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Series:	Bromley, D. Allan, Files
Subseries:	Organization Files - PCAST

OA/ID Number:	62078
Folder ID Number:	62078-001

Folder Title:
President's Council of Advisors for Science and Technology: General [4 of 7] [1992]

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"Document Control"

TYPE: INFORMATION DOCUMENT NUMBER: 9202373
ORIGINATOR: 02 STATUS C DIRECTORATE STATUS
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FROM: WILLARD, DEREK: THE UNIVERSITY OF IOWA

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 07/29/92

SUBJECT: LETTER EXPRESSING CONCERNS REGARDING DR. BROMLEY'S LETTER 06/08/92 WHICH SOLICITS VIEWS ON THE CURRENT STATE OF THE RESEARCH UNIVERSITY/FEDERAL GOVERNMENT PARTNERSHIP.

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DIRECTORATE ASSIGNED: STAFF ASSIGNED:

ACTION REQUIRED: STAFF ACTION:

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SENDER'S DUE DATE:

OSTP DUE DATE: STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT:

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COPIES TO: PCAST
D. Allan Bromley

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

OSTP RECEIVED: 08/14/92 DEPT RECEIVED:
FILE: P-PCAST

CENTRAL FILES:

2373

THE UNIVERSITY OF IOWA

July 29, 1992

Mr. D. Allen Bromley, Chair
President's Council of Advisors
on Science and Technology
The White House
Washington, D. C.

Dear Mr. Bromley:

The University of Iowa has the following concerns regarding your letter of June 8, 1992, in which you solicit our views on the current state of the research university/federal government partnership:

1. The Federal government should invest more of its resources in university-based, investigator-initiated basic research. Funding for basic investigator-initiated projects is becoming increasingly more difficult to obtain a) because industrial laboratories are now devoted almost entirely to applied research, b) because the recent economic climate has reduced support of basic research by governmental agencies, and c) because increasingly scarce federal funds are focussed on large projects like the super-conducting super collider and the human genome project. Basic research is inexpensive relative to applied research. Documentary evidence for the economic advantages of supporting basic research is good, both at the world and national levels. This indicates that the Federal government's past investment in basic university research has paid off.

2. Graduate programs at research universities across the country are being overwhelmed with applications from China, Taiwan, the Middle East, and India. Students from these countries typically have great motivation. However, it is important to discover why not more American students are applying for admission to graduate programs. A timely response by the Federal government could, for example, involve the funding of proposals from qualified investigators to conduct among undergraduates interviews, surveys, and the like in order to determine what can be done to make graduate education more desirable for them.

3. Political interference with peer-reviewed research may damage the nation's ability to obtain timely and accurate information. Recent examples include a) the survey study on adolescent sexual practices, which was reviewed for scientific merit and funded, only to have that funding withdrawn because the topic was not agreeable to political conservatives in the Federal government and b) the current restrictions on the use of fetal tissue, again because such use is not politically acceptable in certain quarters of the Federal government.

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AUG 3 1992
OFFICE OF SCIENCE AND TECHNOLOGY POLICY

Office of the Vice President for Research 201 Gilmore Hall Iowa City, Iowa 52242 319/335-2119
FAX 319/335-2130

4. Serious thought must be given to additional restrictions on the use of animals in research. Continuing to promulgate stricter regulations in response to pressure from animal rights groups seriously erodes the ability of research universities to carry out projects that result in benefits to large segments of the population, including animal rights activists and their families. NIH should be producing materials in support of the use of animals in university research.

5. The ability of research universities to respond to Federal government needs for health services research is hampered by: a) low-level funding of Federal initiatives, making the preparation of grant proposals a high-risk enterprise, b) emphasis on esoteric theory and methods (in the name of rigor) at the expense of useful and relevant projects, c) insufficient funding for doctoral training, d) lack of core support to university-based health services research centers, and e) lack of outcomes research to evaluate the technology NIH helps to develop. Such instability in Federal funding causes dramatic shifts in personnel which can cripple the ability to respond to new initiatives. Furthermore, anticipation of instability precludes investment in mid-career and senior investigators who can upgrade a university's capabilities, increase depth in key areas, and diversify its mix of disciplinary skills.

6. Support for infrastructure is desperately needed. Many university research facilities throughout the country are in a serious state of disrepair, are obsolete for modern research needs, and/or are overcrowded. Because of a lack of peer-reviewed funding programs, many institutions have turned to earmarking as the only source for obtaining badly needed funding to address these demands. As you surely know, recent studies show that physical plant improvements paid by institutions are also the primary factor in increases in indirect costs charged to research grants. At the same time that universities are experiencing increased facilities construction, maintenance, and repair costs, there has been a dramatic decrease in Public Health Service funding for Biomedical Research Support Grants, Shared Instrumentation Grants, and Small Instrumentation Grants. These programs traditionally have provided more direct, hands-on types of infrastructure support to new and established individuals as well as teams of investigators.

Thank you for providing this opportunity for The University of Iowa to comment on issues concerning its relationship with the Federal government.

Sincerely,

Derek H. Willard
Interim Vice President

"Document Control"

TYPE: INFORMATION DOCUMENT NUMBER: 9202395
ORIGINATOR: 02 STATUS C DIRECTORATE STATUS

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FROM: WOODS, SUSANNE: FRANKLIN & MARSHALL COLLEGE

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 07/29/92

SUBJECT: LETTER TO JIM MCCULLOUGH REGARDING SUCH A LAVISH AND EFFECTIVE MEETING.

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DIRECTORATE ASSIGNED:

STAFF ASSIGNED:

ACTION REQUIRED:

STAFF ACTION:

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SENDER'S DUE DATE:

OSTP DUE DATE:

STAFF DUE DATE

DATE COMPLETED:

DATE COMPLETED/DEPT:

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COPIES TO: PCAST
D. Allan Bromley

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FILE: P-PCAST

CENTRAL FILES:

2395

Franklin & Marshall College

July 29, 1992

Mr. James McCullough
Office of the Assistant to the
President for Science and Technology
Executive Office Building
The White House
Washington, D.C.

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92 AUG 11 P12:45
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MAIL ROOM

Dear Jim:

I enjoyed the meeting last Friday, and learned from it. Thank you for inviting me to be a part of the program.

For the record, I want to lavish some praise on you and your staff for putting together an effective and productive meeting. It is very difficult to handle meetings of this type, and everyone was knowledgeable, efficient, and courteous. And you kept things pretty well on time, a near miracle when we academics are involved!

It was also a particular pleasure to meet you. Thanks again for letting me give the liberal arts colleges a voice, and good luck to you all as you confront the difficult issues in the government-academy relationship in science research.

Sincerely yours,

Susanne

Susanne Woods
Vice President for Academic
Affairs and Dean of the College

cc: Dr. D. Allan Bromley, Assistant to the President for Science and Technology
Jean Narum, Independent Colleges Office

Office of the Dean of the College, P.O. Box 3003, Lancaster, Pennsylvania 17604-3003 (717) 291-3986

"Document Control"

TYPE: ACTION DOCUMENT NUMBER: 9202162
ORIGINATOR: 02 STATUS I DIRECTORATE STATUS

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FROM: TRICK, Timothy N.: UNIVERSITY OF ILLINOIS

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 07/29/92

SUBJECT: HE IS FORWARDING HIS VIEWS ON THE PARTNERSHIP BETWEEN THE NATION'S RESEARCH-INTENSIVE UNIVERSITIES AND THE FEDERAL GOVERNMENT.

****

DIRECTORATE ASSIGNED: PCAST

STAFF ASSIGNED:

ACTION REQUIRED: AS NECESSARY

STAFF ACTION:

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SENDER'S DUE DATE:

OSTP DUE DATE: 08/17/92 STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT:

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COPIES TO: D. Allan Bromley

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REMARKS: NRN des AKD

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FILE: P-PCAST

CENTRAL FILES:

University of Illinois
at Urbana-Champaign

Department of Electrical and Computer Engineering

155 William L. Everitt Laboratory
1406 West Green Street
Urbana, IL 61801-2991

Timothy N. Trick, Head

217 333-2301

2162

RECEIVED
92 AUG 3 P12:24
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MAIL ROOM

July 29, 1992

The President's Council of Advisors
on Science and Technology
c/o D. Allan Bromley, Director
Office of Science and Technology Policy
The White House
Washington, D.C.

Subject: Partnership between the Nation's research-intensive universities and the Federal Government

Dear Members of the Council:

Last year the Department of Electrical and Computer Engineering at the University of Illinois, Urbana-Champaign campus, celebrated its centennial. In researching the history of the department, it was found that the changes in the curriculum, mission, and funding of the department in the post-World War II years were dramatic. In 1940, the mission was primarily teaching, and the curriculum prepared students predominantly for jobs in the electrical utility industry. Approximately 90% of the income to the department came from tuition and state support. Immediately following World War II the mission of the department became teaching and research. Each function was given equal status. A faculty member could become tenured by excelling in either area. However, the university did not support research. Any faculty, staff or student time on research had to be charged to a contract. It was common for faculty to pay one-half their academic year salary for contracts in order to reduce their teaching load by one-half to allow time for research. As early as 1950, only one-third of the income to the department came from tuition and state support. Already over 60% of the department's income came from grants and contracts. Only a couple of percent of the income came from gifts. Interestingly, in 1990 we still have approximately the same percentages in sources of funding. There have been some changes. For example, in 1950 almost all grants and contracts were with the federal government. Today approximately 15% of the grants and contracts are with industry, and the percentage of income from gifts has doubled, although it is still a small percentage.

ADDITIONAL HISTORICAL OBSERVATIONS

Although the percentages for the sources of funding to the department have changed little in the past four decades since the University of Illinois became a major research university, there have been other significant changes. Some of these are cited below.

Curriculum

The curriculum changed dramatically in the 1950's and 1960's to reflect the demand for engineers in the electronics industry. The research faculty played a dominant role in these changes, and they were responsible for most of the new textbooks of this era.

Teaching Faculty

The two ladder tenure system (teaching or research) failed. Some teaching faculty couldn't keep pace with the changing curriculum and felt like 2nd class citizens. While some research faculty could not teach. In the 1960's the university adopted a policy that faculty must have acceptable performance in both teaching and research and must excel in one of these areas, or preferably both in order to be awarded tenure.

Uncontrolled Expansion of Graduate Programs and Research Universities

Virtually any university wishing to establish a graduate program in science or engineering was successful. With graduate programs it became necessary for universities to obtain research funding in order to attract graduate students. Today it is extremely difficulty for tenure-track science or engineering faculty to become tenured at any university with a graduate program unless they are very successful at winning research grants.

Research Expense

Except for computing, the cost of research equipment has grown much faster than inflation. The microelectronics industry is a good example. In the 1960's an IC facility could be built for less than $100,000. Next generation IC facilities are projected to cost $1,000,000,000.

Grant Size

Since World War II basic research has been a "Queen Bee," and there has been no birth control. The presidents of universities aspiring to become research universities were typically successful gaining the support of local industry and local politicians for their cause. Since the federal government is the primary supporter of basic research in universities, the federal government found itself with many more mouths to feed, and the political pressure intensified. To appease the masses the number of grants awarded by federal agencies increased in this period, but grant size shrunk in real dollars. "Pork barrel" funding for research became more common in congress.

In the 1950's and 1960's it was common for a research professor to have a single grant which provided support for a couple of junior faculty, several graduate students, and support staff. There was a strong mentoring relationship between the senior faculty and the junior faculty which in general was very positive. In our Coordinated Science Laboratory the Joint Services Electronics Program (JSEP) provided almost 100% of the funding for the faculty and students.

Today in absolute dollars NSF grants and the JSEP block grants are at about the same level, but in purchasing power these grants buy only about 20% of the research that they did several decades ago. Today JSEP is still an excellent program. The review process is more stringent than the peer review process for individual grants, but the program comprises only 25% of the research funding for the Coordinated Science Laboratory. In the experimental area approximately $50,000 to $100,000 is required annually to support a graduate student. This includes the student's salary, supervision and support staff time, research expenses and overhead. On the average a faculty member must juggle 3 to 5 research grants

to support five graduate students. Continuity in funding has become a problem. Today research faculty operate under considerably more stress than they did several decades ago. Due to the multitude of contracts required to support a few graduate students, it is no longer possible for senior faculty to support junior faculty, and some agencies no longer will pay the percentage academic year salary for the time the professor spends on research. The university is expected to pay now even though the faculty have less time available for teaching today because of great increases in their management responsibilities. Successful research faculty have become very valuable in the academic market. Bidding wars are common between universities for the most talented research professors.

During this period of explosive growth of research universities, it became very difficult for junior faculty to obtain funding. To address this issue various programs for young faculty, minorities, and women were developed. Unfortunately, these programs make awards mostly on factors other than the merits of one's research proposal. Young faculty are given awards typically greater in magnitude than senior faculty can obtain from the same funding agency. These awards weaken the mentoring process. These grants are typically made for five years at low overhead rates. The young faculty often do not learn how to compete for grant money, and at the end of five years they often have difficulty obtaining grants of sufficient magnitude to support themselves in the lifestyle to which they have become accustomed. Studies have shown that in the long term young faculty receiving these awards perform no better than other young faculty who earn NSF Research Initiation Awards or other types of grants.

Industrial R & D

Excessive debt, foreign competition, and government policies on trade and support of commercial R & D has caused most U. S. companies to sharply cut back or curtail basic research. Their focus is now much shorter term and more product oriented. Universities and government owned-government operated or government owned-company operated laboratories are the only institutions left to perform long term basic research.

RECOMMENDATIONS

The four signatories on this letter have over 60 years of experience in academia, over 20 years of experience in government research laboratories, and several years of experience in an industrial research laboratory. We are concerned about the ability of the U. S. in today's environment to maintain a strong basic research capability. Yet we recognize that resources for basic research are not unlimited and that only nations with a strong economic base can afford long term basic research.

Recommendation No. 1 : Continue to create and expand funding for "Centers of Excellence" in areas of national importance.

Although we favor the enhancement of "Center of Excellence," we do not advocate the elimination of individual investigator grants. Research initiation grants for new faculty are important, and not all research ideas can be packaged neatly into centers. Thus, a proper balance must exist between centers and individual investigator grants. However, there are some clear advantages for centers in today's environment.

a) The creation of centers requires that research priorities be set. Research is more focused; the centers have a clear mission and goals. Centers have a larger center of mass and are more visible, thus it is easier to communicate results to government, industry and universities. Centers attract more visitors and provide a good forum for exchanging ideas.

b) Successful centers have more stringent review procedures. Typically these centers have an internal advisory or policy board and an external technical advisory board. In addition, typically the funding agency sends a site visit team annually to review the research projects. These site teams may contain scientists and engineers from other universities, government, and industry. The projects receive not only a peer review, but also a more critical review of their relevance and significance with respect to other external activities.

c) Centers promote a sharing of resources among faculty which is almost non-existent in single investigator grants. This is essential today in most areas of scientific investigation because of the high cost of facilities.

d) Centers foster more collaboration and interdisciplinary research among faculty. Faculty are not inclined to cooperate if each has an individual grant to manage and no strong incentive exists to promote cooperation.

e) Centers provide longer term and more continuity in funding than individual grants. The director of the center has more management responsibility than an individual principal investigator, but the other faculty can devote more time to teaching and research and less time to seeking grants, if the center is adequately funded. With the proper review and management teams, weak projects can be eliminated from the center.

Although centers must have a mission and goals, they must remain flexible. One never knows where basic research will lead. New information must be constantly evaluated and new directions taken when prudent. A quality program will have these features. The DOD JSEP and NSF ERC "Centers of Excellence" are good examples of outstanding programs that are inadequately funded. Building on these existing excellent programs within DOD, NSF, and other agencies, bringing the funding to an adequate level, and enhancing the interaction among these centers, government research laboratories, and industry should be given top priority. Finally, if centers are to play a significant role in industrial collaboration and technology transfer, then industry should be involved in the conceptualization and planning for the establishment of national Federally funded centers of excellence in universities.

Recommendation No. 2: The transfer of new inventions/technology to industrial use is of greater importance as industrial laboratories reduce their research capacity. To further this transfer new ideas are needed that go beyond the usual conference/seminar interactions of university and industry researchers.

As the relevance of research to society and its relation to industrial needs is getting increased attention, particularly for engineering and the physical sciences, it is of the utmost importance that the Federal Government funding agencies develop a clear understanding of the university's research mission which is different from the mission of an industrial research laboratory. The leading universities must play a role in these developments, but the short term views of industry cannot and should not be imposed upon universities. The inertia of research conducted by graduate students who learn and cannot react within weeks or months needs to be taken into account. The university is a resource base to educate people to solve tomorrow's problems. The influence of Government on university research also must stay free of parochial interests.

However, government and industry must play a key role in guiding long term university research. The Semiconductor Research Corporation (SRC) is an excellent example of an organization that is sponsoring long term university research relevant to industrial needs, and SRC has been extremely effective in educating industry in what can and cannot be expected from university research.

The best way to transfer ideas and technology is through the transfer of people. Universities transfer students by graduation and faculty through sabbaticals. However, more effective programs are needed to transfer people among government, industry and universities. We suggest collaborative research programs in which the government would share the cost of industry researchers working in university research centers. Such funding would be awarded in response to joint proposals submitted by industry/university partnerships for specific collaborative projects which would promote technology transfer in designated technological areas.

Recommendation No. 3: Quality and merit must be the primary criteria for funding research.

We are concerned about the growth in special research programs which seem to be motivated primarily by political considerations. Such programs undermine the confidence and morale of the research enterprise. The NSF NYI and PFF programs

are good examples of programs which should be eliminated. Peer review is the best review process for maintaining the integrity of the research enterprise. However, we recognize that the peer review process is not perfect. Sometimes the broader perspective from science and engineering leaders is needed to establish research priorities. However, in all programs political considerations must be removed as much as possible from the funding process.

We hope that these comments are helpful to you in your deliberations.

Sincerely,

Stephen Bishop, Director
Microelectronics Laboratory

Karl Hess, Director
Center for Computational Electronics

W. Kenneth Jenkins, Director
Coordinated Science Laboratory

Timothy N. Trick, Head
Department of Electrical and Computer Engineering

vlb
14TL57

"Document Control"

TYPE: INFORMATION DOCUMENT NUMBER: 9202189
ORIGINATOR: 02 STATUS C DIRECTORATE STATUS

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FROM: MASSEY, WALTER: NATIONAL SCIENCE FOUNDATION

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 07/28/92

SUBJECT: THANK YOU FOR THE INVITATION TO JOIN IN THE REGIONAL PCAST STUDY ON RESEARCH UNIVERSITIES.

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DIRECTORATE ASSIGNED:

STAFF ASSIGNED:

ACTION REQUIRED:

STAFF ACTION:

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SENDER'S DUE DATE:

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STAFF DUE DATE

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D. Allan Bromley

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CENTRAL FILES:

2189

NATIONAL SCIENCE FOUNDATION
1800 G STREET, N.W.
WASHINGTON, D.C. 20550



OFFICE OF THE
DIRECTOR

July 28, 1992

RECEIVED
JUL 30 1992
WHITE HOUSE MAIL ROOM

Dr. D. Allan Bromley
The Assistant to the President
for Science and Technology
The White House Office
1600 Pennsylvania Ave., N.W.
Washington, D.C. 20500

Dear Allan:

Thank you for the invitation to join one of the regional meetings for the PCAST study on Research Universities and the Federal Government. Unfortunately, the dates mentioned all conflict with previous commitments on my calendar.

I am sure the meetings will develop some excellent ideas. I hope a collected summary of each meeting will be available for study.

I am sorry that I am unable to attend.

Sincerely,

Walter E. Massey

Walter E. Massey
Director

"Document Control"

TYPE: INFORMATION DOCUMENT NUMBER: 9202185
ORIGINATOR: 02 STATUS C DIRECTORATE STATUS
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FROM: WOODS, SUZANNE: FRANKLIN & MARSHALL COLLEGE

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 07/27/92

SUBJECT: LETTER TO DR. SHAPIRO REGARDING PCAST

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DIRECTORATE ASSIGNED:

STAFF ASSIGNED:

ACTION REQUIRED:

STAFF ACTION:

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COPIES TO: D. Allan Bromley

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2185

Franklin & Marshall College

July 27, 1992

RECEIVED
92 AUG 4 A8:45
OSTP
MAIL ROOM

Harold Shapiro, President
Princeton University
Princeton, New Jersey 08540

Re: President's Council of Advisors on Science and Technology

Dear Dr. Shapiro:

I appreciated the opportunity to speak on behalf of undergraduate science research at the July 24 PCAST hearings in Washington, and would like to follow up on the suggestion I made about funding models for collaborative research.

My premise is that collaborative research among undergraduates, graduates, faculty and (possibly) postdoctoral fellows can be both effective education and good science. These collaborations already take place all over the country in an *ad hoc* way. A visible program to develop transferable models for such collaborations would have at least three positive effects: it would invite more such collaborations; it would develop models that could be offered to a variety of interested institutions, who might thereby save considerable planning time and energy; and it would focus both academic and public attention on the interconnectedness between good education and productive research.

Such programs could be of at least three kinds: collaborations between colleges and research universities, in which college faculty and undergraduates work with university students and faculty in state-of-the-art research laboratories; university research projects specifically designed to include undergraduates; and collaborative college programs, in which a set of primarily undergraduate colleges would work together to enhance the critical mass of faculty expertise and limit the most advanced laboratory requirements to only one of several campuses.

A variety of models are possible, depending on whether the research is primarily theoretical or experimental and on the disciplines involved. The program might also be used to expand interest in cross-disciplinary collaborations, as for example in a subset of funding for models developing from the current FIPSE-NEH-NSF initiative.

I bring a personal interest to collaborative research projects of this kind. For the past four years I have been the Principal Investigator for two NEH-funded grants which have produced at Brown University a computer textbase of early literature by women writing in English. This project, an affiliate of the internationally-funded Text Encoding Initiative (TEI), has successfully involved undergraduates, graduate students, and professors from several institutions in developing state-of-the-art text encoding for a wide range of classroom and research purposes. My own model for developing the Brown Women Writers Project, as it is called, came from what I observed of the social and collaborative world of science research.

Office of the Dean of the College, P.O. Box 3003, Lancaster, Pennsylvania 17604-3003 (717) 291-3986

Thank you again for the opportunity to address PCAST. I wish you well in your important task.

Sincerely yours,

Susanne Woods

Susanne Woods
Vice President for Academic Affairs and
Dean of the College

cc: Dr. D. Allan Bromley, ✓
Assistant to the President for Science and Technology

"Document Control"

TYPE: ACTION DOCUMENT NUMBER: 9202245
ORIGINATOR: 02 STATUS I DIRECTORATE STATUS

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FROM: CRECINE, John P.: GEORGIA TECH

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 07/28/92

SUBJECT: HE IS WRITING WITH HIS COMMENTS FOR THE PCAST PANEL STUDYING THE RELATIONSHIP BETWEEN THE FEDERAL GOVERNMENT AND RESEARCH INTENSIVE UNIVERSITIES.

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DIRECTORATE ASSIGNED: PCAST

STAFF ASSIGNED:

ACTION REQUIRED: AS NECESSARY

STAFF ACTION:

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REMARKS: NRN per AKD

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FILE: P-PCAST

CENTRAL FILES:

2245

Georgia Tech

Office of the President

Georgia Institute of Technology
Atlanta, Georgia 30332-0325
404•894•5051
404•853•9163 FAX

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92 AUG 6 P2:02
OSTP
MAIL ROOM

July 28, 1992

Dr. D. Allan Bromley
The Assistant to the President
for Science and Technology
Executive Office of the President
The White House
Washington, D.C. 20006-9900

Dear Dr. Bromley:

Thank you for the opportunity to provide input as PCAST reassesses the partnership between the Federal Government and the Nation's research-intensive universities.

The partnership between the Federal Government and our research insitutions has evolved over a period of fifty years. Therefore, I would caution that any sudden changes may cause major dislocations in higher education. Nevertheless, it is clear that it is time to re-evaluate and strengthen that partnership.

In recent decades, we have witnessed technology and technological leadership become increasingly important in terms of global economic effectiveness. As a result, our higher education institutions, particularly our research-intensive institutions, have assumed the role of providing the Nation with the world's best scientific and technical talent, as well as creating and developing new knowledge and ideas. Our success in filling this role, in turn, is heavily dependent upon the Federal Government. Without this partnership, we would be doomed to failure.

I have attached some comments and observations from our faculty that you may wish to consider as PCAST works to ensure the effectiveness of this partnership. Please do not hesitate to contact me should you desire additional information.

Regards,

John P Crecine

John P. Crecine
President

JPC/pl

Comments Prepared
for
The President's Council of Advisors
on Science and Technology

July 21, 1992

Federal Support of Research

1. A strategic plan for higher education needs to be developed and all members of the partnership -- the Federal Government and its individual elements as well as colleges and universities -- should work together to meet strategic objectives. Policy decisions made by members of the partnership should be in support of the strategic plan and should be made with complete realization of their impact. For example, we sometimes see agencies attempt to fine-tune an aspect of education under their purview by issuing new policies, but doing so without a comprehensive analysis of what the changes may mean to the "big picture." There is a little fine-tuning here, a minor adjustment there, and so on until the cumulative effect is one that was not anticipated.

2. The Federal Government needs to emphasize the support of research which will have the greatest impact. This, almost by definition, is not "incremental" research, but is rather research which by its very nature is "risk taking." Unfortunately, our peer review system, particularly at times of decreased funding for research, tends to protect the status quo and to reward incrementalism. Thus, there must be a balance between merit-based peer review and the decision making of program managers at agencies.

3. Traditional "earmarking" serves a political, local, sociological need within an individual Congressional district or state. Unfortunately, many such pragmatic awards, at least with respect to R&D funds, are made without significant concern for the research caliber of the institution involved or of the desired research result. Typically, there is little "after action" accountability. The allocations often go to institutions without the staff credentials to carry out the awarded research. Such grants are often typified by a focus on where the funds go rather than on the selection of a qualified research team.

4. The escalating use of "earmarking" in the Federal budget should not be dismissed casually as an attempt by the "have nots" to take money away from the "haves." It also signals an imperfection in the peer review system.

5. The funding priorities at several agencies, e.g. NSF, have been: support people, first; support instrumentation, second; and support facilities (brick and mortar), third. Limitation of funds has resulted in no more than the first priority receiving support. As a result, the research infrastructure has eroded significantly over the past twenty years.

6. Single investigator grants have been and should continue to be the foundation of academic research in science and engineering. In recent years, unfortunately, there has been an erosion in funds for single investigator grants, at least in some agencies. This is a serious problem because the innovations and basic discoveries that drive our industrial and scientific enterprises are still largely made by individuals. We need to reemphasize the importance of single investigator grants (including grants for small teams of 2-3 investigators).

7. The growth in demand for Federal support, coupled with fiscal pressures, has resulted in the development of an adversarial relationship. Further, the Federal attitude toward paying the

full cost of federally supported R&D has changed. Universities are asked to subsidize federally supported research on the basis that such research would have been performed in the absence of federal support.

8. A fair system for conducting federally sponsored research and reimbursing the costs of research must be maintained. In June of 1991, OMB proposed a set of regulations that would limit the administrative component of indirect cost reimbursement to 26% of a research project's direct costs. The 26% cap is independent of the true cost structure of the institution conducting the research, the nature of the research, or any consideration of the accounting system employed by the institution which determines whether a particular cost is the basis for a direct or an indirect charge. If the real, indirect administrative costs are more than 26%, the Federal Government will not allow full cost recovery. Based on current Federal auditing procedures, all or nearly all research universities' true administrative costs currently exceed 26% of direct costs. This artificial constraint on full cost recovery destroys the consistency in Federal policy to date and does not allow full recovery of the costs of research. Further, it is interesting to note that the regulation only applies to universities and not to the other providers of Federal research services, whose indirect costs are generally 50% to 100% higher than those of universities. Such an arbitrary constraint restricts the normal course of competition based on both quality and cost. It also may penalize major research universities which must maintain more extensive research facilities than smaller schools or "beltway bandits."

9. The Federal Government's attitude toward support of research in colleges and universities has shifted in the past decade. Whereas, Federal support was viewed as being for long-term basic research, in recent years the focus has been on short-term research with an emphasis on deliverables. The relationship has changed from that of Federal <u>support</u> of research because it enhances the quality of the educational system to Federal <u>procurement</u> of specific research results to solve specific problems. Far too often funding practices discourage in-depth quality work on basic issues. There should be a system which provides stable support of academic research. Further, the duration of research grants should be extended for multi-years so that faculty can spend more time thinking and doing research and less time writing proposals.

10. Historically, universities and Federal laboratories have had different research roles. Primarily, the national laboratories, particularly the defense-oriented laboratories, have functioned as research managers rather than principal researchers for federally sponsored programs. However, in the present climate of declining defense budgets, the personnel and programs at the national laboratories are in jeopardy. This means that the laboratories are seeking more in-house research to support personnel and new missions in non-defense areas. As a consequence, they will be competing more directly with universities and will often have an unfair advantage because they are on the "inside" of Federal budget and policy decisions. What is particularly distressing for research institutions is the fact that, in many cases, the laboratories are not as technically qualified in the research areas they are seeking to dominate. Furthermore, both Congress and the Executive branch are concerned with technology transfer for research developed with Federal dollars. The national laboratories are being designated as primary entities for disseminating technology to the private sector and the Federal agencies are being encouraged to look at the laboratories first for research support.

    Without question, the national laboratories are valuable assets in the Nation's technology mix. However, National policy makers must clarify the importance of universities and encourage balanced research programs that use the best expertise available. This will not only create a more cooperative atmosphere, but will also ensure that the U.S. receives maximum value for its Federal research investment.

11. Universities, as partners with the Federal Government in the National research enterprise, are being subjected to an increasing number of regulations and administrative requirements which

are burdensome and costly. While Federal regulations play an important and necessary role in advancing National policy goals and ensuring that taxpayers' funds are properly spent, questions of research productivity and effective use of science dollars are equally compelling. Historically, the Nation's universities have been strong supporters of Federal regulatory efforts. Indeed, university scientists and policy analysts frequently contribute to the development and refinement of important regulatory standards. However, the extension of many regulations and agency requirements has placed an added financial and administrative burden on the research infrastructure. Some have a direct impact on the conduct of research, inhibiting both the quality and quantity of research.

12. If the U.S. is to be a leader in high technology industries and be competitive internationally, the Federal Government needs to increase support for engineering research even more than it increases support for science. Unfortunately, science seems to be "sexier" to Congress and others. For example, the recent budget request for the FCCT biotechnology initiative allocated too high a proportion of the funds for the basic science of biotechnology and very little for engineering as related to biotechnology. If Japan "beats" us in the area of biotechnology, it will not be because of the basic sciences; it will be a result of their emphasis on the applied science and manufacturing-related issues.

13. In contrast to European countries, the Federal Government's support of public institutions of higher education does not include release time for research. Further, tuition has not been established at levels sufficient to allow comparable teaching loads with our European counterparts. As a result, government support of research in Europe tends to support technicians, equipment, and other infrastructure items. Generally, it is not used to support faculty and graduate students.

14. The number of colleges and universities desiring to receive Federal R&D support has grown significantly, as has the size and cost of research at individual institutions. At the same time, the value of the U.S. system of higher education has increased to the point that U.S. universities are highly sought after "partners" by foreign governments and businesses.

15. Over the past twenty years, graduates from the best research universities have populated universities that would not have been categorized among the "top tier" of research universities. However, these universities have developed research capabilities that rival those at what were categorized as "the best" research universities. The "new breed" demonstrated greater flexibility and greater responsiveness in performing research in new ways on new kinds of problems. While the "old breed" focused on incrementalism, the "new breed" developed new research paradigms.

Federal Support of Education

1. The U.S. needs to make science- and technology-related careers attractive to American young people. Science, technology, mathematics, and computer courses need to be a part of the core, required curriculum of all high school students. Furthermore, we will not be a leading country in the future unless the quality of K-12 teaching of such courses dramatically improves and the percentage of teenagers who graduate from high school significantly increases. The Nation's colleges and universities can play a significant role in improving the quality of mathematics, science, and computing in precollege programs.

2. In general, Colleges of Education have not worked closely with Colleges of Science and Colleges of Engineering to develop remedies to the precollege problem. Precollege programs, nationally, regionally, and locally, lack coordination. Federal agencies compete for

Congressional support by developing the "precollege program of the month"; individual faculty members submit proposals to employ remedies that are, at best, bandaids!

3. An appropriate role for the Federal Government is coordination and support. Whereas the cost of higher education has grown significantly in the past twenty years, the quality of its programs is seldom questioned. In the case of precollege education, while costs have escalated, quality has seemingly deteriorated. We hear that the U.S. spends more on a per capita basis on precollege education than any nation in the world, yet relatively less reaches the classroom than in past generations.

4. The demographic shifts, as well as the changing distribution of wealth, mandate a change in Federal attitudes regarding the cost of higher education. Tuition-free alternatives must receive higher priority for vast segments of the Nation's population. Those who are capable of pursuing advanced degrees in computing, engineering, mathematics, and science must be supported to do so. Ultimately, the quality of life for our people depends upon the technological education level of our people. Working harder than the competition is not a winning strategy--working smarter and harder is!

5. Scholarships, forgivable loans, traineeships, assistantships--all are important and should be included in the Federal Government's portfolio of support of higher education.

6. Despite the "marketing claims" of some agencies to the contrary, the primary benefit of federally supported research in colleges and universities is its impact on the education of faculty and students, not the research result itself. While there are counterexamples that demonstrate that federally supported research produced a specific result in a university that led to commercial success, it is generally the case that such research advances the frontiers of knowledge and contributes to the education of graduate and undergraduate students.

7. The principal contribution made by universities to competitiveness is graduating well-educated students. To obtain an upward spiral in competitiveness, faculty should be encouraged to develop research agendas on the basis of industrial practice; what is learned from research should be taught to students; students who become employed in industry will enhance competitiveness by practicing what they have been taught. The closed loop cycle of *research what is practiced, teach what is researched, practice what is taught* should be encouraged by the Federal Government.

Federal Support of Human Resources

1. The U.S. will not have the necessary science and engineering manpower 20 years from now unless the number of women and underrepresented minorities majoring in these fields dramatically increases. Broadening the participation of women, underrepresented minorities, and disabled persons in engineering, computing, mathematics, and science is essential. The Federal Government has a major role to play in achieving full participation of all segments of society and technology.

2. The support of human resources should be the highest priority of the Federal Government. However, it must also be sustained support. The greatest "leakage" in the pipeline occurs at the transition points: from high school to college and from undergraduate school to graduate school. Support packages should be developed that "bridge" the transitions.

"Document Control"

TYPE: ACTION DOCUMENT NUMBER: 9202232
ORIGINATOR: 02 STATUS I DIRECTORATE STATUS

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FROM: COLLINS, Thomas C.: OKLAHOMA STATE UNIVERSITY

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 07/28/92

SUBJECT: HE IS FORWARDING HIS COMMENTS FOR THE PCAST PANEL STUDYING THE RELATIONSHIP BETWEEN THE FEDERAL GOVERNMENT AND RESEARCH INTENSIVE UNIVERSITIES.

****

DIRECTORATE ASSIGNED: PCAST

STAFF ASSIGNED:

ACTION REQUIRED: AS NECESSARY

STAFF ACTION:

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SENDER'S DUE DATE:

OSTP DUE DATE: 08/20/92 STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT:

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COPIES TO: D. Allan Bromley

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Oklahoma State University

VICE PRESIDENT FOR RESEARCH
DEAN OF THE GRADUATE COLLEGE

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July 28, 1992

MEMORANDUM

TO: Dr. Allen Bromley
Assistant to the President for Science and Technology

FROM: Thomas C. Collins Thomas C. Collins
Vice-President for Research
Dean of the Graduate College

SUBJECT: PCAST Review of the Relationship Between the Federal Government and the Nation's Research-Intensive Universities

As you are well aware, the current relationship between the research universities and the federal government has been driven by the Cold War. The recent events in the international security arena have altered that connection. Global economic competition is now becoming the driving force in the alliance between the federal government and the research universities.

The competitive economic environment requires rapid generation and utilization of knowledge across the entire sociotechnological spectrum. With an expected 8-10% redistribution of the federal budget from DOD and DOE operations to civilian and other governmental agencies, it is essential that all entities become much more proficient in generating and utilizing knowledge.

In each of the government agencies, a process and relationship need to be established to fund research and create an infrastructure to absorb the scientific knowledge which will emanate from this budgetary redistribution. The federal government will have to subsidize this endeavor. The states are reeling from absorbing increasing medical and welfare costs, and will not be able to adjust their tax base sufficiently to handle the costs of developing such an infrastructure.

A brief summary of how the relationship between the federal government and academia evolved over the past thirty years lays the groundwork for examining the weaknesses of that approach in the current environment.

The Department of Defense (DOD) was set up to absorb and utilize scientific knowledge rapidly and continuously by performing the entire research, development, testing, and evaluation (RDT&E) cycle. The Department of Energy (DOE) also has some similar capabilities. However, most of the civilian industry, as well as other governmental agencies, are not equipped to absorb knowledge continuously. The typical approach is to absorb new knowledge up to a point, then settle into a lengthy status-quo phase. An example is the automobile industry which reached a point where the expected return on investment virtually caused technological innovation to cease in the 1950s until global economic competition forced a paradigm change in the 1980s.

No effective policy for planned change in this arena has existed heretofore at the federal level. For example, the thousands of scientists and engineers created by John F. Kennedy's investment in NASA found themselves unemployed when Richard Nixon reduced the NASA funding by 40% in fourteen months. The investment in training costs, much of which had been subsidized by the federal and state governments, were sacrificed. To his credit, Nixon soon started the War on Cancer, investing heavily in biotechnology, but general social well being is sorely affected by these sudden changes in federal priorities. The Mansfield Amendment of 1968 is another example of how political decisions affect the direction of funding for research. This amendment has forced federal government to concentrate funding for mission-driven, short-term research, which may or not be the most expeditious utilization of the federal research dollar overall.

In the transition from the Cold War to global economic competitiveness, there needs to be a well developed planning process of phased-in shifts to facilitate the continual growth of the overall scientific base. This requires an understanding of change and an ability to develop policy to manage and stimulate knowledge utilization and growth. A new relationship between the federal government and the research-intensive universities needs to be forged. This relationship should be organized around new and innovative strategic partnerships including government, academia, and industry. Human and capital resources need to be leveraged to achieve the RDT&E cycle across the entire sociotechnological spectrum. What is needed is an innovative federal initiative including a plan for controlled growth, effective policy to implement the redistribution of R&D funds, and a mechanism to create the appropriate infrastructure for the development of strategic partnerships.

A response to each of the questions is attached. Thank you for the opportunity to participate.

RESPONSES

1. Capacity of research-intensive universities to fulfill their mission in research, education and public service; principal concerns, suggested remedies.

The infrastructure (buildings and equipment) of the research intensive universities is scarcely adequate to fulfill the present mission; yet they face an expanded mission to support our global competitiveness in the economic and environmental spheres. As present resources are inadequate for this task, new strategic partnerships will be required with government, industry and the academy in order to maintain our mutual strengths and capacities. This new capacity will be measured by the ability to leverage resources to solve sociotechnological problems.

A second area of concern is maintaining a vital base of intellectual capacity. Either more American youth must be stimulated to pursue advanced degrees or we must import this intellect from abroad. History teaches us that a nation which relies solely on the latter course has ultimately abandoned the education of its youth to others and must expect to see its values eroded by this choice.

2. Nature of the current relationship between research-intensive universities and the Federal Government; changes occurring or in view; principal problems or areas of difficulty; suggestions for improvement.

Currently the government is not paying the true cost of the research it contracts with the universities. The current climate is forcing the universities to over cost share, accelerating the deterioration of the universities' infrastructure. This problem is exacerbated because the state governments are not able to support the universities as they did in the past. Too many state resources are being mandated for programs that formerly were the province of the Federal government.

3. **Key elements of principles that should characterize the relationships between research-intensive universities and the Federal and/or State governments in the coming years.**

There is a need for strategic partnerships among government entities, research universities, and the private sector. An additional requirement is the ability to forecast and manage change collectively. However, although some aspects are performed more effectively collectively, others require independent action. Therefore, it is essential for the government, the universities, and the private sector to maintain separate identities in the process.

4. **The most pressing challenges confronting research-intensive universities over the next decade; role, if any, for the Federal Government.**

There needs to be an effective mechanism for redistributing the federal budget across the agencies, effective policy to implement the redistribution, and effective policy to facilitate, rather than hinder, the development of strategic partnerships.

5. **Concerns regarding physical facilities for research: realistic needs, barriers (e.g., limits to campus expansion), role of institutions, States, Federal Government in financing.**

All research universities must maintain a basic core, regardless of their distinct and unique mission. For efficient use of limited resources, additions to the physical plant must be carried out in a well-planned, continuous mode, rather than sporadically. There must be a continual revenue stream devoted to non-obsolescence (e.g., equipment and repair).

6. Balancing merit-based peer review with other criteria for supporting research.

It is not in the best interests of the country to base allocation on one criterion. The federal government is aware of the "haves" and the "have-nots" with respect to the percentage of federal funds which accrue to universities. There will probably always need to be boosts given to certain research universities to allow them to remain competitive. The federal EPSCoR model is a good example of how the geographic distribution of research support can be improved while retaining the best aspects of peer review. Criteria other than geographic distribution could be (and have been) matched with peer review in a similar fashion to produce beneficial results.

7. General commitment expected of Federal Government to the university-based pool of highly trained scientists and engineers.

It is essential to have a strategic plan underwritten by policy so that the career path for a highly skilled segment of society is not eroded because of political actions and priorities.

8. The Federal Government's role in expanding the number of university-based women and minorities in science and engineering.

One of the roles of the federal government is the social welfare function. This function includes assuring a highly-skilled labor force with opportunities and career paths for all persons. It is incumbent on the research universities and the federal government to create career paths which assure the success of its student body. Included in the model will be federal and state assistance for underrepresented cohorts.

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ORIGINATOR: 02 STATUS I DIRECTORATE STATUS

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FROM: MURRIN, Thomas J.: DUQUESNE UNIVERSITY

TO: DR. D.A. BROMLEY

DATE OF CORRESPONDENCE: 07/27/92

SUBJECT: HE IS WRITING WITH SUGGESTIONS FOR THE PRESIDENT'S CAMPAIGN REGARDING POPULATION CONTROL.

****

DIRECTORATE ASSIGNED: PCAST

STAFF ASSIGNED:

ACTION REQUIRED: FOR DAB'S SIGNATURE

STAFF ACTION:

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SENDER'S DUE DATE:

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THOMAS J. MURRIN
OFFICE OF THE DEAN
A.J. PALUMBO SCHOOL OF BUSINESS ADMINISTRATION
TELEPHONE (412) 434-5156
FAX (412) 642-9106

July 27, 1992

Dr. Allan Bromley
Assistant to President for Science
and Technology
Office of Science and Technology Policy
The White House
Washington, DC 20506

Dear Allan,

In response to your welcome note of July 15 accompanying David Packard's views on population control, I offer the following ...

David is, as usual, capable and courageous in articulating his insightful views on this crucially important topic. BUT, I would not encourage the President to make this a conspicuous "plank" in his very challenging campaign during the next few months. As a last resort before doing this --- if it was decided to "charge ahead" --- I would urge that his position be endorsed beforehand by influential leaders of different faiths --- such as Cardinal O'Connor of New York; representing the Catholic Church. Otherwise, this could do much political harm --- if only because of the complexity of the topic.

Rather, I urge that the President concentrate on Economic Growth --- and espouse a vigorous Industrial Policy (without calling it by this jargon)! Beyond any other issue, our citizens are looking for leadership for Secure Jobs --- and continuation of our American Dream! See attached ...

Happy to discuss!

Many Thanks! Good Luck! God Bless!

Most sincerely,

Tom

Thomas J. Murrin
Dean

TJM/lg
Enclosure

Five Key Global Competitive Factors

The following summarizes my views on Five Key Global Competitive Factors. These derive partly from the writings of others --- and partly from my several-decade-long pre-occupation with this increasingly important subject. Obviously, lengthy reports or books could and should be devoted to each --- and the Council on Competitiveness is doing this in regard to two of the factors: Capital and Technology. Perhaps the list should be lengthened to add, for example, Trade Policies and Procedures --- but, in any case, the following five factors are crucial:

o National Will. That is, a top-priority of a country --- arrived at by consensus; guided by a strategy; and made effective by enlightened leadership. After World War II, we did a superb job of prioritizing National Security and developed and sustained a tremendous infrastructure to succeed. Unfortunately, we --- compared especially to Japan --- have neglected Industrial Pre-eminence and Economic Growth Goals and now must rapidly re-orient our resources from "swords to plowshares".

o Available, Low Cost and Patient Capital. Though there are different views regarding our capital's availability and comparative cost --- relative to Japan and Germany, for example --- Michael Porter's analysis makes it painfully clear that we have serious problems with Patience; Time Horizons; and Capital Investment Policies and Procedures.

o Leading Technology. Our post-World War II lead in all Critical Technologies has virtually dissipated --- and we are now overtaken by Japan and/or Germany in several key areas. Worrisomely, current trends suggest that we may continue to lead in few, if any, technologies in five or ten years.

o World-Class Education. Here our shortcomings are well-known --- and generally are being addressed; hopefully in a timely manner. But is becoming increasingly clear that we also need new mechanisms to "re-thread" countless supervisory and managerial personnel --- and this may be an opportunity for some discerning schools, companies and other organizations.

o Continuous, World-Class Quality and Productivity Improvement. Happily some of our organizations have developed such policies-and-procedures --- and the big challenge/opportunity now is to diffuse these throughout Industry, Government, Academe, Health Care ...

Recently --- with the "help" of a dozen Japanese executives to whom I was lecturing at CMU --- we ranked the U.S. vs. Japan vs. Germany on these five factors. Overall, the U.S. came in a "close" third --- but third nevertheless; behind Japan and Germany! The attached N.Y. Times article reports on a study which seems to confirm the credibility of this worrisome assessment ...

It appears that our biggest near-term opportunity for improvement is in regard to National Will!? Perhaps the opportunities afforded by the current political campaign will help to make a critical contribution.

Happy to discuss!

Thomas J. Murrin
June 25, 1992

U.S. Business Dips in Status

GENEVA, June 21 (Reuters) — A survey released today shows the United States falling from second place to fifth in a ranking of industrial countries' business competitiveness.

The report, based on the responses of 18,000 corporate executives worldwide, gave the United States low marks on overall economic strength, science, technology and management. It also asserted that the quality of American workers was dropping sharply, based on the education system's perceived inability to meet the needs of a competitive economy.

The survey was compiled by the IMD international management school in Lausanne, Switzerland, and the World Economic Forum, a Geneva-based group that specializes in business conferences.

Japan topped the list of most competitive countries in both 1991 and 1992. In the newest ranking it was followed by Germany, Switzerland, Denmark, the United States, the Netherlands and Austria. Last year, the United States was ranked second, followed by Germany, Switzerland, Canada, Austria and the Netherlands.

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6-22-92

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TYPE: ACTION
DOCUMENT NUMBER: 9202276
ORIGINATOR: 02
STATUS I
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FROM: MURRIN, Thomas: DUQUESNE UNIVERSITY

TO: DR. D.A. BROMLEY

DATE OF CORRESPONDENCE: 07/27/92

SUBJECT: HE IS FORWARDING HIS RECOMMENDATIONS FOR 1993 GOALS.

****

DIRECTORATE ASSIGNED: PCAST

STAFF ASSIGNED:

ACTION REQUIRED: AS/IF NECESSARY

STAFF ACTION:

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SENDER'S DUE DATE:

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July 27, 1992

Dr. Allan Bromley
Assistant to President for Science
and Technology
Office of Science and Technology Policy
The White House
Washington, DC 20506

Dear Allan,

Again, it was great being with you at Duke!

I'm sorry but I can't join you for the next PCAST and David's magnificent California escape! (I hope to be vacationing with my family on the Outer Banks of North Carolina.)

In response to your request for recommendations for '93 Goals, I urge that we increase our efforts aimed at Global Competitiveness; Economic Growth and the continuation of our American Dream!

For example,

- We should support and stimulate the new FCCSET 21st Century Manufacturing initiative --- and related programs such as Peter Likin's Agile Enterprise Manufacturing and Tom Malone's Fibre/Textile/Apparel Complex;

- We should also promote programs to effect Concurrent Engineering; World-Class Quality and Productivity Improvement; and radically Shortened Cycle Times;

- We should popularize the emerging techniques for The Management of Technology; and

● We should aim to help develop practical, prudent means for our companies to exploit some of the tremendous knowhow and resources heretofore kept SECRET --- and Jim Watkins enlightened efforts in DOE's National Labs is relevant, exciting and promising. We should all ponder the current Issues article: "The Perils of Government Secrecy: Excessive classification of information wastes money, handcuffs innovation, and makes a mockery of democracy."

Many Thanks!

Good Luck!

God Bless!

Most sincerely,

Tom

Thomas J. Murrin
Dean

TJM/lg

Attachments

Five Key Global Competitive Factors

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6-22-92

DUQUESNE UNIVERSITY
A. J. PALUMBO SCHOOL OF BUSINESS ADMINISTRATION

INTER-OFFICE CORRESPONDENCE

To: Dr. T. Pollack - Dr. W. Presutti - Dr. R. Bond
Dr. K. Paige - Dr. L. Kurke

From: Dean Thomas J. Murrin

Date: July 7, 1992

Subject: HEAD TO HEAD

The attached book, HEAD TO HEAD: The Coming Economic Battle Among Japan, Europe and America by Lester Thurow, Dean of MIT's Sloan School of Management is strongly recommended for you and your people.

To whet your appetite, Dean Thurow writes in Chapter 1:

"The nineteenth century is remembered as the century of Great Britain. It was the dominant economic power. The twentieth century will be remembered as the century of the United States. It was, and is, the dominant economic power. In terms of the calendar, the twenty-first century has not yet quite begun, but a future economic historian looking backward will date the end of the twentieth century slightly early. Just as the fall of the Berlin Wall in November of 1989 marked the end of the old contest between capitalism and communism, so the integration of the European Common Market, on Jan. 1, 1993, will mark the beginning of a new economic contest in a new century at the start of the third millennium. At that moment, for the first time in more than a century, the United States will become the second largest economy in the world. This reality will become the symbol for the start of the competition that determines who will own the twenty-first century."

Japan 2000

Report on Japan's Quest for World Economic Dominance

By Andrew J. Dougherty, Rochester Institute of Technology

A Digest

Highlights

Japan: 2000 portrays a Japan singlemindedly bent on global economic dominance and systematically exploiting foreign nations to achieve it. The report prepared by the Rochester Institute of Technology under contract by the U.S. Central Intelligence Agency, claims that the U.S. Economy is teetering on the brink of collapse as Japan's economic power soars. It characterizes Japan's system of values as irreconcilably at odds with that of the West. Without a massive, concerted effort to counter Japan's global ambitions, the report foresees nothing less than the destruction of Western civilization as we know it. Japan: 2000 is an unabashed call to economic arms.

The monograph, from which the CIA has distanced itself, is undoubtedly the most inflammatory contemporary depiction of the Japanese economic challenge from a serious source. It echoes the themes of several of the so-called revisionists - - Van Wolferen, that Japan is "different" from Western trading partners and so must be approached differently; Choate, that Japan dangerously manipulates U.S. public opinion and political decision making; Fallows, that Japan's economic might should be contained. But it is more extreme in tone and content than the works of any of these writers.

Details

The Japanese Paradigm

Japan: 2000 starkly juxtaposes two "operative global economic models" - - the Western Paradigm and the Japanese Paradigm - - as fundamentally at odds with one another. The report warns against accepting the fallacy that "Japan and the U.S. are bound together by democratic values and common national objectives. In fact, the cultures of the West and East are worlds apart and very few values are shared." Likewise, the notion that the "U.S. and Japanese economies are becoming increasingly intertwined, converging to mutual advantage" is rejected as a "fantasy."

The Western Paradigm derives from Judeo-Christian traditions which, according to the report, embrace universal truths. It rests on principles of democracy, individuality, equality, and human rights. The Western Paradigm believes in the sharing of knowledge for the betterment of all and in an open trading system leading toward world economic parity.

The Japanese Paradigm, by contrast, does not recognize the existence of absolute truths. In the Japanese Paradigm, achieving economic power is paramount; and since ethics are only situational, any tactic is acceptable to achieve power.

Japan's propaganda machine, according to the report, is equally active at home: "Within Japan, the focus is directed toward reinforcing the vision of the U.S. as a racist, Japanese-bashing, and decaying 'has-been'."

Having achieved stunning success with its economic program, Japan is nurturing the same system in other Asian countries. Japan: 2000 warns, "...what we seem to be witnessing is not simply a Japanese challenge but an Asian challenge, a development that cannot but call into question the very basis of the pax-Americana." As the Asian market grows, Japan is less dependent on American and European markets and less susceptible to threats of exclusion from them. "Asia is now feeding on Asia and Japan is in control," the report declares. It ominously likens this trend to the Greater East Asia Co-Prosperity sphere of the 1930's.

Consequences for the West

Time and again, Japan: 2000 warns that the Japanese Paradigm is in danger of supplanting the Western Paradigm. When prevailing systems of beliefs are no longer shared, the report theorizes, "a vacuum develops as a new paradigm emerges....The Japanese paradigm has the potential for filling that vacuum and emerging as the dominant paradigm, replacing Western values with Japanese values." Later, the danger appears to have grown: "...the eclipse of the Western Paradigm is now underway." And grown again: "America's grand strategy has failed and we have been brought to the brink of economic disaster."

Withstanding the ominous ways in which the report characterizes the Japanese threat, it does not attribute any sinister motives to Japan - - unless getting rich is sinister. It states: "Their mission is...to be a richer Japan and to create a world in which it is possible and safe to continue to make money."

Nevertheless, Japan: 2000 foresees dire consequences if the Japanese Paradigm is allowed to eclipse the Western Paradigm. There is of course the prospect the U.S. will become a second-rate economic power - - "disaster for the American standard of living for our children." Beyond economic dependence, the report fears the destruction of the Western value system: "Economic domination could precede the imposition of substitute value systems." This is particularly troubling if one accepts the report's assertion that "the essential amorality of the Japanese Paradigm is in direct conflict with widely and deeply held Western moral imperatives."

There are also national security consequences. The report questions whether the U.S. will be willing to provide security to a country that is profiting from exclusive economic relationships in the region. This raises the possibility "Japan may undertake a major increase in its own military capabilities."

Japan's trustworthiness as a national security ally is also called into question. The report reminds readers that Japan allied with Hitler in 1939. This time around, it might be the Soviet Union, the report speculates. Underlying these uncertainties is the unnerving notion that Japan is unlike any country the U.S. has

"Document Control"

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FROM: EVERHART, THOMAS: CALIFORNIA INSTITUTE OF TECHNOLOGY

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 07/27/92

SUBJECT: ATTACHED COPY OF A SPEECH GIVEN AT THE PCAST MEETING IN BERKELEY.

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DIRECTORATE ASSIGNED: STAFF ASSIGNED:

ACTION REQUIRED: STAFF ACTION:

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SENDER'S DUE DATE:

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DATE COMPLETED: DATE COMPLETED/DEPT:

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COPIES TO: PCAST
D. Allan Bromley

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Talk to the President's Council of Advisers on Science and Technology,

Berkeley, California

July 15, 1992

by T. E. Everhart

President, California Institute of Technology

Government/University Relations: A Strained Partnership

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Thank you for the invitation to speak to you today. My role is to represent private research universities, and I shall speak from that perspective, although I have spent more than two-thirds of my professional life in public universities. What I shall say will often strike a chord, I suspect, with my colleagues from public research institutions.

Our country responds well to a crisis, and often we learn from the experience. World War II was such a crisis. University professors were mobilized to solve scientific and engineering problems sometimes in, and sometimes out of, their fields of expertise. Radar, JATO, aeronautics, electronics, and a host of other scientific and technological advances helped save lives and win the war. The nation learned that the old maxim: "those who can, do; those who can't, teach" did not hold for scientists and engineers from research universities. From this experience, Vannevar Bush gained a vision: "Science, the Endless Frontier", and a partnership was born between research universities and the federal government that propelled this country to the lead in science and technology. We have held that lead ever since, although we are being challenged much more strongly by other countries now. How can we regain our preeminence, and with it, our strength and commitment to the future of our nation?

I believe our partnership was born out of a need for a strong national defense, plus a desire to promote the health of our citizens. The partnership was fostered by a strong economy, which provided resources for our nation to take on many initiatives. The principal motivation for the strong defense was the USSR, not now viewed as a strong adversary. The health motivation remains, although the increasing cost of health care

may be reducing popular support for health related research. Our economy has decreased in strength; put another way, there are more demands for funds than there are funds to supply, and by increasingly larger margins.

The nation wants solutions to its manifest problems: problems of education, health care, homelessness, poverty, a lack of jobs for those who want them, and increasing numbers of people who do not seem to want them, the chronically unemployed. There are also problems of the spirit: we had a "can do" spirit in World War II, a spirit that put the goal first, above arbitrary rules. That spirit has been replaced by a faltering unasked question: "can we do it?", and an enforced attitude that following rules is more important than achieving the goal. In short, we have problems of spirit and of motivation, as well as problems of reduced natural resources and increased global competition. These changes have strained our partnership.

Just as research universities helped solve the problems of World War II, we now must help solve the problems of the 1990's. The nation <u>needs</u> the students we educate; they must be educated to think broadly, to understand complex systems, to formulate complex problems with scientific, technological, political and social components, and to advance toward their solution. Society expects us to help them do this, as well as perform research that will benefit those who pay the bill—the project monitor, the agency, and ultimately, the taxpayer.

Teaching and research are synergistic. They are both-and propositions, not either-or propositions. Perhaps John Slaughter put it best when he was Director of the National Science Foundation: "Research is to teaching as sin is to confession; if you don't take part in the former, you don't have much to say in the latter."

There are many suggestions about what needs to be done to solve our problems. One which members of PCAST know well arrived on my desk yesterday. Entitled simply "Science and Technology", and issued by the Executive Office of the President, it outlines much that can be done, much that is in progress, and some things that have already been done. The Council on Competitiveness, headed now by George Fisher, has made suggestions, as have reports from the National Academy complex. All these suggestions require the intellectual and human resource output of the research universities. Our institutions, unlike national laboratories

and industrial research laboratories, not only produce knowledge, but also produce educated humans. Indeed, many of us believe that our output in human terms is more important than the output in terms of knowledge, important as that is. Therefore, it is essential that the nation foster our partnership.

This partnership is based on a mutual trust, and that trust has been strained. When universities charge items to the federal government that the public thinks improper, the trust is reduced. When complex issues like overhead, which even some of our faculty cannot understand, are misunderstood by the public, the trust is reduced. When employees of foreign companies are seen working in laboratories funded primarily by federal dollars, and employees of US companies are not found working there, the trust is reduced. Universities have a responsibility to act accountably. We also have a responsibility to explain clearly why what we are doing benefits those who fund us—ultimately, the taxpayer. In short, we must do our part to help restore the trust.

We can point proudly to past achievements that have benefited the nation. Aerodynamic studies at Caltech played a large role in the development of the aircraft industry in southern California. Its transformation into the aerospace industry was helped a great deal by the knowledge generated at the Jet Propulsion Laboratory, as well as many other laboratories, university and industrial.

Stanford can point with pride to silicon valley. Many of the scientists and engineers there received at least part of their education at Stanford, although faculty and students from Berkeley and many other institutions played important roles as well. Boeing has prospered in Seattle because of education available from the University of Washington. Oceanography is strong in San Diego because of Scripps. I could list many other examples.

This investment in the foundations on which advances in commercial technology are based reminds me of an exchange between the British scientist Michael Faraday and the parliamentarian William Gladstone. While watching Faraday at an experiment that showed no practical result, Gladstone asked, "Of what use is such a discovery?" Faraday is said to have replied: "Why, sir, you will soon be able to tax it!" A more recent British politician, Margaret Thatcher, recently noted that "Although basic

science can have colossal economic rewards, they are totally unpredictable. And therefore, the rewards cannot be judged by immediate results. Nevertheless, the value of Faraday's work today must be higher than the capitalization of all the shares on the stock exchange."

For many years, our partnership between the federal government and research universities was an honest one. The government paid the full cost of research it sponsored, and the universities responded by providing quality research and education to their students. In recent years, the federal government has asked universities to provide matching funds to supplement federal research grants. As a Chancellor of a public university, I could go to the state and argue for state funds to provide the match, on the grounds that I would leverage the state funds with federal funds, and vice versa. As a President of a private university, I find it much harder to go to the endowment, or to a private donor, and get the same result. Consequently, private universities that have wished to stay competitive in research have had to find internal funds to match federal research grants. These funds may sometimes come at the expense of teaching support, and the balance of the university may consequently suffer. As state budgets grow tighter, the same diversions may occur in public universities, which will not inspire greater public trust and confidence. Assigning graduate students to teach important courses to undergraduates in order to free faculty for research, or to save dollars on teaching, is another way that some universities have altered their balance, hurting their image with students and their parents, and ultimately, with the public. The harm is magnified when the graduate students have difficulty expressing themselves in English.

Funding facilities in which first-class research can be performed has been difficult on many campuses. My institution has a policy, enforced by our Board of Trustees, of using overhead reimbursement for building and equipment depreciation to renovate laboratories and otherwise improve our physical plant. As a result, our plant is in good shape. Our overhead is based on the square footage of our physical plant used for research, as circular A-21 requires. We have recently been told by federal auditors that we should base our recovery instead on the salaries of the personnel who do the research—our graduate students and postdoctoral students. While this would reduce our overhead rate, it neither matches the spirit or letter of A-21, and certainly would not allow us to renovate our plant so we can continue to perform first class

research on federal grants. — A partnership cannot flourish when one partner tries to take advantage of the other. These two examples show why universities are becoming demoralized as they try to hold up their part of the partnership.

Our faculty, like faculty at all research universities, find themselves spending more time writing proposals to get research funding, and spending less time actually supervising graduate students and doing research. As a result, their classroom teaching is more harried, and may suffer also. Their graduate students observe what is happening, and question whether they wish to follow their mentors into academia—or into the rat race, as they sometimes put it. As engineers have found, not every person who gets a PhD need become a faculty member. There are satisfying jobs in industry that can benefit the individual and the country. Unfortunately, not all faculty members believe this is true, and many imply to their students that unless they become academic researchers like their professor, they will be considered failures. As more academics chase the federal research dollar, and as experimental research becomes more expensive, the life of all academic researchers has become more harried. Anything which reduces paperwork and bureaucracy would help reduce the resulting frustration, and improve the partnership which is so important to our country's future.

As we look for effective models of interaction between universities, national laboratories, and industry, cooperation of the sort being fostered by the National Technology Initiative meetings being held around the country, we should not ignore some models that have endured for many years, and have benefited the nation. The model I know best is the relationship between the Jet Propulsion Laboratory and Caltech. Caltech not only manages JPL for NASA, but many of our faculty participate in the mission of JPL. Ed Stone, a professor of physics, is the principal scientist on the Voyager mission, which visited the four large outer planets so successfully. Ed became Director of the Laboratory when Lew Allen stepped down, and is doing very well. There are many other examples of cooperation and synergism between faculty and students at Caltech and scientists, engineers, and projects at JPL. Concurrent computing, microfabrication, materials research, software development, to say nothing of planetary exploration have all benefited from our interaction. In addition, the nation has had excellent laboratory management, according to several reports, from annual NASA audits, to

the Packard Bromley report of a decade ago. JPL regularly lists more applications for commercialization than any other NASA laboratory. Much of the construction work for spacecraft is subcontracted out to industry, causing a close interaction with industrial scientists and engineers. Overall, managing JPL has been good for Caltech, for JPL, and for the nation.

I'm told that after Governor Claude A. Swanson of Virginia had made a long and rambling speech, a woman came up to the speaker's table to shake his hand. "How did you like my speech?", he asked.

She answered: "I liked it fine, but it seemed to me you missed several excellent opportunities."

Swanson was puzzled. "Several excellent opportunities to do what?"

"To quit," she replied.

I also have missed several opportunities. Let me thank you for listening to me, and take this opportunity to quit. I'll be glad to answer any questions you may have.

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ORIGINATOR: 02 STATUS I DIRECTORATE STATUS

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FROM: DOBLIN, Steve: UNIVERSITY OF SOUTHERN MISSISSIPPI

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 07/24/92

SUBJECT: THEY ARE FORWARDING THEIR COMMENTS FOR THE PCAST PANEL ON THE HEALTH OF U.S. UNIVERSITIES.

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DIRECTORATE ASSIGNED: PCAST

STAFF ASSIGNED:

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THE UNIVERSITY OF SOUTHERN MISSISSIPPI

COLLEGE OF SCIENCE AND TECHNOLOGY

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July 24, 1992

D. Allan Bromley
The Assistant to the President
for Science and Technology
Executive Office of the President
Office of Science and Technology Policy
Washington, DC 20506

Dear Mr. Bromley:

We appreciate the opportunity to provide the President's Council of Advisors on Science and Technology with our thoughts concerning some of the challenges facing U.S. higher education as we move into the 21st century, and the critical nature of the government-university partnership. While certainly not a comprehensive approach to addressing the issues raised by the members of PCAST, the following concerns came to the forefront as the members of our curriculum committee (biological sciences, chemistry and biochemistry, computer science and statistics, engineering technology, geology, marine science, mathematics, medical technology, physics and astronomy, polymer science, science education, scientific computing) discussed the content of your letter of June 8. (Please note that the term "science" in this letter should be assumed to include science, technology, and mathematics.)

American science is at a watershed. We can choose either to proceed toward large centers of expertise, or to emphasize flexibility by encouraging networking among small, geographically dispersed research groups. Science is becoming increasingly interdisciplinary, mandating cooperation among groups that encompass a variety of disciplines. Leading nations in the rest of the world are beginning to recognize this fact and to direct some effort and resources toward this end. For example, in Japan the inbred *koza* system is being challenged by new and ambitious collaborative ventures which emphasize national and international networking among small groups. In Western Europe the trend is the same. However, in this country it appears that we are moving in an antithetical direction toward concentrated science centers. There is clearly a potential for such centers to trade diversity for unity of focus and to become merely a larger version of the *koza* system.

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"Big" vs. "Small" Science. It is critical that large initiatives such as the human genome and supercollider projects not divert support from smaller scale individual and collaborative research projects. Indeed, throughout history most of the significant advances in science (e.g., superconductivity) have been made by single investigators and members of small research groups. Recent funding trends of Federal agencies appear to be toward the support of a relatively few, large "research centers," often developed around a megauniversity or conglomerate of well-known institutions within a small geographic area. As the number of scientists competing for research dollars continues to increase along with the actual cost of doing research, the ability and willingness of the government to provide adequate and stable financial support will be subjected to increasing and diverse pressures. However, in our opinion, it would be a mistake to respond to this situation by funneling more and more of the research dollars into fewer and fewer institutions, surely resulting in the ultimate demise of the smaller research entities. Such a development would ensure the loss of diversity and freshness of approach to research that historically have been characteristic of fundamental discovery.

The demise of support to state and/or regional research institutions would likely result in the transfer of the best faculty to the large centers. Science education and training in areas thus deprived of active research faculty would undoubtedly suffer, as would the potential for technology-based economic development. Indeed, continued support of broad-based, regional, science and technology research provides the greatest opportunity for maintaining the intellectual diversity so critical to scientific and technological advances.

The Nations's Key Asset -- An Educated and Trained Work Force. The principal aim of research intensive universities is to provide the nation with a pool of scientists with the breadth, vision, and flexibility to meet both present and future needs. This is especially important today when "the success of American capitalism no longer depends on the private investments of highly motivated American capitalists. Our nation's future economic success depends instead on our unique attributes -- the skills and insights of our work force and how well we link those skills to the world economy. The government's role is not just to spread the wealth; it is to build our human capital and infrastructure, and to bargain with global capital on our behalf. American economic policy must be adapted to the new realities of the world economy" (R.R. Reed, The Brookings Institute).

Hence, it is critical that the concepts which are being developed in research in academia be transferred to the public -- particularly to secondary school teachers -- and the new programs designed to attract young people and inservice teachers into research experiences be strengthened and expanded. This is particularly important at a time when the need for scientists and technologists is greater than ever before, but the desire of today's youth to become involved in careers in science is at perhaps its lowest ebb.

Science and the Public. Over the past century, scientists have made enormous contributions to the improved health and prosperity of humankind. Unfortunately, benefits of scientific advance are quickly adsorbed by the human consciousness and taken for granted thereafter. In addition, a number of broadly beneficial scientific advances have later exhibited undesirable side effects. The side effects have often received more publicity than the benefits, and the scientific community has often been ineffective in initiating rational discourse concerning the issues involved. Indeed, it appears that scientists have lost their credibility. The media incessantly report on environmental pollution, toxic waste, and destruction of the atmosphere (or even the planet itself), and attribute such horrors to unthinking or uncaring scientists. Misconduct is widely reported, so much so that the public may well perceive this to be the norm rather than the exception.

So, what can and should be done? Scientists must be encouraged to move away from the arrogance of isolation, to help the public understand the importance, significance, beauty and utility -- with respect to graduate and undergraduate education, economic development, and benefits to humankind -- of science in general and of the research enterprise in particular. It is important for government, in partnership with business, industry and education, to support programs of science education for the public.

Broadening the Partnership. The fact that American universities and American science remain ascendant while our manufacturing and technological bases erode seems to be an indictment of academic science. If our science is preeminent, why has it not served to fuel more technological advances? The President's Council for Competitiveness has noted that many modern technologies were invented in American research intensive universities but were successfully commercialized by other nations. The problem thus appears not to be in the generation of basic science but in the "hand-off." Perhaps funding entities should more frequently require joint proposals from teams which involve personnel from government and industrial laboratories as well as academic scientists. The major stipulation upon which one must insist is that allowance must be made for the size of the state's industrial base in determining the degree of industrial participation required.

There is no doubt that the encouragement and support of research -- from basic to applied to technology transfer -- should be a shared endeavor. As the costs of research have escalated and the areas of potential impact and need have broadened, it has become evident that involvement far beyond that of the present infrastructure is required. Business and industry, federal and state government, private foundations and individuals must join into partnership with university scientists to meet the challenges of the 21st century. Much of this is becoming reality, as smaller colleges and universities, professional disciplinary groups, and local business and industry have begun networking to build collaborative bridges. It is critical that these types of efforts be vigorously encouraged.

Geographically Targeted Research. There exist numerous examples of attempts -- some of which have been remarkably successful -- by the Federal government to provide support for research and development outside the normal competitive peer review channels to scientists in various states and regions. One such mechanism, with roots in the 19th century, is the support provided to land grant colleges and universities. Institutions receiving this designation have received preferential (if not exclusive) access to large blocks of monies. While it is not clear that agencies have adequately evaluated the effectiveness with which these funds have been used, particularly with respect to the competitive edge in research that it was intended be developed, there is little doubt that this collaborative initiative has been fruitful. Indeed, it might be worthwhile to identify modern counterparts (e.g., biotechnology, global change) and actively encourage broad-based, widely distributed, government-industry-university collaboratives.

Initiatives such as the National Science Foundation's successful Experimental Program to Stimulate Competitive Research (EPSCoR) were designed to affect profoundly the infrastructure of science. A fundamental EPSCoR goal is that support to scientists in selected states will result in long-term competitiveness for research funding among the people involved. As long as such programs continue to utilize the peer review process, even if the funding is initially targeted to a particular state or region, they should be extended. Assuring that traditionally under-represented regions are provided access to a share of Federal research support -- while maintaining peer review by unbiased scientists from outside the targeted regions -- can only strengthen the science and technology enterprise in this country.

Basic Research. The Federal government must continue to accept responsibility for providing the majority of funding for basic research. Truly basic research may well have no immediately apparent economic or industrial application, and may only serve to advance knowledge of the world around us and to satisfy the curiosity that characterizes the human spirit. Unfortunately, mounting research costs pressure funding entities (both governmental and private) to support research which has the potential for immediate economic impact. Although private foundations contribute some support, the Federal government is essentially the only source of major funding for basic research. While it is clearly appropriate and necessary for the government to encourage applied research and to push for technology transfer, this must not occur at the expense of basic research. The ultimate goal should be some sort of balance between the two extremes, and input concerning an appropriate position should be sought from diverse sources within the research community.

Improvement in Peer Review. A significant difficulty with the present peer review system is that it purports to be objective when, manifestly, it is not. Efforts to render the reviewer as ignorant of the identity of the proposer as the proposer is of the reviewer usually run afoul of the need to evaluate not only the ideas embodied in the proposal, but also the ability of the proposer and his/her institution to implement those ideas. This real problem might be averted by separating the reviewing process into two parts, much as capital offenses are in our justice system. Phase one would consist of a review of the merits of the ideas and methodology -- does it represent good and doable science? This phase would be scrupulously double blind. No proposal would be accepted for review which revealed the identity of the proposer or of the institutional affiliation either directly or inferentially. Other than this restriction, the phase one review would be carried out in the usual peer review manner. Proposals that were found to be scientifically meritorious in phase one would then be subjected to a second phase in which the proposed budget as well as the ability of the institution and the principal investigator to carry out the proposed activity would be evaluated. This second phase might not even require peer review and could be performed by agency personnel.

The above represent only a few of the pressing issues confronting U.S. science and technology and our universities. Decaying research facilities at institutions across the country, outdated and dilapidated equipment in undergraduate teaching laboratories, controversy over indirect cost rates, scientist loan/exchange programs between educational institutions and industry, the importance of public understanding of the research endeavor -- its components as well as its benefits to humankind, expanding the participation of traditionally underrepresented groups in science, and the involvement of research entities in science education all must be addressed through a broadened partnership. Some of these issues are discussed in greater depth in the appendix to this letter. I hope we have provided the members of PCAST with ideas that will be valuable as they formulate recommendations to the President concerning the partnership between research-intensive universities and the Federal government. If there are additional ways in which we may assist, please feel free to contact us. Thank you.

Sincerely,

Steve Doblin, Ph.D.
Dean

APPENDIX

The research intensive university must have two main thrusts. These are 1) to provide for the educational, material and human resource needs of American society in the future and 2) to maintain the competitiveness of our academic research with that conducted in other countries.

Vannevar Bush, in his treatise on *Science, the Endless Frontier*, stated in 1945 that "new products and processes are founded on new principles and conceptions which, in turn, are developed by research in the purest realms of science."[1] This statement is probably more true today than when it was made and yet, while American academic research is still recognized as being preeminent in the world, our national critical technologies in liquid crystal displays, electronic packaging materials, robotics, automated equipment, printed circuit board technology, optical information storage, and memory chips are losing badly to foreign competition. It is notable that all of these technologies were invented here. According to the National Science Board, U.S. industry's technical leadership is eroding.[2] The administration's recently announced statement on national technology policy was too diffuse to be effective[3], but this erosion is not a consequence of bad federal policies nor does it arise from bad technology. It is because the corporate system lacks a strategic vision and too often succumbs to Wall Street pressures to show profit quickly and regularly.

The Industrial Research Institute (IRI) conducted a survey to try to understand why technological innovation was being stifled in American corporations. This study was aimed at trying to decide why R&D spending was declining in industry. Five possible causes were listed:

- General management practices
- External financial pressures
- Changing global technology environment
- Technology management practices
- Federal technology policy

The results showed that general management practices and external financial pressures were perceived as the main causes and all of the other causes came in a distant third. IRI's Executive Director, Charles Larsen, noted that "R&D continues in free-fall with less and less attention given to it in annual reports in recent years." Respondents to the questionnaire lamented that "MBA holders in upper management have little or no apprenticeship in understanding the nature of the business of products."

The situation we are in today is described aptly by Richard Foster in his book entitled *Innovation*.[4] He describes the decline of the influence of technology in the board room as the "lab in the woods" phenomenon. Following World War II, the board room view of science was to emulate the Manhattan Project and provide their own variants of Los Alamos in order to "give scientists the opportunity to think unencumbered by the day-to-day cares of business." It didn't work. The labs received inadequate guidance and there was little interaction between R&D and manufacturing and marketing. As a direct consequence, by the late 1950's, the R&D promise had become jaded.

Science and the Public

Over the past century, scientists have made enormous contributions to the improved health and prosperity to much of humanity. However, benefits of scientific advances are quickly adsorbed by the human consciousness and taken for granted thereafter.[5] In addition, a number of broadly beneficial scientific advances have later shown undesirable side effects. The side effects have often received more publicity than the benefits and the scientific community appears to have lost its effectiveness in bringing rationality to the issues involved. It appears that the scientists have lost their credibility.

The percent of popular magazine articles critical of science rose to 10% just after the 1929 stock market crash, dropped to almost zero after World War II and then resumed to climb when conscience pervaded post-Hiroshima science.[6]

Today, the media incessantly reports on environmental pollution, toxic wastes and destruction of the atmosphere, on even the planet itself and attributes these horrors to unthinking or uncaring scientists. Misconduct is widely reported, so much so that the public may perceive such misconduct to be the norm rather than the exception.

Regulatory Pressures

Public disillusionment of the chemical industry is exacerbated by the perception of the industry as a major polluter. The chemical industry was a poor steward of the environment and of health and safety. But today, as a result of voluntary programs and regulatory pressures, the industry has considerably cleaned up its act. These improvements in quality of life carry a considerable price tag, both in terms of capital invested and in R&D effort which is required.

The U.S. currently spends $115 billion or 2.1% of its gross national product on pollution control. By the year 2000, the cost of protection could rise as high as $185 billion a year (1990 dollars) or 2.8% of the GNP.[7]

Recently, the EPA, Science Advisory Board has said that federal laws or programs "are more reflections of public perceptions of risk than of scientific understanding of risk."[8] Even if this statement is true, I think that the majority of the scientific community would agree that a clean environment and a safe and healthy work place are goals which are worth pursuing.

The problem arises, however, in the disbursement of the costs of pursuing these goals. Often the costs of meeting regulatory demands are not considered separately but are hidden within the R&D budget or within capital expansion plans. This fools the investor and the board room simultaneously by creating a false sense of security, because these expanded budgets are regarded as direct increases in innovative R&D effort or plant capacity improvements, when in fact, the level of activity in these two areas have often been reduced and valuable resources have been divested to deal with regulatory issues.

As a consequence of the diversion of funds into regulatory areas, development of new products and processes are slowed or neglected. This further exacerbates the flow of new science and technology from research intensive universities to industry. One way to solve this problem would be to divert some academic research into collaboration with industry to develop the products and processes. While there is need for this, it must not take priority over the main objective of research intensive universities to conduct fundamental research and to train scientific minds. The President's Council on Competitiveness issued a report entitled "Gaining New Ground—Technology Priorities for America's Future." According to Bobby R. Inman, who headed the panel, "We lack clear national priorities and the commitment from the public and private sectors necessary to meet the challenges."

It is not surprising that the Administration, seeing deepening red curves in its budget doesn't much like government involvement in a seemingly endless march of new technology siphoning an endless stream of funds. The current view appears to be that if industry thinks that these technologies are so important, it should raise the money itself. Japanese industry continues to overtake the U.S.'s base. U.S. corporate response has been disappointing and Congress wants more to be done. Japan's success lies not so much in government spending for research (which are scant) as it does with government policies that force companies to cooperate in research, then compete commercially. We could learn a lot from the Japanese ability to network efficiently! The Council on Competitiveness recommended the following changes.

1) Stronger industry participation in government agency-supported research groups.

2) Eliminate federal labs that do not contribute to technological innovation.

3) Add $150 million to the industrial matching grants program at the National Institutes of Science and Technology.

We would like emphasize that academic involvement in government agency-supported research projects would greatly enhance these projects and that the industrial matching grants program should be substantially enhanced to truly meet the needs of American competitiveness.[9]

The Nation's Key Asset—A Trained Work Force

The notion that products have national origins is so deeply ingrained that governments

and the public are often pre-occupied with such things as calibrating trade imbalances and determining corporate tax on "local production." Such notions are meaningless in the new world economy. For example, Peter Spraque, the Chairman of National Semiconductor Corporation, comments, "We are using Russian engineers living in Israel to design chips that are made in America and assembled in Asia. Is this an American product? Who can tell?" The relevant issue is what portion of the value of any given product derives from the ability of the nation's workers to conceptualize problems and solutions?

Skill Building

The principle aim of research intensive universities is to provide the nation with a pool of highly trained technologists to meet future needs. This is especially important today when "the success of American capitalism no longer depends on the private investments of highly motivated American capitalists. Our nation's future economic success depends instead on our unique attributes—the skills and insights of our work force and how well we link those skills to the world economy. The government's role is not just to spread the wealth; it is to build our human capital and infrastructure, and to bargain with global capital on our behalf. American economic policy must be adapted to the new realities of the world economy."[10]

In today's world, financial capital is being subordinated to intellectual capital. As intellectual capital continues to displace plant and equipment as the key asset, it is the joint role of government and research intensive universities to insure an adequate supply of intellectual capital to meet the needs of the country.

Good planning could encourage foreign investors to inject capital into the U.S. while the important assets of greater value are kept here within our borders. Cumulative skills and insights upon which future innovations are based, make up the nation's key technological assets. They will be lost if they are insufficiently nurtured and developed. These assets can only be properly developed in an atmosphere of world class research. High quality research is therefore seen to be the process and the skilled researcher as the product. This brings us to the second important aim of the research intensive universities and that is to maintain the standards and quality of these institutions and to insure that they continue their leadership role in the global arena. There are more scientists and technologists alive today than there have ever been and this, coupled with modern efficiencies in research and information flowing across global frontiers at the speed of light, has led to an explosion in knowledge which renders it impossible for a single isolated investigator to maintain a competitive leadership role for very long. Networking and teamwork will be the key words of the future, yet we must be careful that the role of the individual is not diminished by networking and teamwork.

The American system, as it stands now, is built upon the individual investigator in fierce, cut-throat competition for research funding. If a faculty member loses funding, the activity in that area would come to an end. The present system in which the investigator is expected to set up his lab, write proposals, teach, and produce papers does insure survival of the fittest, but it

may mean that some important areas, such as teaching, may be skimped. Proposal writing with fair peer review insures competence of the individual. Peer review, however, fails when it becomes doctrinaire or favors large institutions at the expense of small institutions. Some of our newest and best technologies, such as polymers and detergents, came from individuals who "swam against the flow" of conventional wisdom in their own time.

In Japanese systems, the research group or *koza* consists of a professor, an associate professor, two assistants, and graduates and undergraduates. This is a very stable organization which encourages team performance, but there are disadvantages in that as well. All of the members of the koza share the same background and this tends to lead to stagnation in ideas and innovation and also, the strict parametric system gives little opportunity for the independent advancement of talented individuals. Further, in the Japanese system, each koza receives a set amount of funds every year regardless of the research activity. If adopted in the American system, such an organization would inevitably lead to degradation of the science and a high level of inactivity. Any new policy for research at the national level should recognize the interdisciplinary nature of science and encourage networking between centers of expertise and between talented individuals in different sites both on a national and an international level. This has already been recognized in Europe in which there are many different schemes which link individual researchers in different centers in academia and industry. Examples are case awards, collaborative awards, subcontract awards, major program funding awards, teaching company schemes, and the European collaborative programs. (See end of this appendix).

The importance of networking is not lost in the Japanese. For example, last year Japan sent nearly 8,000 researchers to the U.S. whereas the U.S. sent only 1,400 researchers back to Japan, even though the Japanese government will foot the bill to attract American scientists. The Japanese have recently initiated some new and ambitious collaborative ventures in this respect. One is the Graduate University for Advanced Studies headed by Saburo Nagakura, an emeritus professor of physical chemistry at the University of Tokyo. This university is initiating a new system of post-graduate education by fostering exchange with other domestic and foreign graduate schools. It encompasses seven major national institutes within its organization. These are National Museum of Ethnology, Institute of Statistical Mathematics, National Laboratory for High Energy Physics, Institute for Molecular Science, National Institute of Genetics, National Institute for Basic Biology, and National Institute for Physiological Sciences. The frontier research project funded by the Science and Technology Agency in Japan stresses interdisciplinary collaboration and has an international flavor. The Ministry of International Trade and Industry has recognized the importance of basic science to industry and has started to consider subsidizing university laboratories. Such international ventures compensate for the homogeneity and stratified structure in Japan and make up for the advantage that the U.S. enjoys in attracting foreign scientists with new ideas and concepts. It is important, therefore, that any science policy should include a mechanism which encourages free exchange of people and ideas.

In view of the opening comments of this discussion, it is also important that the concepts which are being developed in research in academia should be transferred to the public and especially to secondary education teachers, and the programs to attract young people and existing

teachers into research experiences should continue to be encouraged, and if possible, to be enlarged. This aspect is extremely important in a time when the need for scientists and technologists is greater than it has ever been, but the desire of young people to become interested in careers in science is at a very low ebb.

References

1. V. Bush, *Science, the Endless Frontier*, U.S. Office of Scientific Research and Development, Washington, DC, 1945, reprint edition, National Science Foundation, 1960.

2. *Chemical and Engineering News*, *14*, February 11, 1991.

3. *U.S. Technology Policy*, report by the OSTP, October 1990.

4. R. Foster, *Innovation, the Attacker's Advantage*, McMillan London Limited, 1986.

5. Donald J. Berets, *Chemical and Engineering News*, *30*, January 14, 1991.

6. Marcel C. LaFollette, Making Science Our Own: Public Images of Science 1910-1955, Chicago Press, 1990.

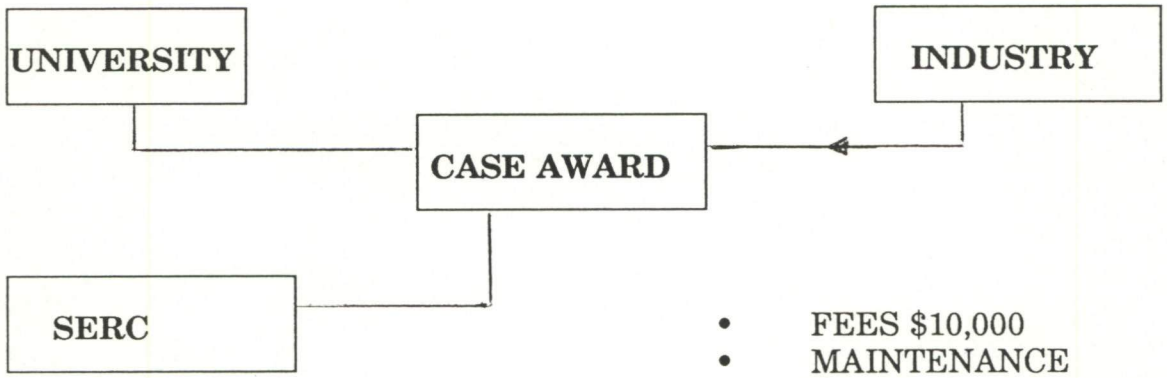
7. William K. Reilly (EPA Administrator), "The Cost of a Clean Environment," report to Congress, February 1, 1991.

8. *Chemical and Engineering News*, *25*, February 18, 1991.

9. Report of the National Critical Technologies Panel, March 22, 1991.

10. R. R. Reed, The Brookings Institute, *Atlantic Monthly*, February, 1991, p. 35.

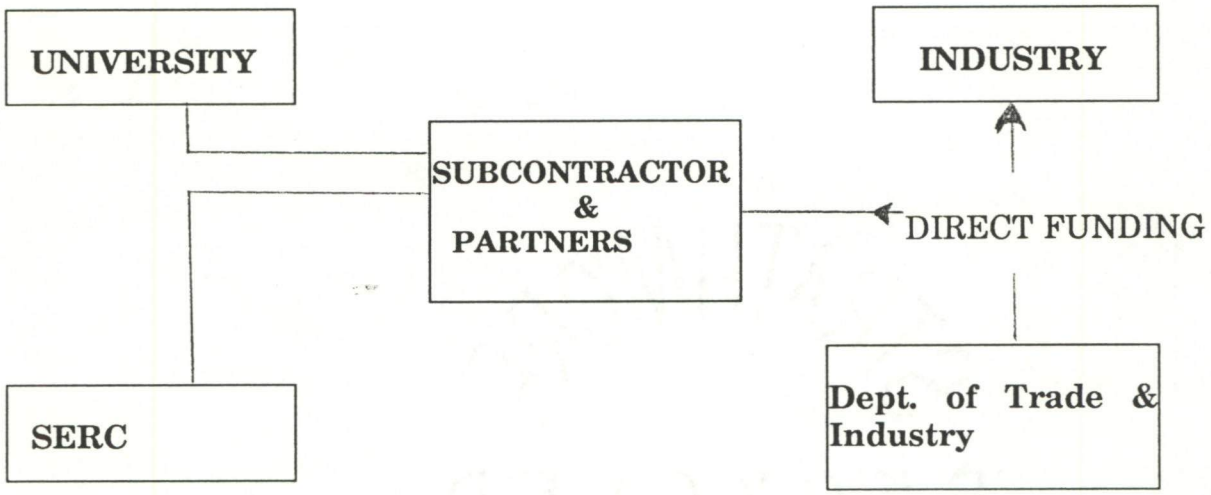
GREAT BRITAIN
CASE AWARDS
(Cooper Award Scheme in Science and Engineering)



- FEES $10,000
- MAINTENANCE $5000
- CONSUMABLE $2000
- TRAVEL FOR REVIEW

- ONLY FOR Ph.D. STUDENTS
- 3 YEARS DURATION
- COMPETITIVE
- MUST BE SUITABLE FOR Ph.D. QUALITY

GREAT BRITAIN
SUBCONTRACT AWARD



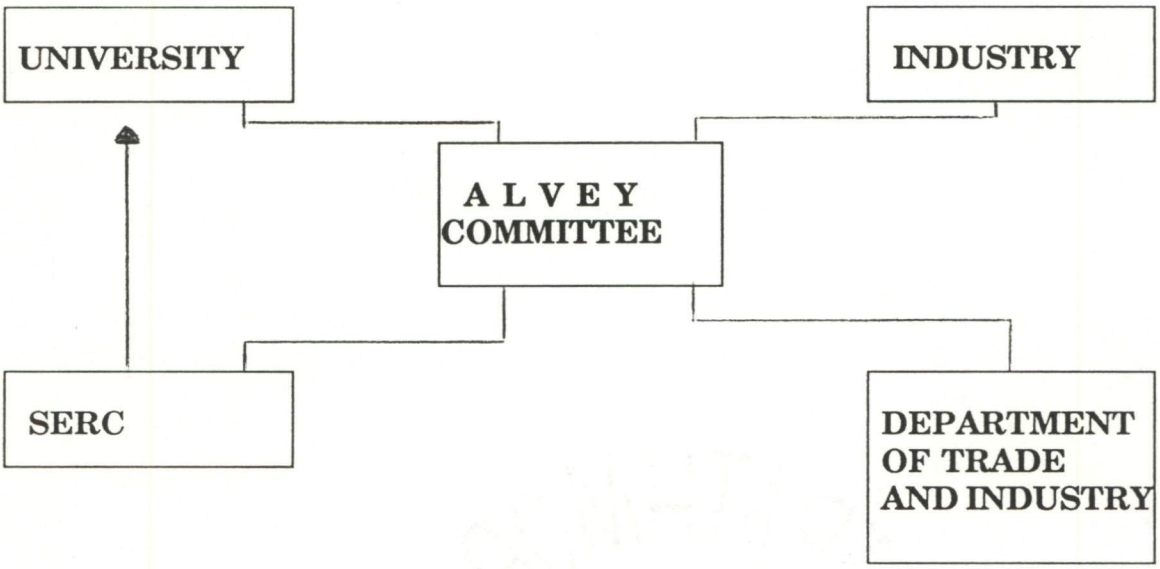
- SAME AS COLLABORATIVE AWARD
- NOW OVERHEADED AT 60-75%
- PUBLICATION RESTRICTIONS POSSIBLE

(IF NO PUBLICATION, OVERHEAD IS 120%)

GREAT BRITAIN
COLLABORATIVE AWARDS

- FOR WELL-DEFINED TARGETED PROJECT
- 50% FUNDED BY UNIVERSITY
  50% (CASH AND KIND) FUNDED BY INDUSTRY
- USUALLY LARGE GRANTS FOR POST-DOCS/STUDENTS/TECHNICIANS
  - $80,000 - $500,000
- USUAL DURATION IS 1 TO 2 YEARS
- INTELLECTUAL PROPERTY RIGHTS BELONG TO UNIVERSITY
- EXCLUSIVE LICENSE TO THE COMPANY

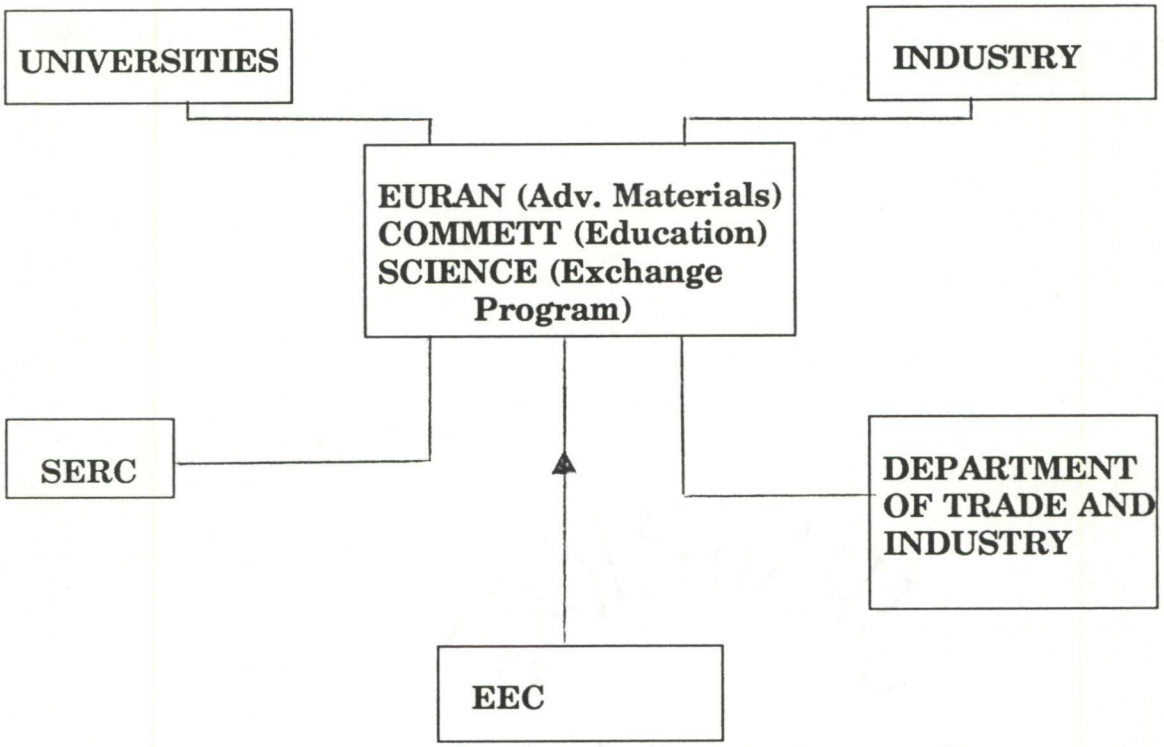
GREAT BRITAIN
MAJOR PROGRAM FUNDING
FOR NEW TECHNOLOGY



- USUALLY 2-3 UNIVERSITIES INVOLVED
- 4-6 INDUSTRIAL PARTNERS
- PROJECT FUNDING USUALLY EXCEEDS $1.5 MM
- GENERAL AIMS DEFINED
  - NO SPECIFIC DETAIL

EXAMPLES:
- NEW POLYMERIC MATERIALS
- ASYMMETRIC SYNTHESIS
- BIOSENSORS

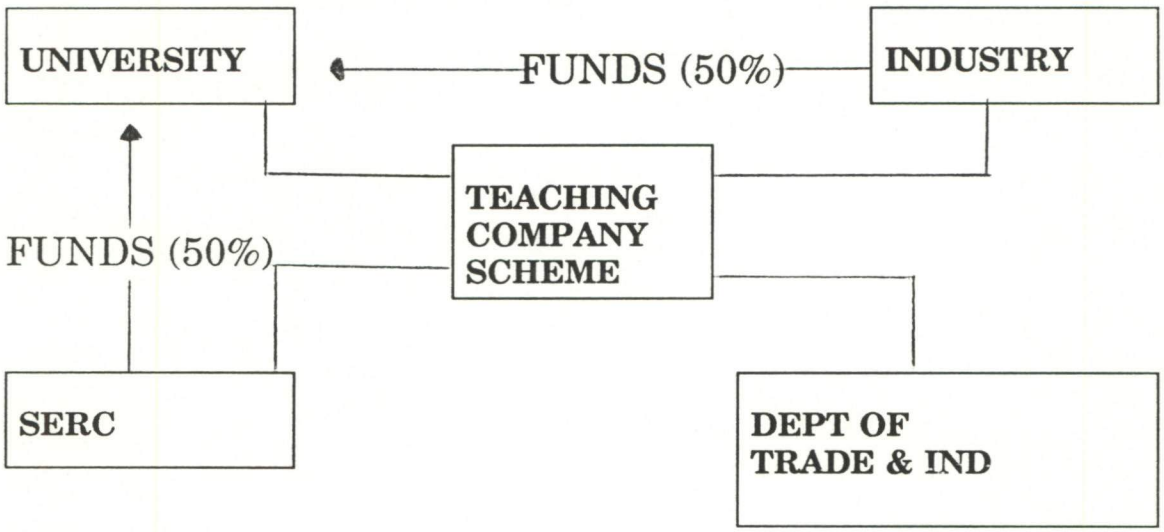
EUROPEAN COLLABORATIVE PROGRAMS



- DESIGNED TO TRANSFER BASIC RESEARCH INFORMATION THROUGHOUT EUROPE BY:
  (1) Collaboration Between Industry and Universities in Different Countries
  (2) Training and Developing Technology
  (3) Encouraging Mobility within Europe

- 2 LEVELS
  (i) Undergraduate Exchange (ECTS)
  (ii) Postgraduate Scheme
    - May Do Research in Any Country Except Where They Did Undergraduate Studies

GREAT BRITAIN
TEACHING COMPANY SCHEME



- TARGETED FOR SMALL INDUSTRY (500 OR LESS EMPLOYEES)
- AIM: TO TRAIN RESEARCH ASSOCIATES
- OBJECTIVE: TO INCREASE VIABILITY OF THAT COMPANY/INDUSTRY (ASSESSED BY PROFITABILITY)
  (ASSOCIATE USUALLY ENTERS COMPANY)
- COST $100-$150 K OVER 3 YEARS PER ASSOCIATE
- USUALLY TWO ASSOCIATES PHASED INTO PROGRAM
  - TRAINED IN MANAGEMENT
  - 10-15% OF TIME IN UNIVERSITY COURSES
  - BASED IN INDUSTRY
  - ALTERNATIVE TO Ph.D. PROGRAM (NO DEGREE IS GIVEN)
- UNIVERSITY GETS - 1/2 PROFESSORS SALARY
  1/2 SECRETARY'S SALARY
  KEEPS EQUIPMENT

"Document Control"

TYPE: ACTION DOCUMENT NUMBER: 9202172
ORIGINATOR: 02 STATUS I DIRECTORATE STATUS

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FROM: LEIGHTON, Morris W.: ILLINOIS STATE GEOLOGICAL SURVEY

TO: DR. D.A. BROMLEY

DATE OF CORRESPONDENCE: 07/24/92

SUBJECT: HE IS WRITING REGARDING THE PCAST STUDY OF THE PARTNERSHIP BETWEEN THE NATION'S RESEARCH INTENSIVE UNIVERSITIES AND THE FEDERAL GOVERNMENT.

****

DIRECTORATE ASSIGNED: PCAST

STAFF ASSIGNED:

ACTION REQUIRED: AS NECESSARY

STAFF ACTION:

****

SENDER'S DUE DATE:

OSTP DUE DATE: 08/17/92

STAFF DUE DATE

DATE COMPLETED:

DATE COMPLETED/DEPT:

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COPIES TO: D. Allan Bromley

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WHITE HOUSE TRACKING #:

CONTACT PERSON:

PHONE: EXT:

REMARKS: NRN per AKD

OSTP RECEIVED: 08/03/92 DEPT RECEIVED:

FILE: P-PCAST

CENTRAL FILES:

2172

Illinois State Geological Survey

Natural Resources Building
615 East Peabody Drive
Champaign, IL 61820-6964
217/333-4747
FAX 217/244-7004

Illinois Department of
Energy and Natural Resources

RECEIVED
92 AUG 3 P1:16
OSTP
MAIL ROOM

July 24, 1992

Dr. D. Allan Bromley
Assistant to the President
for Science and Technology
The White House
Washington D.C. 20500

Dear Dr. Bromley:

I am writing to urge that the review of the partnership between the Nation's research-intensive universities and the Federal government being conducted by the President's Council of Advisors on Science and Technology include an understanding of the importance of the state geological surveys. All 50 states have state geological surveys or at least an office of a state geologist. Most are strong research and public service agencies working on the natural resource issues of importance to their respective states. Their responsibilities differ from state to state, depending upon the enabling legislation and the traditions under which the surveys have evolved. A majority of state geological surveys, including Illinois, enjoy a strong relationship with their respective state research-intensive university. A majority of state geological surveys are located on or adjacent to the campus of the state university. Some are administratively part of the university; others, like Illinois, are located on campus but administered and budgeted through another arm of state government.

In Illinois, we enjoy a somewhat unique arrangement of three State Scientific Surveys, the Illinois State Geological Survey, the Natural History Survey and the State Water Survey. All three are located on the campus of the University of Illinois. All three have a core budget of state General Revenue Funds and all three accept, through the Board of Trustees of the University of Illinois, grant and contract funds for support of research and service work that fits within our missions. The aggregate totals of those grants and contract funds are greater than the core of state General Revenue Funds. For the Illinois State Geological Survey in the recently completed Illinois FY92, the state General Revenue Funds totaled $5.8 million while grants and contracts, mostly handled through the University of Illinois, totaled an additional $7.4 million. Federal funds provided 21% of those grants and contracts.

Printed on recycled paper

It is very important that the partnerships between the federal government and research universities properly allow for and support the activities of associated state geological surveys. Those surveys conduct original research and they maintain, curate, update, and make accessible, and they interpret many of the data bases used in joint university and federal research partnerships. The federal government should continue to encourage these partnerships between state geological surveys and the USGS, DOE, EPA, USDA, NSF and others. The federal government should continue through Requests for Proposals, Program Opportunity Notices and other mechanisms continue to provide opportunities for the most appropriate and capable research agencies to work with the federal government in conducting the research necessary to provide both economic benefits and sound environmental policies for use of natural resources.

The partnership between the state geological surveys and the federal government has a long and proud history. For more than a hundred years we have worked with the U.S. Geological Survey and since 1908 have met regularly through the Association of American State Geologists to discuss issues of common interest and to initiate united actions when warranted. That relationship was further strengthened this year when President Bush in May signed into law the National Geologic Mapping Act of 1992 (Public Law 102-285), a program of federal/state cost sharing to produce detailed geologic map coverage for the nation.

Should you wish any additional information about the state geological surveys, either individual surveys or the system of state geological surveys, please do not hesitate to contact the Association of American State Geologists. I have begun a term as President of that organization and would be pleased to facilitate any interactions that you might wish to undertake.

Sincerely,

Morris W. Leighton

Morris W. Leighton
Chief

"Document Control"

TYPE: INFORMATION DOCUMENT NUMBER: 9202151
ORIGINATOR: 02 STATUS C DIRECTORATE STATUS
****

FROM: PUTMAN, CHARLES: DUKE UNIVERSITY

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 07/23/92

SUBJECT: THANK YOU FOR PARTICIPATING IN PCAST REGARDING THE SCIENCE AND EDUCATIONAL ISSUES.

****

DIRECTORATE ASSIGNED: STAFF ASSIGNED:

ACTION REQUIRED: STAFF ACTION:

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SENDER'S DUE DATE:

OSTP DUE DATE: STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT:

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COPIES TO: PCAST
D. Allan Bromley

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

OSTP RECEIVED: 07/29/92 DEPT RECEIVED:
FILE: PCAST

CENTRAL FILES:

2151

Duke University
Durham
North Carolina
27706

Executive Vice President
for Administration
203 ALLEN BUILDING

(919) 684-3403
FACSIMILE-684-8525

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92 JUL 29 AM 07
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MAIL ROOM

July 23, 1992

Dr. D. Allan Bromley
Assistant to the President for
Science and Technology
The White House
1600 Pennsylvania Avenue
Washington, D.C 20500

Dear Al:

Thank you so very much for your participation and interaction during the recent visit of the President's Council of Advisors on Science and Technology.

At a rather short notice during the middle of the summer and with a modified agenda your presentation as well as that of your colleagues, made this meeting a success.

I do thank you personally for your thoughtful comments and obvious expressions of concern for Science and Educational issues that we all encounter on a daily basis.

I wish you the very best for the remainder of the summer and a most productive fall.

With very best regards,

Charles

Charles E. Putman, M.D.
James B. Duke Professor of Radiology
Professor of Medicine

Duke University
Durham
North Carolina
27708

Executive Vice President
for Administration
201 ALLEN BUILDING

"Document Control"

TYPE: ACTION
DOCUMENT NUMBER: 9202271
ORIGINATOR: 02
STATUS I
DIRECTORATE STATUS

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FROM: MANSOORI, G. Ali: UNIVERSITY OF ILLINOIS

TO: DR. D.A. BROMLEY

DATE OF CORRESPONDENCE: 07/23/92

SUBJECT: HE IS WRITING REGARDING THEIR COMMENTS FOR THE PCAST PANEL STUDYING THE RELATIONSHIP BETWEEN THE FEDERAL GOVERNMENT AND RESEARCH INTENSIVE UNIVERSITIES.

****

DIRECTORATE ASSIGNED: PCAST

STAFF ASSIGNED:

ACTION REQUIRED: AS NECESSARY

STAFF ACTION:

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SENDER'S DUE DATE:

OSTP DUE DATE: 08/21/92

STAFF DUE DATE

DATE COMPLETED:

DATE COMPLETED/DEPT:

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COPIES TO: D. Allan Bromley

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WHITE HOUSE TRACKING #:

CONTACT PERSON:

PHONE:

EXT:

REMARKS: NRN per ARD

OSTP RECEIVED: 08/07/92

DEPT RECEIVED:

FILE: P-PCAST

CENTRAL FILES:

2271

THE UNIVERSITY OF ILLINOIS AT CHICAGO

College of Engineering
Department of Chemical Engineering
Box 4348, Chicago, Illinois 60680
(312) 996-3424

RECEIVED
92 AUG 7 AM : 55
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D. Allan Bromley
Assistant to the President for Science and Technology, and
Director of the Office of Science and Technology Policy
Executive Office of the President
The White House
1600 Pennsylvania Avenue, N.W.
Washington, D.C. 20500

Re: Your letter of June 8, 1992 to Dr. James Stukel, Chancellor of the University of Illinois at Chicago, regarding PCAST's review of the partnership between the Nation's research-intensive universities and the Federal government.

Dear Dr. Bromley: July 23, 1992

I had the opportunity to read your letter and the topics of interest to PCAST. I think discussions about the proposed topics are quite appropriate and timely. However, **I would like to bring to your attention the case of research-intensive urban universities (RIUU), such as the UNIVERSITY OF ILLINOIS AT CHICAGO.** I have been a faculty member at UIC for 22 years with my primary interest in research and education. I have worked on a dozen of research grants and contracts as the principal investigator and funded by various agencies of the Federal government. Based on my experience I believe it is necessary for the Federal government to consider a special treatment for the researchers working in RIUU due to the fact that their job is much tougher in bringing a research project to a conclusion than other universities and their activities are more needed for healing the ills of the nation. The reasons are several:

(1) It is harder to attract better graduate students and scholars to RIUU.

(2) It is more difficult to commute and scientifically communicate in urban areas and as a result the research productivity is lower.

(3) Lack of appropriate housing and safety are major factors in urban areas and all the research staff suffer from it.

(4) RIUU have the best possibilities in training minorities for higher education and research.

(5) Urban areas of the United States are in need of cultural, scientific and technological revitalization. Special treatment of RIUU will help to bring about these changes which is good for the whole nation.

Thank you for your attention and please let me know if there is any question.

Sincerely yours,

G.Ali Mansoori
Professor of Chemical Engineering

cc: James Stukel
John Wanat
Robert Tissot

"Document Control"

DOCUMENT NUMBER: 9202585

TYPE: ACTION
ORIGINATOR: 02
STATUS I
DIRECTORATE STATUS

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FROM: FADEN, Alan I.: GEORGETOWN UNIVERSITY

TO: DR. D.A. BROMLEY

DATE OF CORRESPONDENCE: 07/23/92

SUBJECT: HE IS FORWARDING HIS COMMENTS FOR THE PCAST PANEL STUDYING THE HEALTH OF U.S. UNIVERSITIES.

****

DIRECTORATE ASSIGNED: PCAST

STAFF ASSIGNED:

ACTION REQUIRED: AS NECESSARY

STAFF ACTION:

****

SENDER'S DUE DATE:

OSTP DUE DATE: 08/07/92

STAFF DUE DATE

DATE COMPLETED:

DATE COMPLETED/DEPT:

****

COPIES TO: D. Allan Bromley

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WHITE HOUSE TRACKING #:

CONTACT PERSON:

PHONE:

EXT:

REMARKS: ~~AKD~~ No response Necessary per AKD

OSTP RECEIVED: 07/27/92

DEPT RECEIVED:

FILE: P-PCAST

CENTRAL FILES:

2585

GEORGETOWN UNIVERSITY MEDICAL CENTER

Alan I. Faden, M.D.
Dean of Research

July 23, 1992

RECEIVED
92 JUL 27 AM 11:27
OSTP
MAIL ROOM

Dr. D. Allan Bromley
The Assistant to the President for
Science and Technology
THE WHITE HOUSE
1600 Pennsylvania Avenue
Washington, DC 20506

Dear Dr. Bromley:

In response to your query to Rev. O'Donovan to provide input on issues being addressed by the President's Council on Science and Technology, the following information is submitted on behalf of GEORGETOWN UNIVERSITY.

It is becoming increasingly difficult for research-intensive institutions to fulfill their missions in research and education because of the uncertainties of extramural funding. The present uncertainty of obtaining funding to sustain a research program has reached the point that it serves as a major disincentive for the most competitive students to consider careers in science. Additional directed support for pre- and post-doctoral students, through either institutional or individual training grants, is essential.

Funds increasingly must be made available to replace older, outdated equipment, much of which was purchased in the 1970s or early 1980s.

The federal government must recognize that regulatory requirements are adding considerably to the costs of doing research at a time when there are considerable pressures to markedly reduce direct and indirect costs.

Development of a cooperative arrangement involving government, university and industry must supplant the often antagonistic relationships that now prevail.

Although congressionally mandated research programs have always been with us, it is important that the federal government limit its direction of long-term scientific goals based upon political pressures. The peer review process, albeit far from optimal, continues to provide the best mechanism for allocating funds in a way that is likely to produce maximal benefit to society.

Yours sincerely,

Alan Faden

Alan I. Faden, M.D.

AIF/lp

3900 Reservoir Road NW Washington DC 20007
202-687-7007
FAX: 202-687-2585

"Document Control"

TYPE: ACTION DOCUMENT NUMBER: 9202589
ORIGINATOR: 02 STATUS I DIRECTORATE STATUS

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FROM: KEOHANE, Nannerl: WELLESLEY COLLEGE

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 07/22/92

SUBJECT: SHE IS FORWARDING HER COMMENTS FOR THE PCAST PANEL ON THE HEALTH OF U.S. UNIVERSITIES.

****

DIRECTORATE ASSIGNED: PCAST

STAFF ASSIGNED:

ACTION REQUIRED: AS NECESSARY

STAFF ACTION:

****

SENDER'S DUE DATE:

OSTP DUE DATE: 08/07/92

STAFF DUE DATE

DATE COMPLETED:

DATE COMPLETED/DEPT:

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COPIES TO: D. Allan Bromley

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WHITE HOUSE TRACKING #:

CONTACT PERSON:

PHONE: EXT:

REMARKS: NRN per AKD

OSTP RECEIVED: 07/27/92 DEPT RECEIVED:

FILE: P-PCAST

CENTRAL FILES:

2584

Office of the President

Wellesley College

Wellesley, Massachusetts 02181
(617) 235-0320

RECEIVED
92 JUL 27 AM 7:27
OSTP
MAIL ROOM

July 22, 1992

D. Allan Bromley
The Assistant to the President
for Science and Technology
The White House
Washington, DC 20500

Dear Mr. Bromley:

Thank you for your letter of June 8, with its invitation to participate in one of the public meetings with your colleagues on a Council of Advisors on Science and Technology.

As you seek insight into these problems, I would urge you to keep in mind the important role of colleges as well as universities in educating our nation's scientists. As I'm sure you are aware, based on data provided by a Consortium of fifty liberal arts colleges organized by Oberlin College, our institutions provide an impressive proportion of those undergraduates who go on to careers in science. The intimate relationship between faculty and students in our laboratories and classrooms has much to do with this rate of success. This emphasis on teaching is therefore crucially important to our longterm national production of Ph.Ds.

It is important also to recognize the research needs and contributions of our faculty and students. In the most selective liberal arts colleges our success in teaching science is directly related to the strong hands-on component of laboratory experience by each of our senior majors who participate in research with their faculty directors and present papers to national conferences. This method of teaching is highly successful and very time consuming. In order to sustain it, our faculty members need support not only for their own cutting edge research, but also for this work with their student colleagues. It is too often overlooked that colleges like ours have active faculty researchers who contribute to the growth of knowledge like their university colleagues, in addition to taking a large share of the responsibility for training a generation of successors.

I would be happy along with my colleagues in this area to consult with you at any point about the implications of these points for your policy decisions. I'm sure that several members of your Council will be knowledgeable about this part of the work of your Council and able to be helpful, too.

Thank you again for consulting all of us, and best wishes for your enterprise.

Yours sincerely,

Nannerl O. Keohane

NOK:smh

cc: Dr. Ralph Gomory
Dr. Peter Likins
Dr. Harold Shapiro

"Document Control"

TYPE: ACTION DOCUMENT NUMBER: 9202580
ORIGINATOR: 02 STATUS I DIRECTORATE STATUS

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FROM: MALONE, Thomas J.: MILLIKEN

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 07/22/92

SUBJECT: HE IS FORWARDING HIS COMMENTS REGARDING THE PCAST STUDY OF U.S. UNIVERSITIES FOR DR. BROMLEY'S REVIEW.

****

DIRECTORATE ASSIGNED: PCAST

STAFF ASSIGNED:

ACTION REQUIRED: REVIEW FOR DAB

STAFF ACTION:

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SENDER'S DUE DATE:

OSTP DUE DATE: 08/07/92 STAFF DUE DATE
DATE COMPLETED: DATE COMPLETED/DEPT:

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COPIES TO: D. Allan Bromley

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

REMARKS: NRN per AKD

OSTP RECEIVED: 07/27/92 DEPT RECEIVED:
FILE: P-PCAST

CENTRAL FILES:

2580

MILLIKEN

Dr. T.J. Malone
President

July 22, 1992

RECEIVED
92 JUL 27 AM 8:28
OSTP
MAIL ROOM

Dr. E. Allan Bromley
The Assistant to the President
for Science and Technology
Office of Science and Technology Policy
The White House
Washington, DC 20506

Dear Dr. Bromley:

Congratulations on your very successful public meeting at Duke. I am delighted that I had the opportunity to be a part of the entire session and specifically to present our industry's story. I am pleased that you are interested in reviewing our specific situation and my broad based proposals in greater depth. I look forward to hearing from you soon in regard to a follow up meeting.

You had so much information handed to you during the meeting that I decided not to give you a notebook with my entire presentation, as well as some additional information that gives more details of the facts and data that I presented. I am enclosing that booklet for you to use as you see fit.

I look forward to following up with you in the very near future.

Sincerely,

Tom

Thomas J. Malone

P.O. Box 1926, Spartanburg, S.C. 29304, M-149, (803) 573-2900 Fax (803) 573-1998

CRAFTED WITH PRIDE IN U.S.A.

The President's Council of Advisors on Science and Technology

Duke University
July 21, 1992

Dr. E. Allan Bromley
The Assistant to the President
For Science and Technology

TYPE: ACTION DOCUMENT NUMBER: 9202573
ORIGINATOR: 02 STATUS I DIRECTORATE STATUS

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FROM: CLEGG, James S.: NATIONAL ASSOCIATION OF MARINE LABORATORIES

TO: DR. D.A. BROMLEY

DATE OF CORRESPONDENCE: 07/21/92

SUBJECT: HE IS WRITING IN THE CONTEXT OF THE PCAST PUBLIC MEETINGS TO DRAW ATTENTION TO THE UNIQUE IMPORTANCE OF MARINE LABORATORIES TO THE RESEARCH ENTERPRISE OF THE COUNTRY.

****

DIRECTORATE ASSIGNED: PCAST

STAFF ASSIGNED:

ACTION REQUIRED: AS NECESSARY

STAFF ACTION:

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SENDER'S DUE DATE:

OSTP DUE DATE: 08/07/92

STAFF DUE DATE

DATE COMPLETED:

DATE COMPLETED/DEPT:

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COPIES TO: D. Allan Bromley
ENVIRONMENT

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WHITE HOUSE TRACKING #:

CONTACT PERSON:

PHONE: EXT:

REMARKS: NRN per AKD

OSTP RECEIVED: 07/24/92 DEPT RECEIVED:

FILE: P-PCAST

CENTRAL FILES:

2573

National Association of Marine Laboratories

c/o Marine Biological Laboratory, Woods Hole, MA 02543

President
Dr. James S. Clegg
Bodega Marine Laboratory
P.O. Box 247
Bodega Bay, CA 94923

(707) 875-2211
FAX: 875-2089

RECEIVED
92 JUL 24 AM 8:41
OSTP
MAIL ROOM

21 July 1992

Dr. D. Allan Bromley, Director
Office of Science and Technology Policy
749 Jackson Place, NW
Washington, DC 20506

Dear Dr. Bromley:

In the context of the PCAST public meetings we wish to draw your attention to the unique importance of marine laboratories to the research enterprise of this country. Practically all of the more than 120 marine laboratories nationwide have strong affiliations with universities, and the great majority of the nation's research-intensive universities support their own marine laboratories. This brief letter will not document the importance and great diversity of basic and applied research being carried out at these laboratories, although that can be done if requested. Rather, we focus here on some perhaps less obvious but vital features of this collective national resource.

A number of Federal agencies have coastal ocean programs. However, to our knowledge, no detailed nationwide assessment has ever been made of the adequacy of coastal research facilities and capabilities that will be required to support the goals of these programs, now and in the future. Such an assessment is badly needed, and we suggest that it be listed as a recommendation in the Council's report to the President.

It is not widely appreciated that marine laboratories make major contributions to education, from K-12 through the Ph.D, and are also of prime importance to the awareness of the general public about the marine environment specifically, and science in general. Furthermore, by the year 2000 it has been estimated that about 95% of our population will reside within 50 miles of the coastline, including the Great Lakes. Thus, we can expect to encounter major problems involving human health and the environment, as well as resource management at these locations. Marine laboratories will surely play a vital role in dealing with these issues. To do so, however, they will require more substantial funding from Federal sources than exists at present.

Marine science is multidisciplinary, requiring research and training that, in many cases, can be conducted only at coastal laboratories. Thus, the facilities and expertise at

these sites must be capable not only of meeting the research demands of the future, but also for the training of future generations of scientists. I hope it is evident that this matter must be given careful attention if we are to maintain our position in the international scientific community, and be competitive in such rapidly emerging areas as biotechnology and aquaculture.

Finally, we note that the aim of the Council is to evaluate the relationship between research universities and the Federal government. It is difficult to think of anything more national than our coastline. Although marine laboratories are usually viewed as separate, disconnected entities they all bear many common research and teaching goals as well as physical plant requirements (research vessels, sea water systems, and so on). In a sense, the nation's marine laboratories constitute, collectively, a national laboratory much larger than all the Federally funded national laboratories combined. It was in part this commonality of "structure and function" that led to the establishment of the National Association of Marine Laboratories, whose purposes are listed in the enclosed articles of organization.

We will be pleased to respond to questions and requests for additional information.

Sincerely,

James S. Clegg

James S. Clegg

JSC:sea
Enclosure

Current Copy Date: 18 February 1992

NATIONAL ASSOCIATION OF MARINE LABORATORIES

ARTICLES OF ORGANIZATION

Amended: 12 October 1991

I. NAME

The name of this Association shall be the National Association of Marine Laboratories ("Association" herein), as a non-profit organization incorporated in the State of Massachusetts.

II. PURPOSES

The purposes of the Association shall be:

1. To stimulate research and promote education in marine science, to disseminate information in marine science, to promote application of marine science, and to advance the profession of marine science.

2. To provide a forum for the resolution of problems common to non-profit marine laboratories in the United States.

3. To further the wise use and conservation of marine and coastal resources, and to encourage increased accomplishments and initiatives in related areas.

4. To increase the effectiveness of member institutions in their work on marine and coastal resources.

5. To stimulate cooperation and unity of effort among members.

6. To act on other such matters as may be of mutual interest to marine laboratories.

III. REGIONAL SECTIONS

The Association shall consist of three (3) regional sections which shall have their own separate but similar articles of organization and bylaws. The regular, but not the associate, members of each regional section shall automatically belong to the Association upon payment of annual **capital contributions**, election by the Association Board of Directors, and ultimate ratification by the Association membership at a regular meeting. It is the intent that the Association shall represent the regional sections on matters that cannot be resolved at the regional level and matters of advocacy that should be presented by the Association in behalf of all regional sections on the national level.

The three regional sections are: the Northeastern Association of Marine Laboratories (NEAML), the Western Association of Marine Laboratories (WAML), and the Southern Association of Marine Laboratories (SAML). Laboratories located on the Great Lakes are here defined as marine laboratories and will be eligible for membership in NEAML and NAML.

IV. MEMBERSHIP

Regular membership in the Association shall be composed of marine laboratories operated by state, university, and other non-profit organizations in the United States, Bermuda, Puerto Rico, the U.S. Virgin Islands and Guam. Marine laboratories shall be defined as those shore-based laboratory facilities directly accessing the marine environment or Great Lakes.

V. CONDUCT OF BUSINESS

Conduct of business of the Association shall be governed by these Articles of Organization and the Bylaws. The rules contained in the latest edition of "Roberts Rules of Order", most recently revised, shall govern the conduct of Association meetings provided they are not inconsistent with the provisions of these Articles and Bylaws of the Association.

VI. BYLAWS OF THE ASSOCIATION

The Association shall maintain Bylaws of the Association ("Bylaws" herein), which shall describe the methods of conduct of business for the Association. In the event of conflict between the Bylaws and these Articles of Organization, the Articles shall govern.

VII. AMENDMENTS

These Articles of Organization may be amended at any duly constituted meeting of the Corporation, at which a quorum is present, by a two-thirds (2/3) vote of the regular member delegates present. Notice of proposed amendments shall be mailed at least thirty (30) days prior to the meeting to each member institution. Copies of the proposed amendment shall be made available to all delegates prior to the start of the meeting. Such notice shall include the exact wording of the proposed amendment and shall include the name(s) and address(es) of the proponent(s). However, changes can be made to the proposed amendment language at the meeting.

TYPE: ACTION DOCUMENT NUMBER: 9202577
ORIGINATOR: 02 STATUS I DIRECTORATE STATUS
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FROM: JENNINGS, Lee B.: UNIVERSITY OF ILLINOIS

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 07/20/92

SUBJECT: HE IS FORWARDING HIS COMMENTS FOR THE PCAST PANEL ON THE HEALTH OF U.S. UNIVERSITIES.

****

DIRECTORATE ASSIGNED: PCAST

STAFF ASSIGNED:

ACTION REQUIRED: AS NECESSARY

STAFF ACTION:

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SENDER'S DUE DATE:

OSTP DUE DATE: 08/07/92

STAFF DUE DATE

DATE COMPLETED:

DATE COMPLETED/DEPT:

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COPIES TO: D. Allan Bromley

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PHONE: EXT:

REMARKS: NRN per AKD

OSTP RECEIVED: 07/24/92 DEPT RECEIVED:

FILE: P-PCAST

CENTRAL FILES:

2577

UIC The University of Illinois at Chicago

Department of German (M/C 189)
College of Liberal Arts and Sciences
Box 4348, Chicago, Illinois 60680
(312) 996-3205

RECEIVED
92 JUL 24 A10 : 30
OSTP
MAIL ROOM

July 20, 1992

D. Allen Bromley
Asst. to the President for Science and Technology
Director of the Office of Science and Technology Policy
Executive Office of the President
The White House
1600 Pennsylvania Avenue, N.W.
Washington, D.C. 20500

Dear Mr. Bromley:

As head of a small humanities department at a large state university, I am not so directly involved with Federal funding as would be the case in some other types of departments. What Federal funding we receive is in the form of individual faculty research or teaching fellowships (NEH, Fulbright) or occasional NEH funding for a symposium or workshop. Still, I would like to address the question of the most pressing challenges confronting research-intensive universitites over the next decade.

This challenge lies, I believe, in the broad popular movement, echoed by state legislatures, in favor of deemphasizing research in favor of undergraduate teaching. Granted that some shift of emphasis might be desirable, a number of misconceptions and exaggerations are being aired in the press. One is that experts in research fields are necessarily the best persons to teach beginning courses in their disciplines. Another is that most research, if not financially motivated, is superfluous and trivial (especially in the humanities). Still another is that university professors have a great deal of spare time on their hands.

The universities are partly to blame. We have tended to assume that all faculty are researchers first, teachers second, hoping that the two functions will somehow find the right balance. True efficiency means, rather, giving the discoverers time to do their discovering, and letting the explainers do most of the explaining. Some restructuring of the system may be necessary to achieve this.

Another popular idea is that of "productivity," whereby programs that do not grant a large number of degrees are endangered, often being combined with other programs in such a way as to ensure their demise. This tendency, if carried to the extreme, will reduce universities to trade schools. Restructuring, as it is often encouraged by business-oriented administrators and legislators, tends to take this form -- cutting and merging -- instead of the more thoughtful forms that would produce real efficiency by putting the right people in the right jobs.

As to what the Federal Government might do about all this, I am not sure. Perhaps a campaign to educate the public is called for, pointing out that research is, after all, the acquisition of new knowledge that can be passed on and taught, and that this takes time. Without it, there would be nothing new to teach, however excellent the teachers might be. A new piece of humanistic research, for instance, may seem trivial, but it will fit into the picture of our overall understanding of human history and thought.

Sincerely,

Lee B. Jennings

Prof. Lee B. Jennings
Head, Department ofGerman

Printed on 100% recycled paper

"Document Control"

TYPE: ACTION DOCUMENT NUMBER: 9202206
ORIGINATOR: 02 STATUS I DIRECTORATE STATUS

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FROM: WETHINGTON, Charles: UNIVERSITY OF KENTUCKY

TO: DR. D.A. BROMLEY

DATE OF
CORRESPONDENCE: 07/20/92

SUBJECT: HE IS FORWARDING HIS COMMENTS TO THE PCAST PANEL STUDYING THE HEALTH OF U.S. UNIVERSITIES.

****

DIRECTORATE ASSIGNED: PCAST

STAFF ASSIGNED:

ACTION REQUIRED: AS NECESSARY

STAFF ACTION:

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SENDER'S DUE DATE:

OSTP DUE DATE: 08/12/92

STAFF DUE DATE

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DATE COMPLETED/DEPT:

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REMARKS:

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FILE: P-PCAST

CENTRAL FILES:

2206

UNIVERSITY
OF KENTUCKY

Office of the President

104 Administration Building
University of Kentucky
Lexington, Kentucky 40506-0032
606-257-1701; FAX 606-257-1760

RECEIVED
92 AUG 5 A10:32
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MAIL ROOM

July 20, 1992

Dr. D. Allen Bromley
The Assistant to the President
for Science and Technology
OEOB, Room 358
Washington DC 20506

Dear Dr. Bromley:

Thank you for the opportunity to comment on the challenges facing higher education with respect to the university/federal partnership. You are correct that the changing national and international environments in which our major research institutions function makes this an opportune time for the President's Council of Advisors on Science and Technology (PCAST) to review the partnership between the Nation's research-intensive universities and the Federal Government.

The University of Kentucky (UK), a land-grant institution established in l865, serves as the major graduate degree-granting university in Kentucky's system of higher education and is the principal institution for statewide instruction, research, and service in all fields. The University is unique in that it includes a full service Medical Center, a 14 institution Community College System and 22 multidisciplinary research centers and institutes. UK was recently ranked 55th nationally in terms of total federal obligations. It is one of 45 public institutions in the nation classified by the Carnegie Foundation as a Research I University. During the past five fiscal years, UK has received $292.2 million in extramural awards. The current level of extramural funding involves more than 1,450 projects, with budgets totaling over $145.4 million. Our faculty attracted approximately $90 million in grant and contract awards in FY 1992.

UK's total enrollment for the fall 1991 semester was at an all time high of 70,269 students. The Community College System had 46,069 students, and the Lexington Campus and Medical Center had 24,200 students.

Research-intensive universities in states like Kentucky are important to regional economic development and to ensuring a continued supply of scientists and engineers. The nation must better understand the importance of building these institutions for state and regional growth. A broadly based educational infrastructure of research-intensive universities with strong capabilities to educate undergraduates and graduates alike will provide the human capital for all of the regions of our country to compete in the global economy. These institutions must be developed throughout the nation, not just on the two coasts.

The University of Kentucky is experiencing growth in research, education and public service, in a time of shrinking resources. The greatest challenge to me as President is to provide the resources necessary to sustain this growth. Across the nation, state universities are experiencing a reduction in state support. Here in Kentucky, for example, the state share in UK's budget is declining from 41.1% at the start of the 1991-1992 biennium to 36.9% at the end of the 1993-1994 biennium. This troubling trend is national in scope and comes at a time when the economic health of the country depends more upon investment in research and development than at any other time in history.

I am enclosing comments on the PCAST discussion items based upon our experiences at the University of Kentucky. I hope you find them helpful and thought provoking.

Sincerely yours,

Charles T. Wethington, Jr.
President

University of Kentucky Response
Topics of Interest to PCAST

1. **Capacity of research-intensive universities to fulfill their mission in research, education and public service; principal concerns, suggested remedies.**

Research-intensive institutions must continue to do well those things that they already do well. That is, these institutions must continue to educate the best minds in an intellectual environment characterized by growth and development. We must seek ways to improve the quality of research, training and service at a time when resources are scarce. We must reaffirm the understood roles of the university, state and federal government, and private sector in the renovation and development of our research institutions. The current economic conditions are not providing the stable and supportive environment necessary to insure the vitality of the research enterprise.

2. **Nature of the current relationship between research-intensive universities and the Federal Government; changes occurring or in view; principal problems or areas of difficulty; suggestions for improvement.**

Historically, the Federal Government has taken the primary role of supporting basic research and development, while the state role has focused upon specific applied research and technical development. It is unlikely that these roles will change, nor should they.

At present, the relationship between the Federal Government and research-intensive institutions is strained. The universities are hurting for resources due to reduced state support and reduced federal funding. The erosion of the research infrastructure at universities is accelerating at an alarming rate. The proliferation of new Federal regulations and imposed programs has taken resources away from other important programs. This situation is further exacerbated by the lack of federal support for the increased administrative costs associated with the seemingly constant flow of new requirements.

3. **Key elements or principals that should characterize the relationships between research-intensive universities and the Federal and/or State governments in the coming years.**

The Nation needs a national science and technology policy which incorporates the views of the public and private sectors. There must be a renewed focus on institutional development, reduced regulation and economic development. This policy should delineate the expectations and responsibilities for each of the parties including the Federal Government, state governments, industry and universities. This policy must provide for adequate and stable funding for research to insure that the best and brightest scientists and engineers can fully realize their potential.

A word of caution is necessary in promoting the development of a national science and technology policy. There is a danger in setting priorities having too narrow a focus. Often scientific discoveries having no obvious immediate application are economically important in the long term.

4. **The most pressing challenges confronting research-intensive universities over the next decade; role, if any, for the Federal Government.**

The most pressing challenges confronting us over the next decade are the inadequate funding base for research, the need for infrastructure development and the inclusion of women and minorities in science and engineering. These are discussed elsewhere in these comments. A fourth challenge will be to attract the best and brightest faculty and students.

The US does not graduate enough scientists and engineers at either the BA or PhD level. As a result, we are not educating enough individuals to fulfill either the needs of academia or the corporate world in the 21st century. In academia, we may also face a shortage of faculty members in the humanities and social sciences. Across the disciplines, states like Kentucky are likely to experience the most serious effects from these shortages.

To attract the best faculty and students to our campuses, we must provide an environment which is supportive of intellectual development. We must improve facilities, upgrade equipment and provide adequate compensation.

5. **Concerns regarding physical facilities for research; realistic needs, barriers, role of institutions, States, Federal Government in financing.**

The infrastructure of research institutions is deteriorating at an alarming rate. There is inadequate funding for the renovation and upgrade of the physical plant. At the University of Kentucky, a recent report indicated that there is a $26 million problem with fume hoods, a basic need of laboratories in several disciplines. This is not something to which alumni contribute, the University has no reserves of this magnitude and there are limited State funds for such projects.

One solution would be a new competitive federal program of institutional block grants for facility renovation and upgrade. The new program could require state and/or local matching funds. Such a program should be seriously considered as an alternative to congressional earmarking and must include adequate funds to address the problem. The philosophy which drives this new program should focus upon the development of our research infrastructure as a national investment. This investment would yield a dramatic increase in research and development.

6. **Balancing merit-based peer review with other criteria for supporting research.**

In general, the peer review system works well for the senior, well established investigator. However, the current process does not include sufficient attention to access for women and minorities nor to institutional development. The review process must support the development of the nation's research and technology infrastructure, including human capital, in all regions of the U.S., rather than just the two coasts. A positive example of this at the University of Kentucky has been the National Science Foundation's Experimental Program to Stimulate Competitive Research. This program has been instrumental in developing junior scientists and engineers into competitive researchers.

Secondly, there is a growing conservatism in review and funding decisions. With inadequate availability of funds, beginning researchers and high risk research are not being funded. This is exacerbated by the continuing debate about big-science versus little-science and the perception that one uses up the resources needed by the other. Both are imperative to the nation's growth. We need big science projects in specific targeted areas and we need to be highly efficient in developing these projects. We need little science to generate the new knowledge which drives our technological development and to train new generations of researchers. The nation must support both by increasing its investment in research.

7. **General commitment expected of the Federal Government to the university-based pool of highly trained scientists and engineers.**

Universities are willing to take the risk to train, recruit and develop scientists who can compete for funds, but adequate start-up funding is critical. It is impossible to judge the quality of our people if they have no opportunity to demonstrate their abilities.

Our scientists and engineers must have a stable and adequate source of funding for their research activities. Currently, there are low numbers of proposals being funded and there is inadequate support for beginning scientists and engineers. There must be a reaffirmation of the federal responsibility to support the development of new ideas. The Federal Government must find ways to support additional individual investigators or there will be no encouragement for young scientists and engineers to pursue research careers.

8. **The Federal Government's role in expanding the number of university-based women and minorities in science and engineering.**

In general, there is inadequate support for students. In particular, there is inadequate support for under-represented populations at both the undergraduate and graduate levels.

First we must attract women and minorities to science and engineering early in their educational career. Some programs must focus on the recruitment of these individuals during the K-12 period, other programs must focus on undergraduate training and increased support must be provided at the graduate and post-doctoral levels. Currently, there are federal programs for these students but they are focused on particular areas or they do not provide a stable level of support.

What is needed is a broad-based fellowship/traineeship program for undergraduates and graduates. This program should be institutionally based and open to a broad range of disciplines in the social and natural sciences as well as engineering.