U.S. of products to be sold in the U.S. is an excellent one and should remain unchanged.
2. The program to assist in launching new ventures based on MIT inventions is an important contribution to the American economy that deserves continued emphasis.

7. The Industrial Liaison Program

The Industrial Liaison Program (ILP) was established by MIT in 1948 with the objectives of raising additional resources for research and education while encouraging the transfer of knowledge to industry. The Program has been responsible for developing many productive relationships between the faculty and industry, and currently contributes some \$3 million to the Institute's budget each year (out of a total income to the Program of approximately \$8 million). Member companies are charged a fee, in return for which they are provided with assistance in keeping abreast of work at the Institute.

This assistance is provided in a number of ways: special symposia, help in organizing visits to faculty and laboratories of interest, distribution of summaries of research under way, occasional visits of faculty to company sites, and distribution of publications. The program is operated by a dedicated office, with about twenty professional Industrial Liaison Officers who are each responsible for maintaining

²¹ Bank of Boston, op. cit., Chase Manhattan Corporation, "MIT Entrepreneurship in Silicon Valley" (April, 1990).

effective relationships with a number of companies. As of March, 1991, there were 245 corporate members of the ILP, of which 121 were foreign, including 57 from Japan, 56 from Europe, and 8 from other countries outside the U.S. The ILP has an office in Tokyo, which was established in 1976 primarily to expand the Japanese membership in the program and now services that membership; it has also begun to provide some support to other MIT activities in Japan.

Through its activities the ILP facilitates access to MIT on the part of member companies. It does not provide privileged access; all the information available through the ILP is equally available to non-members on their own initiative. Clearly, however, there is an advantage for a company that uses the ILP to learn about research of interest and to obtain information and contact with the faculty more efficiently. It is that efficiency of access to information that is intended to be the primary motive for companies to join the program.

The faculty at the Institute generally find the ILP a useful vehicle for obtaining information from industry. They also use it to increase funds for research materials and professional travel through the program's incentive system. It cannot be said that there is always, or even usually, reciprocal exchange of knowledge during ILP-mediated visits - that is not the purpose of the program - but in fact it is often considered by the faculty to be a valuable vehicle for staying abreast of advanced industrial research. However, some ILP-mediated visits involve carefully prepared and directed industry representatives. During such visits, the faculty should recognize the importance of insisting on a genuine exchange of knowledge, as discussed earlier. ILP contacts that do involve serious, substantive transfers of knowledge will frequently evolve into another form of relationship, such as sponsored research or consulting.

Industrial contacts arranged through the ILP constitute only a small portion of all relationships between the MIT faculty and industry. In particular, the relationships with American companies are considerably more numerous through direct contacts than through the ILP. The preliminary survey data show that the faculty have five times as many contacts with U.S. firms outside the ILP as through the ILP. This explains in part why foreign companies tend to have a higher level of activity in the ILP than their American counterparts, for those companies have greater difficulty (for cultural, linguistic and geographical reasons) than American firms in developing

their own direct relationships with the faculty. American firms are more likely simply to telephone faculty members, even if they have not previously been in contact.

We considered whether the ILP may now have outlived its usefulness in the transfer of knowledge to industry and as a means of raising resources, and thus whether MIT should reevaluate the justification for the Program in today's circumstances. Its prominence in MIT's relationships with foreign corporations, which has attracted attention and criticism, is also of concern. However, the value of the ILP to the faculty as a vehicle for staying abreast of industrial research, the Program's usefulness in raising resources, and the fact that the outside criticisms of the Program do not accurately reflect the actual extent of the overall relations between MIT and American industry, argue strongly in favor of the Program and give no grounds for recommending reevaluation. In fact, we strongly encourage the development of additional participation by U.S. firms in the ILP as a way of providing additional opportunities for interaction between MIT research and American industry.

On similar grounds, we see no basis for establishing a limit on the proportion of foreign-based companies in the ILP, nor for restricting the provision of services to member companies based on nationality. Restrictions of services to a subset of companies would in many cases be impractical and undesirable to administer; a two-tier system would pose difficult client management problems at the least.

Differential fees for foreign companies are a more appropriate means of reflecting the benefits of access to the results of past U.S. investments. The fees for membership currently average \$33,000 per year for American companies, and \$46,000 per year for foreign companies. We recommend that the Administration continue to differentiate between U.S. and foreign firms in negotiating ILP fees, although we recognize that the elasticity of demand for membership is not at all clear.

We have considered the role of MIT's Tokyo office. It was created to redress the difficulties that distance and cultural differences pose for management of MIT's relationships in Japan, although some have seen it as causing MIT to favor Japanese companies in the ILP. We believe its existence offers an opportunity to increase diffusion of knowledge about the Japanese scientific and technological community. We recommend, therefore, that consideration be given to expanding the role of the MIT

Tokyo office to assist members of the MIT community and non-Japanese members of the ILP to become more familiar with science and technology in Japan and to contribute to the Institute's research and education interests. A comparable office might also be established in Europe to serve similar purposes.

Such efforts would be intended in part as a public service as well as a contribution to central MIT missions; they must be periodically reevaluated to assure their value is commensurate with the resources they require.

Our conclusions and recommendations with regard to the ILP are, therefore:

1. MIT seeks mutually-beneficial relationships through its Industrial Liaison Program (ILP). The ILP serves to raise additional resources while contributing to productive transfer of knowledge.
2. The Program is valuable to MIT and its faculty and represents only a small portion of the Institute's overall industrial relationships, which are predominantly with American industry. Accordingly, we see no reason for recommending a review of the Program, nor for restricting foreign membership or services provided to foreign members. We strongly encourage attempts to increase membership of American firms.
3. When visits organized through ILP involve carefully prepared and directed industry representatives, the faculty should recognize the importance of insisting on a genuine exchange of knowledge as discussed earlier.
4. Higher fees for foreign members of the ILP should be continued.
5. The Administration should consider expanding the role of the MIT Tokyo office to assist the MIT community and non-Japanese ILP members to become more familiar with the Japanese scientific and technological community and to contribute to the Institute's research and education interests. A comparable office might also be established in Europe to serve similar purposes. Such offices should be periodically reevaluated.

C. Cooperation with institutions in other countries

From time to time MIT has established programs of cooperation with universities and other institutions in other countries for research, education, or public service purposes. Often, these are promulgated at the department or laboratory level; sometimes they involve a broader institutional commitment. Those programs established for research and education purposes reflect the increasing necessity to work with foreign researchers as the quality of research competence grows and becomes more widely distributed throughout the world; they are to be welcomed as long as they contribute to research and education objectives, the faculty is fully engaged, and the quality of the cooperating institution is appropriate.

Problems may arise when the objective is to serve a public purpose, such as assisting a university in a developing country or contributing to the economic development of a country in the third world or in Eastern Europe. In such cases, it is essential that there should be strong faculty or research staff interest in working in the program and that adequate administrative and financial resources are available.

A potentially more serious issue arises if the program is primarily designed to serve a community abroad or to raise financial resources, for example, an executive training program in another country, and provides little return of a research or educational nature to the Institute. Such programs may be justified if they do not detract from the basic missions of the Institute while contributing resources for those missions. But it is critical that the faculty that would be involved are supportive of the program, and willing to participate in it. Such programs should be carefully scrutinized by the Administration before approval.

Our proposed guidelines with regard to cooperation with universities in other countries are:

1. The growth of cooperative relationships with institutions in other countries is in part a product of the spread of research competence and activity throughout the world. These arrangements are welcome if they advance the research and education objectives of MIT, reflect faculty interest, and involve institutions of appropriate quality.

2. Cooperative relationships with universities or other institutions abroad can also be appropriate if there is a broader public policy purpose to be served, or if they add to the resource base of the Institute, without, in either case, detracting from the basic education and research missions. Faculty interest in the programs, and their willingness to participate in them, are essential in all cases, as is adequate provision of financial and administrative resources. Such programs should be carefully scrutinized by the Administration before approval.

D. Public service and other programs

Direct service to the nation and to the world at large, beyond contributions to education and knowledge, is, and should continue to be, an important aspect of MIT's culture. There are many possibilities for future international activities to serve national and international purposes that go beyond traditional education and research roles. MIT might, for example, make an institutional commitment to assist in the regeneration of Eastern European economies, to advise a third-world country on energy-efficient technologies, or to assist in the negotiation of environmental conventions. Similar initiatives in the past have included, among many others, an African Fellows program to train senior African officials, programs to help create and staff technical universities in India, and the creation of the Center for International Studies in 1951 in response to a request from the U.S. Government.

More pertinently for this report, MIT's institutional capacity and long-standing commitment to the transfer of knowledge for the benefit of society suggest a strong effort to continue to develop programs that are intended to contribute to American industrial strength in technology. A number of large institutional commitments to support American industrial competitiveness, mentioned earlier, have emerged from Faculty and Administration initiatives in recent years. The best of these serve academic as well as public service goals. One example is the MIT Commission on Industrial Productivity, which conducted in-depth studies of eight major industries and offered a set of recommendations aimed at overcoming the slowdown in manufacturing productivity growth.²² Another is the Leaders for Manufacturing program, conducted

²² Dertouzos, et al., op. cit.

jointly by the Schools of Engineering and Management, which is intended to train a new generation of managers that understands production, a vital topic that has been slighted by higher education in the U.S. A third is the Microsystems Technology Laboratory, a \$24 million facility for chip fabrication research supported by a consortium of American firms.

A new Institute-wide research program will continue the study of productivity and industrial performance begun by the Productivity Commission. The new program will involve MIT faculty and students in a wide-ranging set of activities designed to bring the problems of American industry into the Institute's classrooms and laboratories and will introduce ideas and discoveries generated here into arenas of decision in industry and government.

An initiative of particular public policy importance - and of importance to the quality of MIT education as well - is the MIT/Japan Program, the largest program of applied Japanese studies in the U.S. It is designed to give MIT students language and cultural skills and the experience of extended work in Japan, with the intention of modifying the imbalance in the flow of scientists and engineers and scientific and technological information between Japan and the U.S. Some 250 students have completed the Program since its inception in 1981. All students participating learn the Japanese language, with additional courses preparing them for life in Japan; then, they spend a year in a Japanese laboratory as a working engineer or scientist or in a Japanese office as part of a management team. There are 46 MIT students in residence in Japan in the 1990-91 academic year, 26 in industrial laboratories, 4 in government facilities, and 16 in universities. These students will be in a position throughout their careers to provide American institutions with relatively easy access to the scientific and technological community of Japan. Since the Japanese have such access to American science and technology already, MIT/Japan students will be part of the essential communication link necessary for truly reciprocal interaction between the two countries.

This is a small start given the size of the national need, but appreciable for a single university. We hope that this program will continue to grow, and note that it has been adapted by other universities and formed the basis for a national initiative approved by Congress in 1990. MIT is considering building similar programs related to

other nations and regions.

We also recommend attention by the Administration and Faculty to two other critical needs related to the international scene, one internal and one external:

1) the international dimension of the undergraduate curriculum at MIT, which we have not discussed because of our focus on the economic/industrial aspects of MIT's international relationships, deserves sustained attention; international experience and understanding should be a more significant aspect of education not only as an essential preparation for the world that graduates in any field will face in the future, but also to enhance the contribution they can make to the economic well-being of a country deeply embedded in a global marketplace; and

2) the improvement of science education at primary and secondary school levels is so important to the nation's international position that efforts in support of that goal would be very much in the nation's, and MIT's, interest.

We believe both of these subjects deserve to be high on the Institute's agenda.

Many public service efforts are deserving of MIT's support. However, in all cases, the true costs to the Institute, in faculty and staff time as well as dollars, should be realistically assessed in advance. Programs that are predominantly to provide a public service, rather than a contribution to the Institute's central missions of education and research, must be undertaken with caution; they carry the risk of detracting from those central missions which are the Institute's most important contributions to public welfare.

Accordingly:

1. Direct service to the nation should continue to be a significant aspect of MIT's culture. It is important and appropriate for MIT actively to seek ways to contribute to national objectives, especially with respect to American industry. Several such initiatives have been undertaken in recent years, and more are planned.

2. The imbalance in the flow of scientific and technological information between the

U.S. and Japan is a major national problem. The MIT/Japan program is a significant model of an effective way to redress this problem, as would be other programs to educate more Americans with technical backgrounds to be able to recognize the value of foreign science and technology.

3. We also recommend attention by the Administration and Faculty to two other critical needs related to the international scene, one internal and one external: 1) strengthening the international dimension of the undergraduate curriculum to more effectively prepare graduates for the world they will face in the future; and 2) considering how MIT can contribute to improving science education in the primary and secondary schools.

4. When considering a public service initiative, the full costs to the primary missions of the Institute should be realistically assessed, since those missions are the Institute's most important contributions to public welfare.

VI. Process

The responsibility for the issues discussed in this report, and for implementation of the recommendations, lies with the senior MIT Administration and with the Faculty and research staff of the Institute as a whole. We recommend designated staff responsibility for the matters discussed in this report in the Office of the Provost, with Faculty input on subjects involving education and research policy. Whether in the Provost's Office or elsewhere, a staff capability to advise MIT community members about international relationships would also be of great value.

Difficult and controversial issues will frequently arise with regard to proposed international programs, activities, and relationships. The Faculty has in place a Committee on International Institutional Commitments to represent Faculty views on these matters. The Committee cannot perform the management role of reviewing every proposal that requires Administration approval, but it is essential that the views of the Committee be sought on all those that raise significant questions. The Committee may need a revised charter and should be composed of members with substantial MIT and international experience in order to play this role effectively.

In addition, we believe it is important that a program be undertaken to provide greater understanding of MIT's views of these issues in the Executive Branch and Congress of the U.S. Government, among U.S. industrial leaders, and by the American public. Opportunities for discussions of these matters with other universities, and with the professional scientific and technological community more generally, should be welcomed and encouraged.

Finally, we believe senior Institute officials, and particularly the President, should take a visible public role in discussions of these issues, and should be prominent spokesmen for American universities and for American science and technology in relationships with government, industry and universities in other countries.

Our recommendations in this area of governance are therefore:

1. The responsibility for the issues discussed in this report, and for implementation of the recommendations, lies with the senior MIT Administration and with the Faculty and research staff of the Institute as a whole.
2. The Administration should seek the views of the Faculty Committee on International Institutional Commitments regarding all proposed international programs, activities or relationships that raise significant questions.
3. A deliberate program should be undertaken to work with the Executive Branch, the Congress, industry, and the public to provide greater understanding of MIT's perspective on the issues involved in university interactions with foreign industry and institutions.
4. Senior officials of MIT should take a leading role on these issues as prominent public spokespersons for American universities and for American science and technology.

The International Relationships of MIT in a Technologically Competitive World

Summary

Faculty Study Group, Appointed by the MIT Provost, on the International Relations of MIT

The research universities of America have been a major contributor to American leadership in science and technology, helping to meet the nation's economic, security and social needs. Today, new pressures face these universities as the setting in which they are embedded has changed dramatically, especially in its international dimensions. Important issues must be faced, many arising from the new environment of intense economic competition among nations, increasingly driven by the growing strength of science and technology abroad.

Accordingly, a Faculty Study Group was formed by the Provost of MIT and charged with the task of advising the Administration and Faculty on the general principles and policies that should guide MIT's international activities and relationships, with particular reference to economic implications. A brief discussion of our recommendations follows; extended discussion is to be found in the full report.

General principles

MIT is a research university committed to fostering education and advancing knowledge for the betterment of the human condition. It is, at the same time, a national institution rooted in American culture and traditions and an integral part of the nation's education and research system. MIT's responsibility to the nation in which it was founded and nurtured is served first and foremost by maintenance of its position as a premier institution in education and research in science and technology.

The commitment to maintain preeminence requires that MIT be thoroughly engaged in international activities in science and technology and that its faculty, students and research staff be able to interact fully and openly with, and stay abreast of, research wherever it is carried out.

This commitment also requires that quality be a primary criterion for selection of faculty and research staff and for admission of students.

MIT's responsibility to the nation mandates a strong interest in America's economic health, calling for programs and activities that go beyond the Institute's basic contribution through education and research. In particular, we recommend an intensification of MIT's traditional mission of transfer of knowledge to the community at large, especially to American industry.

Occasionally, there may be major conflicts between national and international roles. In the resolution of such conflicts, we believe the Administration, with the advice of the Faculty, should give primary weight to the general responsibility to the nation.

These general principles can be in conflict or give imprecise guidance in specific cases; the Committee therefore examined the variety of international relationships in which MIT is engaged.

Students, alumni, and faculty

The primary goal of the undergraduate program is education, although undergraduates also take an active part in research at MIT. International students, now close to 9% of the undergraduate student body, provide a degree of diversity which is an essential aspect of undergraduate education. We believe this proportion is about right. The current policies of equal tuition and equivalent treatment in the MIT financial aid process for U.S. and international undergraduates are also appropriate.

At the graduate level in science and engineering, research and education become essentially indistinguishable. Academic quality is the primary consideration for admission, and should continue to be so. International students constitute about 33% of MIT's graduate students; however, the admissions process is decentralized to the departments, so that the distribution is quite uneven across fields.

In those departments for which the number of high-quality applicants from both the U.S. and abroad is far greater than the number of places, limits (formal or informal) on admission of foreign applicants have been in place for a number of years. This practice seems acceptable to us, since it preserves opportunities for American students, without violating the criterion of quality. Similarly, we see the partiality in financial aid that results from Federally programs restricted to American citizens as an appropriate way to encourage greater participation of American students.

Some MIT programs (such as Leaders for Manufacturing) are designed to address American industrial needs. We would expect American students to be predominantly admitted to such programs, but there should not be a prohibition on participation by international students.

The employment of students upon graduation is a major channel for transfer of knowledge from academia to industry. MIT alumni who join industrial firms abroad may become factors in increasing foreign competition for American firms. However, a large fraction of international students (e.g., about 60% of those receiving doctorates) elect to stay in the U.S., resulting in a significant net contribution to American industry and universities.

This inflow has also led to a resurgence of concern about a "brain drain" from developing countries. MIT does not tailor its core curriculum to the needs of those countries. The unique quality of that curriculum depends on its close interaction with the cutting edge of research, which cannot be altered by fiat. Although this policy is appropriate in the light of MIT's primary missions, the brain drain is a serious issue which deserves attention by the U.S. Government and by the countries affected.

MIT hires faculty and senior research staff without discrimination on the basis of nationality, a policy we believe is essential to fulfill MIT's commitment to preeminence in research.

Access to research at MIT

The investment of Federal funds in the research universities has been of great value to the strength and vitality of the nation. There can be no doubt that much of

the past investment has paid off handsomely. The challenge is to see that it continues to pay off in the future. A crucial element of success in research is open communication, now made more important by the global spread of high-quality science and technology. For MIT to remain a preeminent research and education institution, open communication must characterize relationships with foreign colleagues.

Other nations have undoubtedly benefited economically from the American investment in science and technology at MIT and other research universities, as the U.S. benefited from earlier European investments in those fields. We think it appropriate that foreign firms and nations help to ensure that the research base is maintained, by adding money as well as knowledge to it, especially in a climate of increasing financial pressure on research universities.

This is not meant to suggest that most of the economic benefits of MIT research flow abroad. Preliminary results of a recent survey of the faculty and research staff about their international relationships suggest that the preponderance of their contacts with industry is with U.S.-based corporations. The most significant relationships that provide access to research at MIT include the following:

1. Visiting faculty, post-docs, and research scientists

An important route for transfer of knowledge from MIT is through extended visits that provide access to research results in preliminary and prepublished form, give indications of promising directions of research, and provide exposure to intangible aspects of processes and techniques.

Long-term visitors (a semester or more) are normally invited to the Institute on the basis of their knowledge and expertise, both to contribute to research projects and to learn from their stay. Openness in the exchange of knowledge should be a condition of all such visits. In essence this means that the host should have a realistic expectation that visitors will participate appropriately in the research underway, be willing to share their own skills and knowledge, and in general be full scientific colleagues. If genuine openness exists, foreign visitors, including those from industry, are a valuable resource as contributors to research and as sources of knowledge about work outside the U.S.

The responsibility for ensuring that the condition of openness is met can only be carried out by individual faculty or laboratories in their selection of visitors and conduct of relationships. With understanding of this responsibility, which we believe should be reinforced by a statement of policy, we do not believe any areas of research at MIT should be prohibited from hosting visitors from abroad. Acceptance of visitors should always be at the Institute's discretion.

MIT has relatively few visitors from domestic industry who come for extended stays. We encourage the Administration to explore with American companies ways to increase such visits.

Industrial sponsors of long-term visitors are often charged a special fee, determined by host laboratories. Charging higher fees for visitors from foreign firms and governments seems to us to be an appropriate standard policy, except in special circumstances. The fee might be waived when useful to encourage more visitors from American corporations.

2. Support of Research

MIT undertakes sponsored research that advances the education and research missions of MIT, fulfills the intellectual interests of the faculty, provides an enriching experience for students, and can be freely and openly reported. In recent years, MIT has attracted research support from a number of foreign-based companies, amounting in 1990 to approximately 3% of the campus research budget, and about 20% of all industrial funding.

We believe foreign research support is fully acceptable as long as (1) the faculty has autonomy in deciding what research has scientific and technological merit, (2) the work has similar conditions of access as other research at the Institute and will be freely and openly reported, and (3) there are no atypical benefits of the results accruing to the sponsor. Such support helps to keep U.S. academic research abreast of the research frontiers of interest to foreign enterprises, provides information about the state of knowledge abroad, and helps to maintain research and education in the U.S.

In all cases, bona fide students at the Institute should be eligible for participation in research, whatever their country of origin, with the research sponsor having no say in their selection.

The Administration and faculty should be particularly sensitive to identifying research opportunities that are responsive to the needs of American industry, and be willing to offer American companies an early chance to invest in particularly promising research ideas. Consortia of companies sponsoring research that exclude participation of foreign companies raise no issues of principle as long as: other faculty outside the program remain free to pursue their research with any sponsor; the research has similar conditions of access as other research and will be freely and openly reported; and there are no non-academic restrictions placed on students who take part in the research.

3. Faculty consulting and off-campus visits

Faculty members often visit industrial sites as consultants and for research and other professional purposes. Such visits are a natural aspect of professional activity, serve as a channel for knowledge transfer to and from industry, and provide faculty members with insights into industrial problems. The dominance of domestic over foreign firms in faculty consulting with industry strongly implies that the transfer of useful knowledge through these contacts continues to be mainly to American industry.

Visits to foreign corporations, however, can be valuable to the education and research missions of MIT, as faculty surveys have shown. When such visits are part of a university (rather than private) relationship, they should be subject to the same conditions of openness in the exchange of knowledge that apply to meetings with foreign visitors on campus. Whenever possible, reciprocal visits should be built into agreements that bring visitors to MIT, as a means of gaining access to industrial laboratories in other countries that may have been inaccessible in the past.

4. Commercialization of results of research

Gaining access to research results is just one step in the commercialization of new processes or products. Of greater importance is the ability of industry to convert new ideas and information into high-quality products rapidly and efficiently. American firms in many industries are lagging behind their foreign competitors in this key dimension of performance. MIT, in cooperation with industry, has developed several programs designed to address various facets of the problem. We recommend that the President of MIT consult with industrial leaders to establish a continuing dialogue and mechanism for additional action on this issue.

It is important, however, that weakness in the translation of research to the commercial market, the causes of which in significant part lie outside the university, not be used as a reason to limit openness of university research, a step that would ultimately erode the quality of research without producing substantive benefit.

5. Gifts

The most appropriate way for foreign beneficiaries of American science and technology to contribute to the continued productivity of the research base is through unrestricted gifts that support the infrastructure of education and research. Approximately 30 of the 215 endowed chairs at the Institute have been funded by foreign-based corporations. They support the university and strengthen major areas of research, but do not direct the goals of the research, nor involve a specific quid pro quo. Accordingly, we support this policy for raising needed resources and see no reason to be concerned about the proportion of chairs funded from abroad.

6. Licensing of MIT patents, start-up companies

As part of its commitment to the transfer of technology to the community, MIT has increased the attention given to protecting and licensing intellectual property created by faculty and students. Federal guidelines mandate that licenses for patents resulting from Federally-funded research require "substantial" manufacturing of the product in the U.S. if the product is to be sold in the U.S. MIT goes further and requires that licensees of all MIT inventions be subject to the same provision. We believe this policy is an excellent one.

MIT also endeavors to help new industrial ventures based on MIT inventions, following the pattern of entrepreneurial activity that has long characterized the ethos of the Institute. New companies started by graduates and professors from MIT have contributed substantially to the U.S. economy, especially in high-technology fields. This program deserves continued emphasis.

7. The Industrial Liaison Program

The Industrial Liaison Program (ILP) was established by MIT in 1948 with the objectives of raising additional resources while encouraging the transfer of knowledge to industry. The Program has been responsible for developing many productive relationships between the faculty and industry, and currently contributes some \$3 million net to the Institute's budget. As of March, 1991, there were 245 corporate members, of which 121 were foreign, including 57 Japanese, 56 European and 8 members from other regions. Member companies are charged a fee, in return for

which they are assisted in keeping abreast of work at the Institute. The Program does not provide privileged access to work at MIT; rather, it provides more efficient access, which is the primary motive for companies to join.

We considered whether the ILP on balance may now have become a liability because of the attention resulting from foreign membership. The value of the ILP to the faculty as a vehicle for staying abreast of industrial research, the Program's usefulness in raising resources, and the fact that faculty contacts with foreign industry through the ILP are only a small portion of their contacts with American industry, argue strongly in favor of the Program and give no grounds for recommending reevaluation. In fact, we strongly encourage the development of additional participation by U.S. firms to increase the interaction between MIT research and American industry.

On similar grounds, we see no basis for establishing a limit on the proportion of foreign-based companies in the ILP nor for restricting the provision of services based on nationality.

Differential fees for foreign companies are a more appropriate means of reflecting the benefits of access to U.S. investments in science and technology. We recommend that the Administration continue its present policy of charging higher fees to foreign firms.

MIT's Tokyo office was created to redress the difficulties that distance and cultural differences pose for management of MIT's relationships in Japan, although some have seen it as causing MIT to favor Japanese companies in the ILP. Its existence offers an opportunity to assist members of the MIT community and non-Japanese members of the ILP to become more familiar with the Japanese scientific and technological community and to contribute to the Institute's research and education interests. We recommend that consideration be given to expanding its role in this way. A comparable office might also be established in Europe. Such efforts must be periodically reevaluated to assure their value is commensurate with the resources they require.

Cooperation with institutions in other countries

From time to time MIT has established programs of cooperation with universities and other institutions abroad for research or educational purposes. These programs reflect the increasing necessity to work with foreign researchers as the quality of research competence grows and becomes more widely distributed throughout the world. They are welcome as long as they contribute to research and education objectives, the faculty is fully engaged, and the quality of the cooperating institution is appropriate.

Problems may arise when the objective of a cooperative program is to serve a purpose that provides little return of a research or educational nature to the Institute. Such programs may be justified if they do not detract from the basic missions of the Institute and if adequate administrative and financial resources are available to carry them out. It is critical that there be strong faculty support and willingness to participate. Such programs deserve careful Administration scrutiny before approval.

Public service and other programs

Direct service to the nation and to the world at large, beyond contributions to education and knowledge, is, and should continue to be, an important aspect of MIT's culture. In particular, MIT's institutional capacity and its commitment to the transfer of knowledge for the benefit of society suggest a strong effort to continue to develop programs to contribute to American industrial strength. A substantial number of programs, such as the Commission on Industrial Productivity, Leaders for Manufacturing, and the MIT/Japan Program, have emerged to this end in recent years. These serve both academic and public service roles.

We also recommend attention by the Administration and Faculty to two other critical needs related to the international scene: 1) strengthening the international dimension of the undergraduate curriculum at MIT, which is increasingly important on educational grounds, and also to the needs of the nation deeply embedded in a global marketplace; and 2) contributing to the improvement of science education at primary and secondary school levels, so central to the nation's future international position.

Notwithstanding the many needs, programs that are predominantly to provide a public service, rather than a contribution to the Institute's central missions of education and research, must be undertaken with caution, and their true costs assessed; they carry the risk of detracting from those central missions which are the Institute's most important contributions to public welfare.

Process

The responsibility for the issues discussed in this report and for implementation of the recommendations lies with the senior MIT Administration and the Faculty and research staff of the Institute as a whole. We recommend designated staff responsibility in the Office of the Provost, with Faculty input on subjects involving education and research policy. The views of the Faculty Committee on International Institutional Commitments should be sought on all proposed international activities that raise significant questions. The Committee may need a revised charter and should be composed of members with substantial MIT and international experience.

The study group was composed of Eugene Skolnikoff, chair; Rudiger Dornbusch, Arnaldo Hax, Nancy Hopkins, Eric Johnson, Arthur Kerman, Philip Khoury, Richard Lester, Nicholas Negroponte, Jack Ruina, Richard Samuels, and Kenneth Smith, members; David Hart, staff.

"CORRESPONDENCE TRACKING"

TYPE: INFORMATION

DOCUMENT NUMBER: 9121474

FROM: GUPTA, J.P.: SCIENCE COUNSELLOR, EMBASSY OF INDIA

TO: DR. BROMLEY

DATE OF
CORRESPONDENCE: 05/15/91

SUBJECT: NOTIFICATION THAT DR. S.K. JOSHI HAS TAKEN OVER AS
DIRECTOR GENERAL, COUNCIL OF SCIENTIFIC & INDUSTRIAL
RESEARCH AND SECRETARY, DEPARTMENT OF SCIENTIFIC &
INDUSTRIAL RESEARCH, GOV'T OF INDIA, NEW DELHI.

ASSIGNED TO:

ACTION REQUIRED:

SENDER'S DUE DATE:

OSTP DUE DATE:

DATE COMPLETED:

COPIES TO: D. Allan Bromley
INTERNATIONAL/POLICY

WHITE HOUSE TRACKING #:

CONTACT PERSON:

REMARKS:

DATE RECEIVED: 05/21/91

FILE: INTERNATIONAL - INDIA



विज्ञान उपदेष्टा
भारतीय राजदूतावास

**SCIENCE COUNSELLOR
EMBASSY OF INDIA**

RECEIVED

91 MAY 21 AID: 38
TEL: (202) 939-7072
(202) 939-7073
TELEX: 440365
FAX: (202) 939-7027
2107 Massachusetts Avenue, N.W.
Washington, D.C. 20008, U.S.A.
OFFICE OF THE
DIRECTOR

No WAS/SW/J-2/91

May 15 1991

Dear Dr. Bromley,

Dr S.K. Joshi has taken over as Director General, Council of Scientific & Industrial Research(CSIR) and Secretary, Department of Scientific & Industrial Research(DSIR), Government of India, New Delhi since April 17, 1991.

CSIR has 42 labs in almost all areas of sciences (non-defense) spread over all over the vast land of India. Their scientists work closely with numerous US scientists in different disciplines on cooperative research programs. Several visits are exchanged between scientists working at the US science organizations and CSIR labs.

Enclosed is a bio-data of Dr Joshi by way of background information. This shows that he has been highly commended for his pioneering work over the years.

With best wishes,

Sincerely,

JPGupta

(Dr J.P. Gupta)

Dr D. Allen Bromley,
Assistant to the President for
Science & Technology and
Director of the Office of
Science & Technology Policy,
White House Office of Science
& Technology Policy,
Old Executive Office Building,
Room 360,
Washington DC-20500.

B I O D A T A

NAME

ADDRESS

- : DR. SHRI KRISHNA JOSHI, Padma Shri
- : Director General
Council of Scientific & Industrial Research
and
Secretary
Deptt. of Scientific & Industrial Research
'Anusandhan Bhavan'
Rafi Marg
New Delhi 110001.

Telephone Nos.: 3710472 (Off.)
3710618 (")
583864 (Res.)

DATE AND PLACE
OF BIRTH

- : June 6, 1935 at Anarpi in Pithoragarh
district of Uttar Pradesh, India.

MARITAL STATUS

- : Married, wife Hema; Two sons (Sanjay and
Ashutosh).

ACADEMIC CAREER

- : First Division all through from High
School to M.Sc.. Awarded Ward-Vidyant Gold
Medal of Allahabad University for Standing
First in M.Sc. Physics (1957).

Ph.D. (1962) from Allahabad University.
Thesis title 'Study of Diffuse Scattering
of X-rays'.

ACADEMIC POSITIONS
HELD

- : Lecturer in Physics, Allahabad University
(1957-67); Visiting Lecturer, University
of California, Riverside, U.S.A., 1965-67;
Professor, Physics Department, Roorkee
University, (1967-86); Head of the Depart-
ment (1967-78, 1984-86); Director,
National Physical Laboratory, New Delhi
(1986-April 17, 1991); Director General,
Council of Scientific & Industrial
Research and Secretary, Department of
Scientific & Industrial Research, New
Delhi (April 18, 1991-continuing).

BROAD AREAS OF
SPECIALIZATION

- : Solid State Physics; Atomic and Molecular
Collisions.

CURRENT RESEARCH
INTERESTS

- : Electrons and phonons in disordered
systems; transport and optical properties
of disordered alloys; lattice dynamics of
transition metals; surface states in semi-
conductors; surface segregation; spin
glasses; metal-non metal transition; heavy
fermions; high temperature super-
conductivity.

AWARDS

1. Watumull Memorial Prize for 1965 by Watumull Memorial Foundation, Honolulu USA.
2. Shanti Swaroop Bhatnagar Prize for Physical Sciences for 1972 by the Council of Scientific and Industrial Research.
3. C.S.I.R. Silver Jubilee Award 1973 by the Council of Scientific & Industrial Research.
4. Meghnad Saha Award for Research in Theoretical Sciences 1974 by University Grants Commission (Hari Om Ashram Trust Awards).
5. The K.S. Krishnan Memorial Lecture 1987 by Indian National Science Academy.
6. Padma Shri (1991)

FELLOWSHIP AND MEMBERSHIPS OF ACADEMIES AND ASSOCIATIONS

1. President, Indian Physics Association (1989 -)
Vice-President, Indian Physics Association (1973-74).
2. Fellow, Indian National Science Academy since 1974 (Secretary of the Academy 1983-86; Foreign Secretary 1989 -).
3. Fellow, National Academy of Sciences since 1974; (Vice-President 1989 -).
4. Fellow, National Academy of Sciences (Council service 1989 -).
5. Vice-President, Materials Research Society of India (1989 -).

OTHER RECOGNITIONS

1. C.V. Raman Centenary Medal (1988).
2. Santanu Ghosh Memorial Lecture (1989).
3. Kedarashwar Banerjee Memorial Lecture (1988).

RESEARCH SUPERVISION

NUMBER OF Ph.D. THESIS SUPERVISED : 17

RESEARCH PUBLICATIONS : More than 160 papers.

"CORRESPONDENCE TRACKING"

TYPE: INFORMATION

DOCUMENT NUMBER: 9121477

FROM: LAUSTRIAT, G.: UNIVERSITE LOUIS PASTEUR STRASBOURG

TO: DR. BROMLEY

DATE OF
CORRESPONDENCE: 05/03/91

SUBJECT: THE BOARD OF ULP HAS DECIDED TO APPOINT PROFESSOR
GREINER AS ONE OF THE THREE DOCTOR HONORIS CAUSA OF
THE UNIVERSITY FOR 1991, THE CEREMONY WILL TAKE
PLACE 12/06/91.

ASSIGNED TO:

ACTION REQUIRED:

SENDER'S DUE DATE:

OSTP DUE DATE:

DATE COMPLETED:

COPIES TO: D. Allan Bromley
INTERNATIONAL/POLICY

WHITE HOUSE TRACKING #:

CONTACT PERSON:

REMARKS:

DATE RECEIVED: 05/21/91

FILE: P-INTERNATIONAL

THE WHITE HOUSE
WASHINGTON

July 9, 1991

Dear President Laustriat:

My apologies for the long delay in responding to your letter of May 3rd in which you tell me of the decision to award Doctorates Honoris Causa to Professors Greiner, Debakey, and Eisenmoser in 1991. These are all very distinguished gentlemen and I feel honored to have been selected in an earlier group of honorees by your university, or more correctly, our university.

It is my hope that I can be present for the ceremony on December 6th and I am currently trying to arrange my schedule to make that possible. I would appreciate receiving a copy of the program of the day as soon as it becomes finalized.

Let me express my personal thanks to you for your effective response to my nomination of Professor Greiner. I have every confidence that he will add distinction to the roster of those who have already become associated in this way with your university and that he will play an increasingly important role in the activities of your pioneering research laboratories in the areas of nuclear science.

I appreciate your comments on the Human Frontiers Program and, although I cannot be definite at this precise moment, I believe that I can assure you that before the summer is out, we, in the United States, will have taken steps to provide support substantially beyond that available in the past to what has clearly developed as a program characterized by excellent science.

I would ask that you treat this last as a confidential item and something that you can be appropriately surprised about when the formal announcement occurs.

I look forward to the possibility of returning to Strasbourg and to the even greater pleasure of meeting you at that time.

With warmest best wishes,

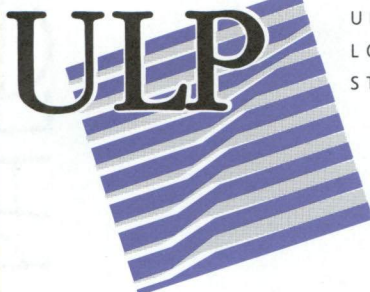
Sincerely yours,



D. Allan Bromley
The Assistant to the President
for
Science and Technology

Professor G. Laustriat
President
Louis Pasteur Universite
4, rue Blaise Pascal - B.O. 1032F
67070 Strasbourg Cedex
France

9121477



UNIVERSITE
LOUIS PASTEUR
STRASBOURG

RECEIVED

91 MAY 21 AM : 12

OFFICE OF THE
DIRECTOR

Professor D. Allan BROMLEY
Assistant to the President for
Science and Technology
WHITE HOUSE OFFICE
1600 Pennsylvania Avenue
WASHINGTON D.C. 20500

Strasbourg, May 3rd, 1991

Le Président

Dear Professor Bromley,

Let me first thank you for your kind letter of April 4th. Professor GALLMANN has kept you informed of the latest developments concerning Professor GREINER. It is nevertheless my pleasure to confirm officially that the Board of ULP has decided to appoint Professor GREINER as one of the three Doctor Honoris Causa recipients of our university for 1991, the two others being Professor Michael DEBAKEY of Baylor College of Medicine in Houston and Professor Albert ESCHENMOSER of the ETH Zürich.

The ceremony will take place on December 6th and it would be a pleasure and an honour for us if you could be present on this occasion. The detailed programme of the day has not been finalized yet, but you will receive it in due course.

To come back to the Human Frontier Science Program, I have heard that the NIH have decided to transfer some of their fellowships to the HFSP long term fellowships. I hope that this positive move of the USA will prompt other countries to follow suit. The results of the recent selection procedure confirmed the very high quality of the awardees.

I thank you very much for your friendly and encouraging comments about my work and our university, and hope to see you again soon in Strasbourg to discuss further matters of common interest.

With my best wishes,

Sincerely yours,



G. LAUSTRIAT

"CORRESPONDENCE TRACKING"

TYPE: INFORMATION

DOCUMENT NUMBER: 9121410

FROM: GUPTA, J.P.: SCIENCE COUNSELLOR, EMBASSY OF INDIA

TO: DR. BROMLEY

DATE OF
CORRESPONDENCE: 05/03/91

SUBJECT: DR. P. RAMA RAO HAS TAKEN OVER AS SECRETARY,
DEPARTMENT OF SCIENCE & TECHNOLOGY, GOVERNMENT OF
INDIA.

ASSIGNED TO:

ACTION REQUIRED:

SENDER'S DUE DATE:

OSTP DUE DATE:

DATE COMPLETED:

COPIES TO: D. Allan Bromley
INTERNATIONAL/POLICY

WHITE HOUSE TRACKING #:

CONTACT PERSON:

REMARKS:

DATE RECEIVED: 05/13/91

FILE: P-INTERNATIONAL

THE WHITE HOUSE
WASHINGTON

July 9, 1991

Dear Dr. Gupta:

This is a much belated thank you for notifying me of the change of appointments relating to science and technology within the government of India. Of course, Dr. Rama Rao, whom I have known for a great many years, will provide a very strong voice for science and I am pleased to learn that my old friend, V. R. Gowarikar, has been appointed Science Adviser to your Prime Minister. I enclose herewith two letters that I would ask you to pass on to these two gentlemen.

With all best wishes,

Sincerely yours,

A handwritten signature in dark ink, appearing to read "D. Allan Bromley". The signature is fluid and cursive, with a prominent "B" and a trailing flourish.

D. Allan Bromley
The Assistant to the President
for
Science and Technology

Dr. J. P. Gupta
Science Counsellor
Embassy of India
2107 Massachusetts Avenue, N.W.
Washington, D.C. 20008

Enclosures

THE WHITE HOUSE
WASHINGTON

July 9, 1991

Dr. V. R. Gowarikar

Dr. J. P. Gupta, the Science Counsellor in the Indian Embassy here in Washington, has told me of your appointment as Science Adviser to the Prime Minister of India. I shall much look forward to working with you in that capacity, to try to strengthen the bonds of cooperation between our two great countries.

It has been a pleasure dealing with you over the years during your tenure as Secretary of the Department of Science and Technology and I look forward to continuing that pleasant interaction in your new role.

With all best wishes for every professional and personal success,

Sincerely yours,

A handwritten signature in dark ink, appearing to read "Allan", with a stylized flourish at the end.

D. Allan Bromley
The Assistant to the President
for
Science and Technology

THE WHITE HOUSE
WASHINGTON

July 9, 1991

Dr. Palle Rama Rao

Dr. J. P. Gupta of the Indian Embassy here in Washington has notified me that you have taken over as Secretary of the Department of Science and Technology in the Government of India. Let me begin by congratulating you on this appointment and expressing to you my deep interest in strengthening the Science and Technology interactions that have been forged over the past 10 years beginning with the Reagan/Ghandi Head of State Science and Technology Initiatives (STI) in which you played a key role.

A few months ago I had the pleasure of talking to Dr. Gowariker about some of the problems that had arisen over the past few years and although I understand the difficulties that have, in some cases, limited the amount of cooperation, I feel certain that these can be resolved with good will on both sides and a recognition of the importance that our two great democracies cooperating in this and other areas.

When next your travels bring you to Washington, please do let me know so that I can plan to spend some time with you on these topics.

Again, congratulations on your new appointment and on the very distinguished career that you bring to bear on the problems of Indian science and technology.

With warmest best wishes,

Sincerely yours,



D. Allan Bromley
The Assistant to the President
for
Science and Technology

1410



RECEIVED

91 MAY 13 PM 2:34

OFFICE OF THE
DIRECTOR

विज्ञान उपदेष्टा
भारतीय राजदूतावास

SCIENCE COUNSELLOR
EMBASSY OF INDIA

TEL: (202) 939-7072
(202) 939-7073

TELEX: 440365

FAX: (202) 939-7027

2107 Massachusetts Avenue, N.W.
Washington, D.C. 20008, U.S.A.

No WAS/SW/*k-1*/91

May 3 1991

Dear *Dr Bromley*,

Dr P. Rama Rao has taken over as Secretary, Department of Science & Technology, Government of India, New Delhi from Dr. V.R. Gowarikar, whose term expired on March 31, 1991. Dr Gowarikar has been appointed as Science Adviser to the Prime Minister of India.

Dr Rama Rao has decided to give bilateral and multilateral science co-operation programmes a top priority. His bio-data, in brief, is enclosed herewith for information.

With best wishes,

Sincerely,

J P Gupta

(Dr J.P. Gupta)

Dr D. Allen Bromley,
Assistant to the President for
Science & Technology and
Director of the Office of
Science & Technology Policy,
White House Office of Science & Technology,
Old Executive Office Building
Room No 360,
Washington DC-20500.

BRIEF BIO-DATA OF DR PALLE RAMA RAO
SECRETARY, DEPTT OF SCIENCE & TECHNOLOGY

Dr P Rama Rao is the Secretary to the Government of India, Department of Science and Technology (DST) since April 22, 1991. The salient areas of DST's responsibility are formulation of policy and guidelines on science and technology, promotion of new areas of science and technology, international scientific and technological affairs, S&T entrepreneurship development, National Council for Science & Technology Communication, National Centre for Medium Range Weather Forecasting and development of Agro- Meteorological Advisory Services, Information Analysis, Evaluation and Management and other measures needed for the promotion of science and technology and their application to the development of the nation.

Until he took over as Secretary DST, Dr Rama Rao was the Director of the Defence Metallurgical Research Laboratory (DMRL), Hyderabad. Prior to his joining DMRL, he was first on the teaching faculty of the Department of Metallurgy, Indian Institute of Science, Bangalore and subsequently the Department of Metallurgical Engineering, Banaras Hindu University for nearly two decades.

His principal areas of research have been X-ray diffraction from structural imperfections and correlation of mechanical behaviour with microstructure of metals and alloys. He has been in recent years involved with alloy development. He has published (over 150 technical publications) as well as lectured extensively. He was Co- Chairman of the Sixth International Conference on Fracture held in New Delhi in 1984 and one of the Editors of the voluminous proceedings of the Sixth as well as the Seventh International Conference on Fracture (held in Houston, Texas, USA). He is on the Editorial Board of six international and three national journals. He was until recently Chief Editor, Transactions of the Indian Institute of Metals and is presently the Editor of Bulletin of Materials Science published by the Indian Academy of Sciences.

A professional metallurgist of long standing, he was elected Fellow of the Indian Academy of Sciences in 1978, Fellow of the Indian National Science Academy in 1980, Fellow of the Andhra Pradesh Akademi of Sciences in 1982, Fellow of the Indian National Academy of Engineering in 1987 and Fellow of the National Academy of Sciences, India in 1990. He is currently serving on the Council of the Indian Academy of Sciences and the Indian National Science Academy. He was in 1990 the Sectional President, Materials Science of the Indian Science Congress Association. He has been a member of the Board of Governors of ICM, an International Body which organises the Triennial Series of International Conferences on Mechanical Behaviour. He has just been elected President, International Congress on Fracture. He has been a member of several Government bodies of which may be mentioned the Science Advisory Council to the Prime Minister (1986-90), Science Engineering Research Council (SERC) of the Department of Science and Technology (1984-90) and Governing Body of the Council of Scientific & Industrial Research (CSIR). He is presently President of the Indian Institute of Metals. He has been chosen (1990) to be a Honorary Professor of Jawaharlal Nehru Centre for Advanced Scientific Research.

Recognition for his scientific achievements has come to Dr Rama Rao through the Pandya Memorial Medal (1964), Kamani Gold Medal (1970) of the Indian Institute of Metals, the National Metallurgists' Day Award (1973), the Shanti Swarup Bhatnagar Prize (1979), the Homi J Bhabha Award for Applied Sciences (1985) of the UGC, the National Lecturership of the UGC (1986), the VASVIK AWARD (1986), the Material Science prize of the Indian National Science Academy (1989) and the Pandit Madan Mohan Malaviya Distinguished Alumnus Award (1989). He was awarded Padma Shri in 1989.

"CORRESPONDENCE TRACKING"

TYPE: INFORMATION

DOCUMENT NUMBER: 9121379

FROM: LUST, Reimar: ALEXANDER VON HUMBOLDT-STIFTUNG

TO: DR. BROMLEY

DATE OF
CORRESPONDENCE: 05/02/91

SUBJECT: A NOTE OF CONGRATULATIONS AND GOOD HEALTH

ASSIGNED TO:

ACTION REQUIRED:

SENDER'S DUE DATE:

OSTP DUE DATE:

DATE COMPLETED:

COPIES TO: D. Allan Bromley
INTERNATIONAL/POLICY

WHITE HOUSE TRACKING #:

CONTACT PERSON:

REMARKS:

DATE RECEIVED: 05/09/91

FILE: P- INTERNATIONAL

9121379

ALEXANDER VON HUMBOLDT-STIFTUNG

RECEIVED

Der Präsident

91 MAY 9 P4:41

□ Alexander von Humboldt-Stiftung, Jean-Paul-Str. 12, D-5300 Bonn 2 □

Jean-Paul-Straße 12
D-5300 Bonn 2 (Bad Godesberg)

OFFICE OF THE
DIRECTOR

Prof. Dr. Allan Bromley
Old Executive Building of the
White House
Pennsylvania Ave./17. Str.
Washington, D.C.

Tel. (0228) 833-111

May 2nd, 1991

U.S.A.

Dear Mr Bromley,

I would like to congratulate you to your 65th anniversary and wish you especially good health for the next years, but also continuing successful achievements as Scientific Advisor of the President. I know that there are some ideas which you continue to bring forward and which would really be a considerable improvement in international scientific relations.

I do hope we will be able to meet you at the AAAS/Humboldt-conference in Berlin in September.

With all best wishes.

Yours Sincerely,



Reimar Lüst

THE WHITE HOUSE
WASHINGTON

July 9, 1991

Dear Professor Lust:

It was indeed thoughtful of you to write your note congratulating me on my 65th birthday, although I find that the enthusiasm for celebration is such birthdays tends to diminish as the number increases.

I have much enjoyed the opportunities that we have had in the past to interact and in your new position I hope that our paths will cross frequently. As you know, we are currently having difficulty with the funding for the space station but I am optimistic that we will indeed succeed in not only having a space station, but equally important, having one that fully responds to our original commitments to our foreign collaborators.

Again, my thanks for your thoughtful note and all best wishes for every success.

Sincerely yours,



D. Allan Bromley
The Assistant to the President
for
Science and Technology

Professor Reimar Lust
President
Alexander von Humboldt-Stiftung
Jean Paul Strasse 12
D-5300 Bonn 2
Germany

"CORRESPONDENCE TRACKING"

TYPE: INFORMATION

DOCUMENT NUMBER: 9121355

FROM: ZENOS, Steven

TO: DR. BROMLEY

DATE OF
CORRESPONDENCE: 05/01/91

SUBJECT: LETTER TO PRESIDENT GEORGE BUSH SUGGESTING THE
UNITED NATIONS SPONSER A NUCLEAR DESALINIZATION
PROGRAM SO THAT ISRAEL AND THE ARAB COUNTRIES WOULD
BE MORE ECONOMICALLY DEPENDENT ON EACH OTHER.

ASSIGNED TO:

ACTION REQUIRED:

SENDER'S DUE DATE:

OSTP DUE DATE:

DATE COMPLETED: -----

COPIES TO: D. Allan Bromley
INTERNATIONAL/POLICY
PHYSICAL SCIENCES

WHITE HOUSE TRACKING #:

CONTACT PERSON:

REMARKS:

DATE RECEIVED: 05/07/91

FILE: INTERNATIONAL

355 Grant Street
Ashland, Oregon 97520
May 1, 1991

RECEIVED

President of the United States 91 MAY 7 410:41
George Bush
The White House
1600 Pennsylvania Ave., NW
Washington, DC 20500 OFFICE OF THE
DIRECTOR

Dear Mr. President:

It recently occurred to me that if Israel and the Arab countries were more economically dependent on each other that peace in the area would eventually be achieved.

One possible way to achieve this interdependence would be for the United Nations to sponsor a nuclear desalinization program for the area. The desalinization plants would be built on the Israeli Mediterranean coast and the fresh water pumped to the Arab areas in Jordan, Syria, Egypt and the occupied areas as well as Israel.

Israel with its new Russian immigrants has the technical expertise to operate and maintain the plants and water distribution system, as well as the expertise and experience to make the desert bloom. The Arab countries and Israel could grow crops, fruit and vegetables to better feed their people and to sell to help pay for the project. It would also provide agriculture and distribution work for thousands of people.

This would be a very large project but could proceed in phases. The first step would be for the world's leading and most experienced nuclear engineers to design, build and test the safest, most fool-proof, optimum size nuclear powered desalinization plant that modern science can conceive. The other engineering problems would more easily be solved and the project could proceed.

The money now going into weapons and armies of all the involved countries would have to be diverted to the project. This would also include other countries like the United States and Saudi Arabia that are supporting one or both sides with billions of dollars. The United Nations would have to guarantee the borders of all nations (with force if necessary) while this project is being constructed and made operational, and possibly for some additional time to allow the interdependence and cooperation to take root. The United Nations would also coordinate, supervise, schedule, set priorities and provide overall management of the project as well as security.

President of the United States
George Bush

- 2 -

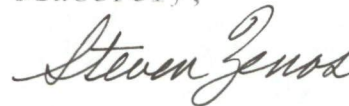
Steven Zenos

Later phases of the project could include siphoning water from the Mediterranean to the Dead Sea and building desalination plants there as well. All countries involved could also share in the chemical and mineral by-products of the desalinization process and in the industrial and agricultural development that would follow.

This is all technically feasible and the funding will be available if the spending on armaments and general defense are diverted to this project. I believe additional financial support would be forthcoming from the United Nations and from private organizations world wide if they could see a possible real solution to this very long standing and dangerous confrontation.

This may be the opportune time to try a new cooperative effort for a critical water resource that is vital to all concerned and to the starving people of Africa as well. It could also be a test project for other similar and critical United Nations projects.

Sincerely,



STEVEN ZENOS

CC: Embassy of Israel
Dept. of Energy
Dept. of State
U.S. Mission to the United Nations
Ass't. to the President for Science & Technology -
D. Allan Bromley
Secretary-General - United Nations
American Jewish Congress
Nat. Assoc. of Arab Americans

5/30

"CORRESPONDENCE TRACKING"

TYPE: ACTION

DOCUMENT NUMBER: 9121472

FROM: YUXIANG, Chen: INSTITUTE OF FORECASTING & DEVELOPMENT, CHINA

TO: DR. BROMLEY

DATE OF
CORRESPONDENCE: 04/29/91

SUBJECT: YALE UNIVERSITY HAS FORWARDED AT LETTER FROM ^{Chen}YUXIANG
REGARDING HIS TRAVEL & HIS REQUEST TO MEET WITH YOU
WHILE IN THE U.S. OR INVITING YOU TO CHINA.

ASSIGNED TO: D. Allan Bromley

ACTION REQUIRED: AS NECESSARY

SENDER'S DUE DATE: OSTP DUE DATE: 05/30/91

DATE COMPLETED: -----

COPIES TO: INTERNATIONAL/POLICY

WHITE HOUSE TRACKING #:

CONTACT PERSON:

REMARKS:

CLOSED

DATE RECEIVED: 05/21/91

FILE: ^p INTERNATIONAL

THE WHITE HOUSE

WASHINGTON

June 10, 1991

Dear Director Chen,

The letter you sent to my former academic home at A. W. Wright Laboratory at Yale University has been forwarded to me here at the White House. I am currently on leave from Yale, and have the honor of serving as the Science Advisor to the President and Director of the Office of Science and Technology Policy.

Your program in New York at the 11th International Forecasting Symposium sounds extremely interesting and I hope that you had a productive week, meeting colleagues from all over the world.

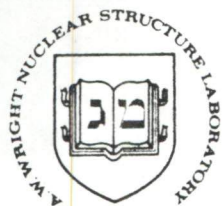
Thank you for your interest in visiting Yale. I hope that you had the opportunity to visit there after the conference in New York.

Sincerely,

A handwritten signature in black ink, reading "D. Allan Bromley". The signature is fluid and cursive, with a large, stylized initial "D".

D. Allan Bromley
The Assistant to the President
for
Science and Technology

Director Chen Yuxiang
Institute of Forecasting and Development
Hefei University of Technology
Hefei, Anhui 230009
People's Republic of China



OFFICE OF THE DIRECTOR

YALE UNIVERSITY

A. W. WRIGHT NUCLEAR STRUCTURE LABORATORY

P.O. Box 6666, 272 Whitney Avenue, New Haven, Connecticut 06511

921472
RECEIVED

91 MAY 21 AIO: 21

OFFICE OF THE
DIRECTOR

May 16, 1991

Dr. Yuxiang Chen
Institute of Forecasting & Development
Hefei University of Technology
Hefei, Anhui 230009
PEOPLE'S REPUBLIC OF CHINA

Dear Dr. Chen:

Thank you for your letter of April 29, 1991. Professor Bromley is on a Leave of Absence from the University in order to serve as Science Advisor to President Bush and therefore will not be in New Haven during your visit to the United States.

I will forward your letter to Dr. Bromley's office in Washington, D.C. and hope that you have an enjoyable visit to the United States.

Sincerely yours,

Mary Anne Schulz

Mary Anne Schulz

mts

Director Chen Yuxiang
Institute of Forecasting
and Development
Hefei University of Technology
Hefei, Anhui 230009
Fax 0086-551-251517
P. R. China
April 29, 1991

Dear Prof. D. Allan Bromley:

Our institute is one which is specially engaged in research on forecasting, assessment, science policy research and development strategy research. With the support of NSFC (the National Science Foundation of China), our institute is now doing a major project "A research on the Forecasting and Assessment in the Development of Science and Technology" and has achieved initial results. From Minerva, I know you leadershiped the research of physics in science policy.

From June 7 to 12, 1991, I shall attend the 11th International Forecasting Symposium to be held in New York city. I am expecting to have an opportunity of visiting your university (one week) after conference and contact with you, to learn and discuss questions about the choice of priorities fields, and discuss the possibility of inviting you to visit China with the name of NSFC, if you could offer me some financial support, housing and meals.

Whether or not there will be any chance on your part, I am looking forward to hearing from you soon (Fax 0086-551-251517).

Yours sincerely,

Chen Yuxiang

RÉSUMÉ

NAME	Yuxiang Chen
SEX	Male
PROFESSIONAL POST	Associate Professor
BIRTH	January, 1951

PRESENT POSITION

1. Chairperson of Institute of Forecasting and Development, Hefei University of Technology
2. Standing Deputy Chief Editor of Journal Forecasting
3. Member of Expert Group of Management Science, Science & Technology Committee, State Education Commission of the People's Republic of China
4. Director of Futurology Association of China
5. Director of Systems Engineering Association of China

EDUCATION AND PROFESSIONAL PRACTICE

Institute of Forecasting and Development, Hefei University of Technology, September 1984 to now

Department of Management Engineering, Hefei University of Technology, January 1983 to September 1984

M.Sc., Industrial Automation Specialty, Beijing Automation Research Institute, Ministry of Machine-Building Industry of the People's Republic of China, September 1979 to December 1982

Computer Specialty, Department of Mathematics, Anhui University, September 1976 to September 1979

MAIN RESEARCH FIELD

1. Technological Forecasting and Technological Assessment
 - A Study of Scientific and Technological Forecasting Theory, Methods and Models

- A Comparison Study of IF and TA in Developing Countries and Developed Countries
 - The Present State of TF and TA in China
 - Forecasting and Assessment of Preferential Fields in Development of Science and Technology
 - The Indicator System of Technological Assessment
 - Research on Computer Expert System of Technological Forecasting
 - Case Research of TF and TA in China
2. Planning and Strategy Research in Education
- Analysis and Evaluation of the Quality of Staff Members in China
 - Research on the Present State of Higher Education in Industry
 - Forecasting Theory, Methods and Application in Demands for Technical Personnel
 - Effect Analysis of Education in Development of Industry
 - Research on Planning System Models in Education
 - Case Research on Development Strategy for Education in Machine-Building and Electronics Industries
3. Economic Forecasting
- Medium-Term and Short-Term Forecasting Research in Machine-Building Industry
 - Research on Marketing Forecasting Theory, Methods and Application in China
 - Market Analysis System
 - Case Research on Marketing Forecasting of Cars, Lathes, TVs, etc.
4. The Government Office and Decision Support Systems Analysis and Design

MAIN ACHIEVEMENTS SCORED IN RECENT YEARS

1. Development Strategy for Education in Machine-Building and Electronics Industries (Ministry of Machine-Building and Electronics Industries), July 1987 to December 1989
2. Comprehensive Assessment for Priority Development Fields of Science and Technology in China's Colleges and Universities (State Education Commission), May 1987 to October 1989
3. Designing for the Government's Office and Decision Support System of Anhui Province (State Science and Technology Commission), May 1988 to October 1989
4. Forecasting and Assessment of Development of Science and Technology in China, winning the Second Prize of Science and Technology Progress of Ministry of Machine-Building and Electronics Industries, April 1986 to February 1988
5. Forecasting for Macroeconomy of Machine-Building Industry, September 1986 to December 1987
6. Models for Comprehensive Development Assessment in Dabie Mountainous Areas, March 1987 to December 1987
7. Forecasting and Comprehensive Development Analysis for the Development of Mechatronics, winning the Third Prize of State Science and Technology Progress, July 1987
8. Forecasting of Demands for Personnel in Anhui Province, winning the First Prize of Anhui Province Science and Technology Progress, December 1986
9. Forecasting and Assessment of Car Market in China in the Year 2000, August 1985 to December 1986
10. Forecasting and Assessment of the Development of Advanced Technology Industries in China (State Science and Technology Commission), July 1988 to December 1989

RESEARCHES UNDER WAY

1. Forecasting of Development of the Disciplines of China's Natural Sciences and Research on Their Assessment System (National Natural Science Foundation of China), 1990 to--
2. Research on Theory and Method for Forecasting of Priority Development Fields of Science and Technology (National

- Natural Science Foundation of China), October 1988 to ---
3. Research on Intelligent Decision Support System (State Science and Technology Commission), May 1990 to ---
 4. Research on Forecasting Methods of Technology and Economy in Machine-Building and Electronics Industries (National Natural Science Foundation of China), October 1988 to ---

REPRESENTATIVE PUBLICATIONS

1. Research on Development Strategy for Education in Machine-Building and Electronics Industries, 1990, Press of Beijing Institute of Technology
2. Selected Comments on Forecasting Cases of Technology and Economy, 1990, Press of the Chinese University of Science and Technology
3. Forecasting Technique and Its Application, March 1985, Publishing House of Machine-Building Industry

THESES

1. Research on Forecasting System in Medium-Long Term Development of Science and Technology, Natural Science Foundation of China, Vol. IV, 1990
2. Analysis and Design of the Government Office and Support System, Management Engineering Journal, Vol. III, 1990
3. Forecasting of Demand for Professional Personnel in Machine-Building Industry of China, Journal of Forecasting, Vol. III, 1990
4. Application of the Delphi Method in China, International Journal of Technological Forecasting and Social Change, No.37, 1990
5. Short-Term Forecasting for Macroeconomy of Machine-Building Industry--Research on Decomposition Method of Time Series, Journal of Systems Engineering, Vol. I, 1989
6. Research on Development Planning Systems of Professional Education, The Annual Meeting of the Second National Education Systems Engineering, October, 1988

7. Erratic Economic Forecasting System, ICSSE' 1988, Proceedings of International Conference on Systems Science and Engineering
8. Experts System Support in Economic Forecasting Analysis, Journal of Forecasting, Vol. IV, 1988
9. Design of Forecasting Plans and Research of Forecasting Analysis, Journal of Forecasting, Vol. I, 1988
10. Comprehensive Assessment for Priority Development Fields of Science and Technology, the First Symposium on Assessment and Forecasting of Advanced Technology Development, December 1987
11. Research and Application on Forecasting System of Demands for Talented Persons, the Fifth Annual Meeting of Systems Engineering Association of China, October, 1987
12. Expanded KSIM Profile Modelling and Its Application, Journal of Systems Engineering, Vol. IV, 1987
13. Micro-Integrated Forecasting of Demands for Qualified Professional Personnel, Journal of Forecasting, Vol. I, 1987

A Proposal for International Cooperation in the Project "A Research on Science Resource Allocation Policy"

I The Introduction to the Project

In order to provide scientific basis for government to formulate the policies of science resource allocation and financial policies. From 1991 onward, IFD will devote itself to the major research project "A Research on the Forecasting and Assessment System in the Development of Science and Technology" supported by NSFC (the National Natural Science Foundation of China). Its objective is that by making a comparative study of the structures of science and technology in various countries, and by predicting and assessing the development of science, we will make clear and definite the status and function of various disciplines in the development of science and technology so as to provide some basis for formulating the policy regarding resource allocation and financial support.

Starting from the above-mentioned objectives, the contents of the project chiefly include:

1. A comparative study of the structure of science and technology internationally. By selecting a number of typical countries (industrialized countries and developing ones), we shall conduct a comparative study of the structure and distribution of science and technology in these countries, including

(1) A comparative study of the formation, development and evolutionary course of the structure of science and technology in various countries;

(2) A comparative study of the relationships between the science and technology structure and social economic development, and of their effects;

(3) Forecasting and analysis of the trend in which the structure of science and technology will change in various countries;

(4) The present situation analysis and assessment of the science and technology structure and resource allocation policy in China.

2. Research on the policies regarding resource allocation and financial support. As things stand, the research which centers around the problems of the coordinated development of science and technology and of the rational allocation of resources still remains a rather difficult field of study which must be further explored. The research in this connection is supposed to include the following:

(1) Research on the sense of value of scientific development in different countries and its influence on scientific development in one's own country.

(2) Research on the criteria of scientific resource allocation.

(3) A comparative study of the policy of financial support given by the National Science Foundation and its influence on the development of scientific causes in one's own country.

(4) We shall, through our research, attempt to come up with some index systems and methods whereby to evaluate the structure of science and technology. And by combining with the demands and conditions, we shall make adjustments in the criteria of the scientific and technical structure so as to provide a basis for the formulation of the policies of resource allocation and development of science and technology.

3. The theory, methodology and model research of science forecasting, science assessment and science resources allocation.

(1) Studying the predictability of scientific activities. We hope to expound in theory the task, function and scope of the research on scientific and technological forecasting and assessment. We also shall perform a study of the characteristics and applicability of varied scientific forecasting and assessment methods, and establish a theoretical and methodological system of scientific forecasting and assessment.

(2) Studying the modes and ways of interaction among different disciplines, and between disciplines and social development goals and conducting research into the influence on assessment indexes and models.

(3) Research of fund distribution models and computer-aided analysis systems.

II. The synopsis of IFD

Ever since 1985, the Institute of Forecasting and Development (IFD) of Hefei University of Technology in China has conducted a great deal of research on scientific and technological forecasting and assessment and in the study of science policies. It has successively undertaken some important research projects such as

- . Forecasting and Assessment of the Development of Science and Technology in China;

- . A Comprehensive Assessment of the Priority Fields of Science and Technology in China's Colleges and Universities;

- . Forecasting and Comprehensive Analysis of the Development of Mechatronics;

- . Forecasting and Assessment of the Development of Highly Technical Industries in China.

This Institute has built up a good basis for international cooperation in scientific and technological forecasting and assessment , in structural analysis , and in accumulation of scientific statistical data.

III. Envisagement of International Cooperation

Science is a constantly growing and changing system of knowledge. It is also a social and recognition activity in which all human beings participate. In order to make a systematic study of various problems faced in scientific development, and which are pertinent to the structure of science , the development goals, the policy of financial support , and organization management , we cannot merely base ourselves on the history of the development of science and technology and on the investigations and evaluation of the present situation in our own country. Only by placing the problems in the main system of the development of science and technology in the world , studying the characteristics of scientific activities in the different developmental period of societies and different countries , delving into the relationships between inner operational mechanisms and cultural background and social economic growth in scientific development, and analysing the background and evolutionary law of the scientific structure will we be able to have a more profound and comprehensive knowledge of the origin from which this complicated problem arises, and our research results will be far more convincing. It is , therefore, necessary that we should strengthen international cooperation and exchange , conduct a comparative study of the relationships between social economic development and the selection of scientific goals , of the sense of value of scientific development , of the structure and distribution of science and technology as well as of the policy regarding scientific development , and probe into the establishment of relatively feasible methods for scientific and technological forecasting and assessment, and of criteria of the distribution of science and technology and resources allocation . this is of universally international significance to promote the practicality of research on science policies. This project , which is a major project of research on the policy of science and technology appointed by NSFC , has now come into a stage of practical research. Our current work is concentrated on the analysis of the historical evolutionary process of the structure of China's science and technology. In order to speed up the research pace and raise the research levels , IFD wishes to encourage international cooperation. And according to the principle of equality and mutual benefits , IFD is ready to carry out cooperation in this project with relevant research institutions and experts. Our suggestions are as follows:

- (1) We can jointly carry out cooperational research by selecting the above- mentioned contents or a particular subject. IFD will further provide detailed information at the request of our

cooperation agreement so that we will jointly apply to relevant organizations for financial support (Our side is NSFC, the other side may apply to the National Natural Science Foundation of its own country or to other foundations).

(2) The contents of our cooperation research include:

- . Exchanging personnel to either country to engage in advanced studies and cooperation research, including inspections, giving lectures, consultations and discussions.

- . Carrying out cooperation research and exchange on forecasting of the development of science and technology, assessment of science and technology, the theory, methods, models and software of scientific and technical resource allocation.

- . Exchange of research information.

- . Holding small international academic discussions on special topics, and so on.

We are expecting to obtain the understanding of relevant experts and scientific research institutions to jointly promote the research in this field. Experts and institutions who are interested in this project are welcome to make contact with IFD.

Chairperson of the Project: Director, Prof. Chen Yuxiang

Address : Institute of Forecasting and Development
Hefei University of Technology
Hefei, Anhui 230009
P. R. China

Telephone: 0551-254711-2558

Fax: 0551-251517

