MEMORANDUM

NATIONAL SECURITY COUNCIL

6594

September 27, 1982

Poindexter
ASAP
Ed McG
Right on it
I'll be glad to help.
DPM

ACTION

MEMORANDUM FOR WILLIAM P. CLARK

FROM: EDWARD McGAFFIGAN, JR. EMcG
GUS WEISS

SUBJECT: National Academy of Sciences' Dinner, September 29

Your hosts for the evening will be National Academy of Sciences' President, Frank Press, and former President of Cornell, Dale Corson. They will be presenting the results of the Academy's review of national security and scientific research, which Corson led.

Talking points in bullet form are attached. We have also prepared a longer memo summarizing the Academy's report and the controversy leading up to it and making a specific recommendation for follow-up: issuance of an NSSD on which Jay Keyworth would take the lead. Peruse it only as your time allows.

Attachment
Talking Points

LT. COL. GREG WALTERS
695-4327

Talking Points
National Academy of Sciences
September 29

-- Complex and controversial set of issues.

-- Corson panel has done a good job elucidating them, bringing government and research community together.

-- Understand need for narrow application of national security controls to scientific communication.

-- Executive Order 12356 on national security information, issued April 2, retained limitation that basic scientific research info not clearly related to national security may not be classified.

-- Don't want to ape Soviet model--too much secrecy blocks technological innovation.

-- First Amendment also protects open communication in U.S.

-- Still, there are sensitive areas where some control is warranted, as your report makes clear.

-- Interested in your recommendation to make greater use of contract and visa controls and less use of export controls, and your call for drastic streamlining of the Militarily Critical Technologies List.

-- NSC will consider this set of issues, and ask an appropriate group to work on follow-up to your report.

-- Jay Keyworth may be best positioned to lead that follow-up, including both technical agencies and export control agencies.

MEMORANDUM

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NATIONAL SECURITY COUNCIL

September 27, 1982

ACTION

MEMORANDUM FOR WILLIAM P. CLARK

FROM: EDWARD McGAFFIGAN, JR. EMcG
GUS WEISS GW

SUBJECT: Background and Talking Points for National Academy of Sciences' Dinner on September 29

You have accepted an invitation (TAB B) from National Academy of Sciences' President Frank Press to attend a dinner and briefing on the Academy's study of scientific research and national security, which will be released on September 30. Talking points for use at the dinner are provided at TAB A.

Background

Over the last four years there has been increasing polarization between the scientific community and government over the government's attempts to limit the Warsaw Pact's access to unclassified technical information. The most recent incident was the last-minute DoD cancellation of over 100 papers scheduled to be presented by DoD personnel and contractors at the Society of Photo-Optical Instrumentation Engineers' annual meeting (see TAB C). The Academy's study is an attempt to set up a dialogue between government officials dealing with export controls and the academic and industrial research community. Jay Keyworth encouraged the Academy to undertake this effort, which Dick DeLauer at DoD and John Slaughter at the National Science Foundation supported financially. Frank Press put together a very balanced group, including several people with DoD and intelligence community experience (see TAB B). Dale Corson, President Emeritus of Cornell, chaired the group.

The Report

We believe that the group did an excellent job of balancing the needs of government to protect sensitive information and

the need of the scientific community to communicate freely in order to advance science and technology to enhance the nation's economic competitiveness and national security. The panel advocates an approach based on security through accomplishment rather than through secrecy. It points out that as part of the nation's science policy we are trying to stimulate technology transfer from the universities and government laboratories, where most basic research is carried out, to industry. The panel also believes, based on the evidence presented to it by the intelligence community, that normal scientific communication has played and will continue to play a minimal role in U.S. technological losses to the Warsaw Pact, compared to espionage and legal and illegal trade. Moreover, they pointed out the strong constitutional protection afforded open communication of information in the United States.

The panel looked at the five mechanisms whereby government can seek to control the flow of scientific information to potential foes: 1) classification; 2) export controls, i.e., requiring a license to communicate the information; 3) controls (e.g., prepublication review) specified in government R&D contracts; 4) voluntary agreements to submit information for review; and 5) visa controls. (See TAB D for executive summary.)

They recommend classification only if the research will lead to near-term military products. Almost all basic research will not fall in this category. They caution against the other controls being used on unclassified research except in narrow "grey areas." They recommend use of contract and visa controls in preference to license controls, and a general exemption from license controls for unclassified information that is available domestically. They warn of the bureaucracy's tendency to broaden the categories for control and recommend that the 700-page classified Militarily Critical Technologies List, which DoD has been developing for four years to serve as the underpinning of the commodity control and munitions control lists, be "drastically streamlined" to concentrate on technologies truly critical to national security. Finally, they find that voluntary agreements between researchers and government agencies will work only in very special instances like cryptography, where a large agency (NSA) is working with a small number of researchers who recognize the potential sensitivity of their work.

Follow-up to the Report

At the dinner, you are most likely to be asked how the government will now follow-up on the findings of this report. We would recommend that the NSC ask Jay Keyworth to take the lead in an NSSD study. None of the existing interagency groups working on export control, such as the State-chaired SIG or the Commerce-chaired Export Administration Review Board, have adequate representation from the technical agencies charged with carrying out R&D, including the R&D side of Defense. An illustrative draft NSSD is attached at TAB E. It has not been shown to any of the agencies thus far.

Recommendation

We would be pleased to brief you further prior to the dinner, which both of us will also be attending. This would be an opportunity to discuss whether we should pursue the NSSD possibility with the agencies involved.

Approve_____ Disapprove_____

Time_____

Attachments

TAB A	Talking Points
TAB B	Invitation
TAB C	Science article on SPIE Conference
TAB D	Executive Summary of Academy's Report
TAB E	Draft NSSD

Talking Points
National Academy of Sciences
September 29

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THE WHITE HOUSE
WASHINGTON

September 22, 1982

Ed:

Per John Poindexter's note, you should prepare talking for WC on the attached.
Thanks

Kay

Bud and John

WC wants to know if you are interested in the attached.

Good idea Judge

I think you should do it.

The Office should prepare some talking points.

6594

NATIONAL ACADEMY OF SCIENCES

2101 CONSTITUTION AVENUE WASHINGTON, D.C. 20418

OFFICE OF THE PRESIDENT

20 SEP 1982

September 17, 1982

Mr. William P. Clark
Assistant to the President for
National Security Affairs
The White House
Washington, D.C. 20500

Dear Mr. Clark:

The Panel on Scientific Communication and National Security has completed a study on the relationship between scientific research and national security. I cordially invite you to a dinner and briefing by our Panel at the National Academy of Sciences on September 29. The report will be released to the public on the following day. The invitation has been extended to a small group of leaders from the Congress and the Executive agencies, as well as representatives from high-technology industry and from the scientific and academic community.

As you know, concerns have been expressed by many officials that the free availability to foreign nationals and certain nations, particularly the Soviet Union and its allies, of some unclassified research results poses a threat to the national security. At the same time, many scientists and engineers and research officials in government, universities and industry believe that restrictions on open communication could threaten the vitality of the educational and scientific endeavors upon which U.S. technologies and our national defense are based. The Panel was charged with the task of examining how these competing national objectives can be balanced to best serve the general welfare. The Panel was briefed extensively, including discussions with the intelligence community. The Panel's recommendations, if adopted, could aid in insuring that both of these important national goals are realized through appropriate policies.

For your information I have enclosed a list of the membership of the Panel, chaired by Dale R. Corson, a physicist and President Emeritus of Cornell University, that was convened under the auspices of the Academies' Committee on Science, Engineering and Public Policy. Financial support for the study was provided by the Department of Defense, the National Science Foundation, the American Association for the Advancement of Science, the American Chemical Society, the American Geophysical Union, and the National Academy of Sciences.

I hope you will be able to reserve a few hours of your time on Wednesday, September 29, to meet with us and discuss this subject of national importance. The program will begin at 6:30 p.m., with cocktails in the Rotunda of the National Academy of Sciences. Dinner will be at 7 p.m. in the Lecture Room and will be followed by the briefing and a discussion of the report. Please respond directly to the Panel's office (Ms. Liz Panos 334-2498) to let us know if you will be able to attend.

Yours sincerely,

Frank Press

Frank Press
President

NATIONAL ACADEMY OF SCIENCES
NATIONAL ACADEMY OF ENGINEERING INSTITUTE OF MEDICINE

COMMITTEE ON SCIENCE, ENGINEERING, AND PUBLIC POLICY

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SCIENCE

Export Control Threat Disrupts Meeting

Participants at SPIE meeting scrambled to withdraw their papers upon learning that they may not have gotten proper clearances

By all accounts, the 26th annual technical symposium of the Society of Photo-Optical Instrumentation Engineers (SPIE) was a shambles. More than 2700 people from 25 countries, including the Soviet Union, attended the meeting, which was held at the end of August in San Diego. But at least 100 of the 700 papers listed in the program were withdrawn at the last minute by frightened and confused authors, acting in some cases under orders from their supervisors or contracting agencies, after the Department of Defense let it be known that some of the scheduled presentations might violate government export regulations. These regulations are designed to keep military-related high technology out of Soviet hands.

The incident is unprecedented and it is being perceived as the most dramatic example to date of Reagan Administration's determination to clamp down on technology transfer. Says Joseph Yaver, executive director of SPIE, "We've lost a few papers here and there but never anything of this magnitude." And the ramifications of the incident are widespread. Some members of SPIE are worried that their freedom to openly discuss their research is threatened and, according to Yaver, a number of members have withdrawn from the organization, reasoning that it is on the DOD's hit list. One large corporation requested that its papers, which were presented at the conference, not be published in the conference proceedings. Other participants asked for refunds of their registration fees. "The whole fabric of our society is unraveling in our hands," Yaver moans. This episode, moreover, could have an adverse effect on other meetings where potentially sensitive technologies are discussed.

Government officials also are concerned. George Keyworth, the President's science adviser, put out a statement saying, "OSTP [the Office of Science and Technology Policy] wasn't involved but there obviously has to be some reconciliation between a legitimate concern for technology transfer and an unfettered pursuit of research, particularly in the international scientific community. I think the incident at the photooptical conference was both unfortunate and ill-timed." A Pentagon official remarks, "The recent events could endanger the constructive efforts of many to foster a healthy DOD-university relationship." The incident comes just before a DOD-National Academy of Sciences panel is scheduled to release a report on technology transfer so it is seen by some observers to have occurred at a particularly inopportune time.

The SPIE incident, which was first brought to public attention by *Science News*, which had a reporter at the meeting, began on Wednesday, 18 August—just 2½ days before the conference registration was to begin. A military officer appeared at the offices of the Pentagon's international security division carrying the SPIE program. He had only recently become aware of the program's contents and was concerned that defense-related technical information was scheduled to be presented. Most of the meeting participants were under contract to the Defense Department or were Defense Department employees—which meant that they were required to get Pentagon clearance before presenting papers at an international conference. The papers included presentations on reconnaissance, characterization of battlefields with electrooptical equipment, image processing, military applications of infrared technology, and fiber optics. Had all of these papers been cleared, the officer asked?

"We looked at the program," says a Pentagon official, "and we called in five or six experts on technology control. We agreed to a man that it was an extraordinarily bad situation." Most of the sensitive papers had not been submitted for clearance. The Pentagon then sent out messages to all DOD personnel and contractors who were scheduled to make presentations at the meeting saying that, if they were planning to discuss defense-related technical information and if they

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had not gone through appropriate clearance procedures, they should do so. Failure to do so could constitute illegal export.

The Pentagon also sent several people to San Diego to convey the warning in person. At the same time, and independently, the Commerce Department sent what it says was a routine telegram to the conference organizers notifying them that Commerce's export control regulations might apply to the scheduled papers. After sending the telegram, Commerce learned that the conference met its criteria for an open meeting, meaning that anyone could attend and that all the papers would be published. It then attempted to reassure the conference participants through a State Department representative at the meeting. A Commerce Department official says, "I told the State Department to tell her [the representative] that as far as we were concerned, the conference is okay."

The result of the DOD and Commerce warnings was that the conference participants panicked. "We all flip-flopped around," Yaver recalls. "Half of us were already on airplanes when the whole thing started to come apart. We were dealing in real time and there were a lot of misunderstandings and overreaction to the DOD directive. People were afraid that if they didn't pull their papers they might be making a mistake."

Richard Wollensack, who is president of SPIE, concurs. The meeting was in disarray with "authors parading up the stairs to talk to strange people and get advice," he says. But the DOD advisers who were sent to the meeting did not have the authority to clear papers. Instead they asked if the work was sponsored by the Defense Department and, if so, was it properly cleared?

About a dozen authors sent their papers to the Pentagon for expedited clearance. Nearly all were told they could present their papers if they made a few modifications.

All parties agree, however, that some people overreacted and pulled papers that could have been presented. "When you work for the DOD or are a DOD contractor, their wish is your command," says Yaver. At least one Air Force contractor, Hajime Sakai of the University of Massachusetts, withdrew his papers even though his contract says nothing about getting a clearance. "The Air Force insisted that my papers go through clearance. I was told that I must not present my papers. The Pentagon sent people to monitor which papers were presented so I could not defy their authority," he says.

John Selby of Grumman Aerospace Corporation says that six out of eight scheduled papers to be presented in the session he chaired on "Infrared Backgrounds and Atmospheric Transmission" were pulled. All Navy personnel withdrew their papers. Yaver and Wollensack say that the total number of papers withdrawn is still being tabulated.

> An Air Force official characterizes the situation as "out of control."

Why, if most of these authors were required to get Pentagon clearance, did they fail to do so and why did the DOD suddenly crack down on this meeting? Pentagon officials, SPIE officials, and conference participants agree that many researchers who failed to get proper clearances simply were ignorant of the DOD regulations. Many DOD employees, for example, get "clearances" from their local supervisors. Contractors get "clearances" from their companies. "The understanding we had is that there is an awful lot of business where a person had a paper scheduled and his boss approved it without doing anything other than sending it to the local public affairs official," a Pentagon spokesman says.

An Air Force official who deals with technology transfer characterizes the situation as "out of control. People are not following the proper procedures." There is no good excuse for this laxness, he says, because, "In the case of contractors, clearance requirements are written into the contract. In the case of DOD personnel, it is even more clear that they need clearances." This official speculates that the reason people have been bypassing Pentagon clearances is that, "Over the last several years, conferences and symposia like SPIE's have mushroomed. The SPIE conference was one of several like it just that week. As this grew out of control people started taking shortcuts."

Since the SPIE meeting was forcibly brought to the attention of Pentagon officials, it became something of a test case. On the one hand, it could be argued that the DOD was simply enforcing regulations that were already on the books. Yet, says a Pentagon scientist, the DOD's actions reflect the Reagan Administration's determination to clamp down on technology leaks to the Soviets.

Whether the SPIE meeting should have been disrupted is debatable. A Pentagon official says, "we have been told by several SPIE members that they have been concerned for a number of years by the subjects presented at the annual meetings." At this meeting, the official says, there was a session on reconnaissance in which, "Soviet representatives were jumping up and taking photographs of every viewgraph. And some Japanese visitors told each other in Japanese that they couldn't believe the United States would let people talk about these subjects in a public meeting."

Yaver and Wollensack have a somewhat different view. Only four Soviets were present at the meeting, they say, and three of them spent nearly all their time at Sea World and Neiman-Marcus. "One of the sessions deemed very sensitive was airborne reconnaissance. During the presentations of the hot items, I was drinking coffee with two of the Russians and the other two were walking to the shopping center to spend their money," Wollensack recalls.

It is the Defense Department's contention, however, that whether or not SPIE members worry about technology transfer, the government does and there are regulations to be followed. But therein lies a hitch. If everyone who was supposed to get Pentagon clearances actually sought them, could the Pentagon even handle the work load? "Naughty question . . . naughty question," one official replied when asked. Currently, according to James Freeman of the public affairs office of the Pentagon, it takes 30 to 60 days to get a clearance. No one knows, however, what percentage of the papers that the Pentagon ought to see it is actually seeing.

"If suddenly we were to get 100 percent compliance we would be unable to cope with the work load. We would need some undetermined extra amount of people," says one Pentagon official. "Certainly anything in extremis can be done. It's a hell of a chore but we would do what would be necessary, I'm sure," says Freeman.

Pentagon officials now are trying to figure out exactly what it is they want to do and how they want to do it. They are meeting with SPIE officials, they are looking for ways to increase compliance with DOD clearance guidelines, and they are pondering the problem of how to handle the increased work load that would result from increased compliance. Says an Air Force official, "The DOD got everyone's attention—that's obvious. Now we have to get the DOD together and decide where we go from here."—GINA KOLATA

EXECUTIVE SUMMARY

The economic and military strength of the United States is based to a substantial degree on its superior achievements in science and technology and on its capacity to translate those achievements into products and processes that contribute to economic prosperity and national defense. There are concerns, however, that the Soviet Union has gained militarily from access to the results of U.S. scientific and technological efforts. Accordingly, there have been recent suggestions that tighter controls should be established on the transfer of information through open channels to the Soviets. Such controls would, however, also inhibit the free communication of scientific and technical information essential to our achievements. The Panel on Scientific Communication and National Security was asked to examine the various aspects of the application of controls to scientific communication and to suggest how to balance competing national objectives so as to best serve the general welfare. This task has involved a careful assessment of the sources of leakage, the nature of universities and scientific communication, the current systems of information control, and the several costs and benefits of controls. These assessments underlie the Panel's recommendations.

UNWANTED TRANSFER OF U.S. TECHNOLOGY

There has been a substantial transfer of U.S. technology--much of it directly relevant to military systems--to the Soviet Union from diverse sources. The Soviet science and technology intelligence effort has increased in recent years, including that directed at U.S. universities and scientific research. The Soviet Union is exploiting U.S.-U.S.S.R. exchange programs by giving intelligence assignments to some of its participating nationals. This has led to reports of abuses in which the activities of some Soviet bloc exchange visitors have clearly extended beyond their agreed fields of study and have included activities that are inappropriate for visiting scholars.

There is a strong consensus, however, that universities and open scientific communication have been the source of very little of this technology transfer problem. Although there is a net flow of scientific information from the United States to the Soviet Union,

consistent with the generally more advanced status of U.S. science, there is serious doubt as to whether the Soviets can reap significant direct military benefits from this flow in the near term. Moreover, U.S. openness gives this nation access to Soviet science in many key areas, and scientific contacts yield useful insights into Soviet institutions and society.

UNIVERSITIES AND SCIENTIFIC COMMUNICATION

The principal mission of universities is education; in many American universities research has also become a major activity, but this research is intertwined with teaching and with the training of advanced research scientists and engineers. Participation in research teaches students to solve difficult, novel problems, often under the guidance of first-rate scientists. Federal policies in support of science have reinforced universities' dual functions.

The system as it has recently evolved has been remarkably successful; American research universities attract some of the best minds from around the world and are the principal source of our scientific preeminence. The effectiveness of this research is now seriously threatened, however, by a number of economic and social forces.

Scientific communication is traditionally open and international in character. Scientific advance depends on worldwide access to all the prior findings in a field--and, often, in seemingly unrelated fields--and on systematic critical review of findings by the world scientific community. In addition to open international publication, there are many informal types of essential scientific communication, including circulation of prepublication drafts, discussions at scientific meetings, special seminars, and personal communications.

THE CURRENT CONTROL SYSTEM

The government can restrict scientific communication in various ways. First, information bearing a particularly close relationship to national security may be subject to classification. This is the most stringent of the control systems because it serves to bar all unauthorized access.

Second, communications with foreign nationals may be restricted by export controls, such as those established by the Export Administration Act (EAA) and its associated Export Administration Regulations (EAR) and by the Arms Export Control Act and its associated International Traffic in Arms Regulations (ITAR).[1] Unless an exemption (or

[1]The Panel is aware that the Atomic Energy Act provides a unique statutory basis for controlling information bearing on nuclear weapons. The Invention Secrecy Act also allows patent applications to be kept secret for national security reasons.

"general license") applies, both systems require prior governmental approval for transfer of technical data--either in written or oral communication--to foreign nationals. Neither EAR nor ITAR is aimed at general scientific communication, and the Constitution limits the government's ability to restrain such communication. Nonetheless, some of the current discussion has focused on the application of export controls to scientific communication. This has proved particularly troubling to the research community in that the current control system appears to be vague in its reach, potentially disruptive, and hard to understand.

Third, the government can include controls on communications in the legal instrument defining the obligations of a recipient of government research funds. A proposal currently under consideration by the Department of Defense would require a DOD funding recipient to allow the government the opportunity for prepublication review of manuscripts dealing with certain research areas of national security concern.

Fourth, the government could attempt to influence conduct by seeking a voluntary agreement with researchers to limit the flow of technical information. Such an agreement is in place to enable the National Security Agency to review manuscripts dealing with cryptography and to negotiate alterations before publication.

Finally, communication with foreign nationals might be inhibited indirectly by limiting their access to the United States. The government can deny a visa request or impose restrictions on activities in this country. In addition, the government can directly regulate the admission of Soviet and East European visitors under particular scientific exchange agreements.

COSTS AND BENEFITS OF CONTROLS

Controls on scientific communications can be considered in the light of several national objectives. Controls can be seen to strengthen national security by preventing the use of American results to advance Soviet military strength. But they can also be seen to weaken both military and economic capacities by restricting the mutually beneficial interaction of scientific investigators, inhibiting the flow of research results into military and civilian technology, and lessening the capacity of universities to train advanced researchers. Finally, the imposition of such controls may well erode important educational and cultural values.

With respect to controls and Soviet military gains, the Panel notes that while overall a serious technology transfer problem exists, leakage from the research community has not represented a material danger relative to that from other sources. However, some university scientists will continue to expand their research beyond basic scientific investigations into the application of science to technologies with military relevance. This raises the possibility that the university campus will come to be viewed as a place providing much better opportunities for the illegal acquisition of technology. Information that is of special concern is the "know-how" that is gained by extended participation in U.S. research projects.

With respect to U.S. military and economic progress, controls may slow the rate of scientific advance and thus reduce the rate of technological innovation. Controls also impose economic costs for U.S. high-technology firms, which affect both their prices and their market share in international commerce. Controls may also limit university research and teaching in important areas of technology. The projected shortage of science and engineering talent can become the pacing factor in U.S. technological advance, so maintaining the flow of talented young people to military and commercial technology development efforts is particularly important. A national policy of security by accomplishment has much to recommend it over a policy of security by secrecy.

Apart from these considerations, the U.S. political system and culture are based on the principle of openness. Democracy demands an informed public, and this includes information on science and technology.

In addition, there are some inherent limits on the feasibility and effectiveness of controls. For example, controls cannot be expected to ensure long-term protection of sensitive information, given Soviet determination to procure data and the many parallel leakage channels, some of which are beyond U.S. jurisdiction. Finally, universities and most civilian research organizations lack the logistical capability to monitor the movement of information or personnel.

After weighing these benefits, costs, and feasibility assessments, the Panel arrived at a series of findings and recommendations.

PRINCIPAL FINDINGS AND RECOMMENDATIONS

Control of University Research Activities

The Panel found it possible to define three categories of university research. The first, and by far the largest share, are those activities in which the benefits of total openness overshadow their possible near-term military benefits to the Soviet Union. There are also those areas of research for which classification is clearly indicated. Between the two lies a a small "gray area" of research activities for which limited restrictions short of classification are appropriate.

The Panel's criteria leave narrow gray areas for which, in a few instances, limited restrictions short of classification are appropriate. An example of such a gray area may be a situation, anticipated in large-scale integrated circuit work, in which on-campus research merges directly into process technology with possible military application. In its recommendations the Panel has formulated provisions that might be applicable to such a situation.

All parties have an interest in having research work done by the most qualified individuals and institutions and in educating a new generation of capable scientists and engineers. These objectives must fit, however, within a system that enables the government to classify work under its sponsorship in accordance with the law and that enables

the university to select only work compatible with its principal mission.

Unrestricted Areas of Research

The Panel recommends that no restriction of any kind limiting access or communication should be applied to any area of university research, be it basic or applied, unless it involves a technology meeting all the following criteria:

- The technology is developing rapidly, and the time from basic science to application is short;
- The technology has identifiable direct military applications; or it is dual-use and involves process or production-related techniques;
- Transfer of the technology would give the U.S.S.R. a significant near-term military benefit; and
- The U.S. is the only source of information about the technology, or other friendly nations that could also be the source have control systems as secure as ours.

Classification

The Panel recommends that if government-supported research demonstrably will lead to military products in a short time, classification should be considered. It should be noted that most universities will not undertake classified work, and some will undertake it only in off-campus facilities.

Gray Areas

The Panel recommends that in the limited number of instances in which all of the above four criteria are met but classification is unwarranted, the values of open science can be preserved and the needs of government can met by written agreements no more restrictive than the following:

a. Prohibition of direct participation in government-supported research projects by nationals of designated foreign countries, with no attempt made to limit physical access to university space or facilities or enrollment in any classroom course of study. Where such prohibition has been imposed by visa or contractually agreed upon, it is not inappropriate for government-university contracts to permit the government to ask a university to report those instances coming to the university's attention in which the stipulated foreign nationals seek participation in any such activities, however supported. It is recognized that some universities will regard such reporting

requests as objectionable. Such requests, however, should not require surveillance or monitoring of foreign nationals by the universities.

b. Submission of stipulated manuscripts simultaneously to the publisher and to the federal agency contract officer, with the federal agency then having 60 days to seek modifications in the manuscript. The review period is not intended to give the government the power to order changes: The right and freedom to publish remain with the university, as they do with all unclassified research. This does not, of course, detract from the government's ultimate power to classify in accordance with law any research it has supported.

The Panel recommends that in cases where the government places such restrictions on scientific communication through contracts or other written agreements, it should be obligated to record and tabulate the instances of those restrictions on a regular basis.

The provisions of EAR and ITAR should not be invoked to deal with gray areas in government-funded university research.

The Export of Domestically Available Technical Data Under ITAR and EAR Regulations

ITAR and EAR should be applied only where they can be effective, and then evenly to scientific communication from both universities and industry. Scientists have broad constitutional rights to disseminate information domestically and, as a practical matter, information that is available domestically is also available abroad.

It is the Panel's judgment that the national welfare, including national security, is best served by allowing the free flow of all scientific and technical information that is not directly and significantly connected with technology critical to national security. The Panel thus concludes that the government has the responsibility of defining in concrete terms those technical areas in which controls on information flow are warranted.

1. The Panel recommends that unclassified information that is available domestically should receive a general license (exemption) from the formal licensing process.

2. The Panel recommends that information that is not directly or significantly connected with technology critical to national security should also receive a general license (exemption) from the formal licensing process. The critical technology list approach--if carefully formulated--could serve to define those limited areas in which controls are appropriate.

The Use of Voluntary Controls

A system of voluntary controls has been inaugurated for prepublication review by the National Security Agency of manuscripts dealing with cryptography. The model established by this system may not be applicable to other areas because of the unique situation in the field of cryptography.

> The Panel concludes that the voluntary publication control mechanism developed for cryptography is unlikely to be applicable to other research areas that bear on national security. However, the Panel recommends that consideration be given to adopting this mechanism in future cases, if and where the appropriate preconditions exist.

The Militarily Critical Technologies List

The MCTL is drawn under congressional mandate for reference in export control administration. Part of the list is classified, thus denying its use to some potential "exporters" of data. Moreover, the list covers a wide span from specific items of hardware to generic definitions of technologies. The current list covers about 700 pages. As it stands, and also as the Panel understands the pending revision, this list is not a useful tool in guiding control of scientific or technical communication.

> The Panel recommends a drastic streamlining of the MCTL by reducing its overall size to concentrate on technologies that are truly critical to national security.

Technology Transfer to the Third World

The Panel has concentrated on the U.S.-U.S.S.R. relationship. However, there are clear problems in scientific communication and national security involving Third World countries. These problems in time might overshadow the Soviet dimension. This entire range of issues is both complex and important, and further intensive study is clearly indicated.

The Panel takes note of the current U.S. policy to help the People's Republic of China (PRC) advance its industrial technology. It is generally recognized that the capacity of the PRC to transfer such technologies to the military sector is limited. This technical assistance policy is not reflected, however, in restrictions the government is imposing on cooperative research and activities of PRC students at U.S. universities.

> The Panel notes that its deliberations did not extend to the complex issues raised by military-related technology

transfer from advanced industrial nations to Third World nations in regionally unstable areas or to those that may be potentially hostile to the United States and its allies. The Panel recommends that this subject receive further attention by the National Academy of Sciences or other qualified study groups under federal sponsorship.

DRAFT NSSD

TO: THE DIRECTOR, OFFICE OF SCIENCE AND TECHNOLOGY POLICY

SUBJECT: Scientific Communication and National Security

At the request of the Department of Defense, the National Academy of Sciences Panel on Scientific Communication and National Security studied the relationship between scientific information and national security. Its interim report and recommendations have now been submitted to the Government and to the public.

Based on extensive briefings by the intelligence community, the NAS report clearly acknowledges that certain kinds of information do require protection in the interest of national security. It continues with several recommendations for Government action that warrant serious review to determine which, if any, should be adopted as Government policy and, if adopted, how they should be implemented.

I am therefore asking that you work with representatives of the other addressees of this directive to review the NAS report and provide recommendations to the National Security Council by March 1, 1983. Although you may wish to address other issues as well, the following should be clearly covered:

1. Is the Panel conclusion correct that export controls are not an appropriate means of regulating the exchange of scientific information? If yes, what changes must be made to implement that conclusion? If the conclusion is not correct, what can be done to ameliorate the problems of vagueness and administrative cumbersomeness that the Panel cited as faults in the current system?

2. The Panel also advocates greater reliance on contractually-imposed restrictions within broad guidelines. If such restrictions are needed and are instituted, can they replace other forms of control? What kinds of general guidelines or appeals mechanisms are needed to assure the appropriateness of the restrictions and that the several agencies of the Government impose procedurally and substantively compatible restrictions on the research community?

In those cases where you make recommendations requiring additional work prior to implementation, please also make clear recommendations on which agency or agencies should have the lead and on what time-table.

cc: The Secretary of State
The Secretary of the Treasury
The Secretary of Defense
The Secretary of the Interior
The Secretary of Commerce
The Secretary of Health and Human Services
The Secretary of Energy
The Director, Office of Management and Budget
The Director of Central Intelligence
Director, Arms Control and Disarmament Agency
Administrator, National Aeronautics and Space Administration
Director, National Science Foundation

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National Academy of Sciences *National Academy of Engineering*

Institute of Medicine *National Research Council*

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(continued)

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Geologic Disposal of Nuclear Waste: Technology Ready For Testing

SOME TIME THIS YEAR the secretary of energy will identify three sites where geologic formations may be suitable for containment of nuclear waste. One will become a center for testing and evaluating disposal technologies. Selection of the test site will start the clock on a series of events, mandated in the closing days of the last Congress, that will culminate in the nation's first permanent nuclear-waste repository by the end of the century.

The Nuclear Waste Policy Act (P.L. 97-425) specifies a series of actions to be taken by the President and officials in agencies responsible for nuclear-waste management and stipulates a timetable for resolving what the act defines as "a national problem" created by the accumulation of tons of radioactive waste from nuclear power plants, weapons manufacture, and other activities. The debate on site selection is likely to be long and acrimonious.

Although final decisions will be influenced as much by political and economic considerations as by technology, responsible officials will have a comprehensive scientific resource in a new report by the Research Council's Waste Isolation Systems Panel. Prepared for the Department of Energy, the report examines each component in the proposed system for geologic disposal and analyzes its role in preventing radioactive materials from reaching the environment.

Following an exhaustive review, the panel concluded that "the technology for geologic waste disposal has advanced to the state of a preliminary technical plan, suitable for testing and for further technical studies

A Study of the Isolation System for Geologic Disposal of Radioactive Wastes. Waste Isolation Systems Panel, Board on Radioactive Waste Management (1983, 356 pp.; ISBN 0-309-03384-5; available from National Academy Press, $24.95).

and pilot-facility confirmation." The Nuclear Waste Policy Act calls for the President to recommend the first site to Congress by March 31, 1987. Thomas H. Pigford, nuclear engineering professor at the University of California at Berkeley and panel chairman, told *News Report* he believes Congress' timetable can be met.

Isolation for Thousands of Years

The objective of placing nuclear waste in repositories mined in salt, basalt, granite, or tuff (volcanic ash rock), said the panel, is "to protect humans now and in the future by isolating the waste from the environment effectively enough and for a period of time long enough that the amount of radioactive material ever reaching the biosphere will present no unacceptable hazard."

A waste-isolation system consists of many components—radioactive waste material, its packaging, the surrounding rock and other geologic media, material for sealing the repository, the slowly moving ground water, and the environment where the ground water surfaces. Characteristics of each contribute to the effective containment of radioactive materials for hundreds of thousands of years, or until the amount of radioactivity is no longer significant. Such long-term protection is needed because some radioactive elements decay at extraordinarily slow rates. For example, plutonium-239 has a half-life of 24,000 years and neptunium-237, a half-life of 2.14 million years.

"Designing a system for such long-term isolation presents a fascinating challenge faced only a few times in the past," said Pigford, "as when engineers of ancient Egypt designed the tombs of the pharoahs." Sealed repositories can be breached by humans, by some geologic event like an earthquake, or by ground water, the mechanism considered in detail by the panel.

Performance Criterion

To evaluate the effectiveness of disposal technologies, the panel first adopted a performance criterion. Suitably effective containment, as defined by the panel, would limit radiation to an individual to an annual dose of no more than 10^{-4} sieverts (1 Sv=100 rem), or about 10 percent of the whole-body annual dose from natural radiation sources. The Environmental Protection Agency is responsible for issuing a performance criterion for geologic isolation, but the panel found "technical flaws" in EPA's draft proposal. It also concluded that the Nuclear Regulatory Commission's proposed regulations to implement the EPA performance criterion contained technical deficiencies and were "premature" because EPA had not yet issued a final standard. The Department of Energy, the third federal agency involved, is charged with designing the first repository. In the absence of a final EPA ruling, the panel recommended that the department adopt its own interim performance criterion based on dosage to the individual.

In its proposed criterion the EPA used a period of 10,000 years for limiting the release of radioactivity to the "accessible environment." But the panel protested that "only a small fraction of the radionuclides ultimately reaching the environment is expected to have been released during that time." It noted that at some sites under consideration as repositories the ground water travels so slowly it may take longer than 10,000 years to reach the surface. A disposal system designed for 10,000 years "is not necessarily capable of continuing to protect people and the environment beyond 10,000 years." The panel concluded that a small amount of radioactivity could be released for hundreds of thousands of years.

The Waste Package

The first line of protection against release of radionuclides is the waste form, consisting of the radioactive material combined with an inert solid, like glass. Packaging in noncorrosive metal such as a titanium alloy can serve as a further barrier. The first loadings in the first repository—in the late 1990s—are likely to be the products of spent fuel that will have been in storage for 30 years or more, as well as defense waste that may be even older. Because of the age of the material, heat generated by radioactive decay is expected to cause few problems, the panel said. Later, however, when more recently discharged fuel with as little as 10 years' storage time is loaded, the rocks surrounding the waste will become much hotter, and the heat will place greater stress on the packaging materials. The panel recommended tests to predict more accurately the performance of borosilicate glass and other materials at high temperatures and also called for "a continuing program to develop new and better alternative waste forms."

As transport by ground water is an important threat to isolation of radioactive waste, the rate a waste form dissolves and diffuses in water is important in calculating the effectiveness of the isolation system. Over a span of years even the most impervious materials will dissolve to some extent, the panel pointed out, but the process can be retarded long enough to allow time for substantial radioactive decay of the waste.

During its study the panel used a new theory to predict how rapidly various radioactive materials dissolve in ground water. Using solubility and diffusion rates of the waste materials and the rate of flow of the ground water, the theory aids in predicting how long the waste can be isolated. Based on this theory, the panel predicted that the low dissolving rates of some important radioactive materials—neptunium-237 and uranium-234, for example—will serve as a further barrier even if water permeates the waste package. Conversely, the dissolving rate of radioactive elements that normally dissolve easily, like cesium-135, will be slower because of the glass encasing them.

Surface Environment

Eventually, the contaminated ground water will surface. If it flows into a large, swiftly moving body of water like the Columbia River, the radionuclides it carries will be further diluted and radioactive releases will be far below the panel's performance criterion. However, noted the panel, if the ground water surfaces where there is little water, there will be little dilution and possibly greater levels of radioactivity. The panel observed that in areas with little flowing surface water, "there will be a greater incentive for future generations to use the ground water for drinking and irrigation." It recommended that these conditions be considered in selecting respository sites.

The panel questioned the advisability of trying to retrieve nuclear waste after it had been placed in a repository. Even though "technically feasible," it said, retrieval would be "difficult, costly, and potentially dangerous." It cited the high temperatures in the waste package and the surrounding rock and difficulties in handling. A wiser procedure, said the panel, is to investigate the site thoroughly in advance, including underground exploration, rather than to plan for removal of the waste after it is in place.

—PEPPER LEEPER

"The success of the space shuttle's operational future is dependent on . . . the timely availability and proper functioning of an extensive and complex array of facilities, components, and services requiring long-term planning."

Panel Questions Logistics Of Space Shuttle Schedule

FEWER SPACE SHUTTLE FLIGHTS than the National Aeronautics and Space Administration's (NASA) Mission Model anticipates five to ten years from now will be possible even if all goes well, a National Research Council panel advised the Congress in a report delivered April 19. The panel was chaired by William T. Hamilton, retired vice president and chief scientist of Boeing Military Airplane Co.

Major pieces of the shuttle and its propulsion system won't be available to meet the Mission Model expectation of increase from 24 launches per year in 1988 to 30 in 1990 and then to 40 in 1992, and there are less-easily pinpointed, fundamental problems in the shuttle program, the panel said. The operational Space Transportation System, of which the shuttle is the most visible part, must be in place for the agency to succeed with its flight schedule. But planning for the whole system—including ensuring continuity of the industrial base to sustain it—trails far behind work on the shuttle itself, the panel reported. "Because of very strict budgetary constraints in the program . . . NASA has had to concentrate on the near-term needs, and its capacity to deal with the longer-term requirements was inevitably curtailed."

The panel estimated that 18 launches per year "in the 1990 time frame" could be achieved with a fleet of 4 orbiters, but availability of solid-rocket boosters to meet this demand appears "marginal." A 24-launch-per-year rate would be "marginal" with 4 orbiters, possible with 5, but the availability of enough solid-rocket boosters for a 24-launch year appears "impossible or highly improbable," and availability of main engines appears "marginal." Whether a 6-orbiter fleet could make pos-

Assessment of Constraints on Space Shuttle Launch Rates. Committee on NASA Scientific and Technological Program Reviews (1983, 68 pp.; available from the committee).

Capabilities of Space Shuttle Components To Meet Launch Rates

Annual Launch Rate	Orbiter Fleet Size 4	5	6	Space Shuttle Main Engine	Solid Rocket Booster	External Tank
18	OK	OK	OK	OK	M[1]	OK
24	M	OK	OK	M[1]	X[2]	OK
30	X	M	OK	X	X	OK[3]
36	X	X	M	X	X	OK[3]
40	X	X	X	X	X	OK[3]

* Assumes 5- to 7-day mission duration and no major setbacks.
M = Marginal.
X = Impossible or highly improbable.
[1] With existing production/refurbishment facilities.
[2] Options for solid rocket boosters being studied.
[3] Firm plans exist to meet increased production requirements.

SOURCE: National Research Council, 1983.

sible a 36-launch year is "marginal," and its ability to provide for a 40-launch year is "impossible or highly improbable." Requirements for external fuel tanks for the higher launch rates can be met, the panel said, basing its estimate here on current planning for increased production; the external tank "appears to be the only major component . . . for which firm planning is in place to attain levels of 24, 30, and 40 flights per year," the panel reported.

These estimates assume a 5-day work week with 3 shifts per day and weekends reserved for recovering time lost in setbacks; they assume

mission durations of 5 to 7 days, no major setbacks in the program, and that the program will increase its attention to meeting all the logistical needs of the Space Transportation System. The panel used the term "logistics" to include "the entire spectrum of activity required to support the buildup of the shuttle program to achieve increased launch rates and to maintain those rates."

Money "apparently was not available" early in the program "for up-front procurement of an engineering data-base, reprocurement data, programming factors, sufficient spares, and overall management information," and "no coherent, long-range maintenance or spares provisioning plan has been instituted," the panel noted.

"Only recently, senior NASA management recognized the philosophical change required. They have moved into place or recruited recognized experts in logistics to include those skilled in planning, acquisition, supply, maintenance, and repair. These individuals have done excellent work in preparing an initial foundation for what must follow."

The program "must address the need for retaining elements of the Orbiter production line to permit reasonable replacement of all key component parts as required," the panel said. "This is particularly critical for the production of very long lead time elements of the Orbiter structure and systems."

Serious Obstacles to High Launch Rates

The panel found:

". . . [W]hile NASA has taken positive steps toward developing the kind of organization required to support planned launch rates, logistics difficulties may well pose serious obstacles to achieving those rates. These problems may manifest themselves not as a shortage of major investment items such as the ET [external fuel tank] or SRB [solid rocket booster], but rather as an inability to provide timely repair or replacement of parts needed to sustain launch site refurbishment and demanding Orbiter turnaround times. A coherent maintenance and spares plan has not been instituted. Many critical commodities are already subject to a diminishing manufacturing base, only waiting for crises to identify them. Unknowns in the results to be expected from launch site corrosion, vehicle stresses, and environmental extremes may cause serious delays . . . . The number

of flight articles is marginal for the lower launch rates and provides no backup for the higher launch rates. Cannibalization will not compensate for lack of spares at higher launch rates.

"DoD [Department of Defense] repair support will increase but will be of limited overall assistance. Improvement will require management action to include better definition of individual NASA logistics support responsibilities, more direct access by senior NASA logisticians to top management, and hard budget decisions to promptly provide needed long-term support for the shuttle program."

The panel reported several specific constraints on higher launch rates. The currently planned total of 19 space shuttle main engines "appears barely adequate to support 24 missions per year," and "current availability of spare pumps and engines appears critical," with NASA already cannibalizing parts to meet its near-term schedules. A "coherent overhaul program" for high-pressure fuel and oxidizer pumps has to be developed, and sufficient spares have to be available, the panel said. The solid-rocket booster "has yet to reach the production and refurbishment rate necessary for 18 flights a year," and early experience in the program shows "the refurbishment task . . . significantly greater than originally planned . . . ." A fourth mobile launch platform may be needed to achieve 30 flights a year, and a fifth platform will be needed for 40 flights a year, the panel said. A fifth platform would require additional vehicle-assembly facilities. And there are more launch-facility requirements.

Air Force plans "to utilize . . . the NASA Control Center for secure DoD [shuttle] missions" until an Air Force facility is added to a Consolidated Space Operations Center "puts another constraint on the flight rate," the panel said. "NASA/DoD management attention is required now to prevent NASA Control Center facilities from becoming a limiting factor for the higher launch rates." The panel said a fourth training aircraft "is essential" to support 40 flights a year, and the Shuttle Mission Simulator "must be augmented . . . to achieve 40 flights per year."

The panel warned:

"Of particular concern . . . are the implications of a shutdown of STS [Space Transportation System] production and the attendant loss of skills, tooling, and contract manufacturing capabilities in general. Reinitiation of STS production lines at a later date becomes a formidable task. Not only will costs be higher but production lead times will be considerably longer—e.g., the lead time for an Orbiter wing increases from 6 to 36 months—and there may be a need to requalify a high percentage of the STS systems.

"The success of the space shuttle's operational future is dependent on its cost effectiveness and on the timely availability and proper functioning of an extensive and complex array of facilities, components, and services requiring long-term planning."

—GERALD S. SCHATZ

The report "has been helpful in taking some of the steam out of the approach of those . . . who would clamp down . . . ."

—Adm. Bobby R. Inman

Scientific Communication & National Security: Six Months Later

Members of National Research Council study committees are naturally curious to know the effect of their efforts; others may be interested as well. To that end, *News Report* will, from time to time, report evidence of apparently related events that are subsequent to (but not necessarily consequent to) the appearance of a Research Council report directed at a major national policy issue. The first such account follows, based on the issuance on September 30 of the report, *Scientific Communication and National Security.*

THE REPORT IN QUESTION, prepared by a nineteen-member committee chaired by Dale R. Corson, assessed the benefits and costs of applying government controls to open scientific communication. The panel confirmed earlier assessments by various U.S. intelligence agencies that the United States has indeed lost militarily significant technologies to the Soviets, but found that this so-called "technological hemorrhage" had occurred primarily through espionage, legal equipment purchases, and third-party transfers. Open scientific communication, it said, has contributed only a "very small part" to the loss and is essential to the vigor of academic research. The Corson panel offered three guidelines that would allow all but a small percentage of government-funded, academically

based research to be performed without restrictions.

The panel's recommendations received widespread coverage in national news media. William P. Clark, President Reagan's national security advisor, told the committee that he planned to brief the President on the report. The Department of Defense requested 350 copies for internal distribution. The intelligence community requested 50 copies. The National Science Foundation and the Office of Science and Technology Policy (OSTP) distributed the report to their executives and to the National Science Board. In an interview with *Science & Government Report,* the President's Science Advisor George Keyworth called the report, "a responsible, good piece of work," adding, "I might take exception with a few small corners of it, but basically I liked it."

In early April, *Science News* magazine sought a reaction from Adm. Bobby R. Inman, who had publicly warned the scientific community of possibly dire political consequences of ignoring the "technological hemorrhage." He was quoted as saying that the Corson panel report "has been helpful in taking some of the steam out of the approach of those . . . who would clamp down as a way to solve the problem."

But has there been any observable effect on the openness of scientific communication? Is the situation better or worse?

It is too early to answer the last question, but there are indications that the report's recommendations are under active consideration and that some are being implemented. For example, the intelligence community's Committee on Exchanges has established the recommended academic advisory group on scientific exchanges and sought advice on possible members from the National Academy of Sciences.

The report has also been endorsed by several groups, notably the Working Group on Export Controls of the Joint Forum of the Department of Defense and Association of American Universities (AAU). Other endorsers are the Council of Scientific Society Presidents, the AAU's Science and Research Committee, the American Chemical Society's board of directors, the Committee on Academic Freedom and Tenure of the American Association of University Professors, and a faculty committee on scientific communication at the Massachusetts Institute of Technology.

On April 19, the Working Group on Export Controls of the DoD-University Forum reported its agreement "that a reasonable approach can be developed to deal with restrictions needed to delay the transfer of that

small set of truly critical technologies that is being developed in university settings." The paper went on to suggest a process for dealing with these areas of research that included the possible barring of foreign nationals and submission to a 60-day prepublication review. *Science and Government Report,* a newsletter on science policy, remarked, "In other times, these recommendations for trimming academe's traditions of free association and unfettered publication would have aroused a storm. But . . . the . . . concessions are minor in comparison to the designs of the hardliners."

State, Commerce, Defense, NSC Join Forces

On December 23 President Reagan directed OSTP to conduct a policy review for the control of "critical military scientific communication", using the Corson panel report as its starting point. Before that review could be completed, however, "the President signed another directive that a comprehensive study be conducted under the direction of a senior interagency group for technology transfer," according to OSTP's Louis T. Montulli.

That review, which Montulli detailed in a recent speech before the American Physical Society (see inset for excerpts of that speech), has a steering committee comprised of members from the National Security Council and the departments of State, Commerce, and Defense. It has three working groups. The first is reviewing current government structures for planning and executing technology transfer policy. The second is looking at the principles of technology transfer policy in relationship to foreign, economic, and national security objectives. And the third, which Montulli heads, will ask representatives from the National Security Council, Central Intelligence Agency, National Science Foundation, National Institutes of Health, and the departments of State, Defense, and Energy to take a broad look at technology transfer requirements, controls, and policies that affect scientific and technical communication.

Public Participation To Be Sought

The review, Montulli told the physicists, "will need your help . . . [and] we will invite participation—first through a questionnaire and then through oral dialogue where appropriate." These will be followed by discussions with professional groups and individuals in July and August.

Interagency Review of

—from a speech by Louis T. Montulli, to the American Physical Society,

. . . The study will be guided by a steering group; three working groups will conduct the detailed study activities. . . . The first group will review the current government organizational structures for planning and executing technology transfer policy. . . .

The second working group will review the principles of technology transfer policy within the contexts of foreign, economic, and national security objectives. They will specifically concentrate on broad policy as it is to be applied to specific countries or country groups.

The third working group, which I will chair, consists of representatives from NSC, DoS, DoD, DoE, CIA, NSF, and NIH. We will look at technology transfer requirements, controls, and policies of both scientific and technical communication in the broadest sense. We will address technology transfer through written, oral, electronic, and visual data transfer and through trade fairs, exhibits, air shows, and the patent process.

. . . I hope to have a very open process. It is also important that we be able to quantify the problem, put it in a proper perspective and understand the impact of any solutions that we might suggest. As a result, I have asked the group to concentrate on two tasks at this time.

We will look at research conducted and funded by universities, conducted by universities but funded by government, conducted by industry with both government and non-government funding, conducted by government laboratories or government development divisions. A selective but representative search of these materials should develop a measure of the probability that militarily sensitive information is present in any particular category. We hope to be able to draw a matrix, a picture if you will, of where the majority of our concern should lie. We anticipate that university research, including that in the scientific and engineering fields, will indeed show itself to be overwhelmingly non-militarily critical. If this is the case, then our control procedures and policies will reflect that, i.e., there will be few, if any, controls needed. As we move up the list to government laboratory and product divisions centered around military missions, we expect to find a greater degree of militarily sensitive information and expect to apply different solutions.

Obviously, we also have to know what the current laws allow the U.S. Government to do and how these current laws can be applied in the most effective and least intrusive manner. For that reason, a second group is currently reviewing the law and developing possible methods of implementation.

. . . [W]e will need your help as well as that of others in industry and universities. Our mutual concern is to arrive at a policy that is acceptable to the research community and does the job required. For that reason, in approximately one month, we will invite participation—first through a questionnaire and then through oral dialogue where appropriate. Your specific answers and comments on the questionnaire will be kept in strict confidence. They will be collected with others and summarized so we will have an opportunity to review the overall response. Using these inputs as guides, in July and August we will have discussions with professional groups as well as individual representatives. After we have completed these discussions and our in-house studies, we should be in a position to formulate a detailed description of the problem and a draft set of policy and implementation recommendations.

At this point . . . . [w]e expect to review our results with representatives from universities, industry, and other non-government entities that obviously have a great deal of interest in this problem. . . . This process should conclude near the end of the year with the publication of our results. These will be forwarded to the senior inter-agency group for review and then forwarded to the President with recommendations for possible actions.

"[W]e expect to review our [draft recommendations] with representatives from universities, industry, and other non-government sources. . . ." The working groups' report is expected to be forwarded by the end of the year to its parent steering committee for review and then to the President with recommendations for action.

Meanwhile, operations of a more direct nature were taking place elsewhere in the government. In December, the Pentagon set up a technology-transfer control group under Richard N. Perle, assistant secretary of defense for international security policy. This group focuses on the transfer of high-technology hardware to the Soviet Union through other countries. It also advises, through the Secretary of Defense, the Department of Commerce on whether a particular export constitutes a national security risk. Each of the military services is establishing similar groups to monitor technologies in specific areas.

Technology Transfer Policy

Office of Science and Technology Policy, April 18, 1983.

Aviation Week & Space Technology magazine reported in January that U.S. defense officials "are now trying to bring European defense ministries and military officers into the technology transfer and export control process. . . ." More recently, the Defense Department set up a new committee to develop methods for controlling the dissemination of technical papers, headed by Edith W. Martin, deputy under secretary for research and advanced technology and engineering. Included in the group's charge will be a review of existing procedures for symposiums and foreign participation in U.S. research projects. The committee will also consider the Corson panel's recommendations for dealing with sensitive, "gray-area" information.

In the meantime, according to news media, federal agencies are continuing to use export controls to prevent or limit the distribution of both classified and nonclassified government-sponsored research. In January, it was reported that several nonclassified papers had been threatened with or actually stamped with export restrictions.

At this writing, there is, in the words of *Science News,* an "apparent calming of tensions." On the other hand, there is as yet no need to update the final words of Dale Corson's contribution to the February 1983 issue of *Physics Today:*

"Our general suggestion was to build high walls around narrow areas that are clearly defined, with priorities established in words that everybody can understand. I don't have any great hope, however, that tomorrow's mail will bring such a list to my desk."

—BARBARA JORGENSON

Mothers' Employment Poses No Intrinsic Harm to Children

MORE THAN HALF of the children growing up in the United States today have mothers who work outside the home. Many people firmly believe that maternal employment is likely to cause serious problems in children's social and cognitive development. A National Research Council panel, chaired by Sheila B. Kamerman, of the School of Social Work, Columbia University, has investigated the effects of parental employment. Its first report, *Families That Work: Children in a Changing World* (see *News Report,* October 1982, pp. 3-6) highlighted the manner in which families, employers, and community institutions are adapting to the needs of working parents. In the just-published second report, *Children of Working Parents: Experiences and Outcomes,* the panel focuses on the influence of mothers' work outside the home on the nature of children's daily experiences and their social, emotional, and cognitive development.

Both reports conclude that maternal employment, by itself, is neither good nor bad for all children in all circumstances. Other factors, such as income, family structure, individual characteristics of the child (age, sex, handicaps), mother's education and attitudes toward employment and housework, and the availability of supportive services outside the family appear to be far more important in shaping children's growth and development.

For *Children of Working Parents,* the panel commissioned review papers on children's relationships with peers, television viewing, educational achievement, use of community resources, and education and career choices. Excerpts from some of the papers follow.

Television Exposure

Paul Messaris and Robert C. Hornik, The Annenberg School of Communications, University of Pennsylvania

. . . First, does children's television viewing have any educational implications? Second, does parental work status have any influence on the television-education link? Our examination of the first question indicates that there is evidence of a negative relationship between television viewing and reading skills, and some of this evidence supports the conclusion that television is the causal agent in the relationship. There is no other solid evidence of a relationship . . . between television and any schooling outcomes, but there are several possibilities that have not yet been investigated adequately. With regard to education in a more general sense (i.e., going beyond schooling), television viewing has been found to be related both to

children's perceptions of social reality and to certain qualities of their interpersonal conduct (aggressiveness, prosocial behavior), but interpretations of the direction of causality in these relationships . . . are problematic. Again, it should be emphasized that there are aspects of television's poten-

tial educational effects that are almost entirely untouched by formal research.

With regard to the second question, we have quite good evidence that parental work status is not related to the amount of children's television viewing and some tentative evidence that parental work status may have consequences for children's program choices: Working mothers may be less likely to guide their children's viewing toward explicitly educational programming. Finally, we have a variety of evidence and speculation on whether and how parent-child coviewing may influence the educational quality of children's encounters with television. There are many indications—some strong, some not so strong—that coviewing can influence the cognitive skills and tendencies as well as the stock of information that children may develop in conjunction with television viewing. There is no indication, however, that presence or absence of parental employment outside the home has any influence on the relevant aspects of coviewing. Other aspects of parental employment (such as degree of job satisfaction) may make a difference here—although the lack of pertinent data has prevented us from examining such a possibility in any detail. . . .

Family-School Relationship

Jean Ann Linney and Eric Vernberg, University of Virginia

The most salient family-school linkage . . . is parent participation and parent involvement in their children's

schooling. Parent involvement has included such diverse activities as helping a child with homework, attending parent-teacher conferences, speaking to a child's class on Career Day, volunteering time as an aide in the classroom, or using home-based curriculum material designed to parallel classroom activities. Despite the widespread belief that such involvement is beneficial to children, there is limited research systematically examining the context and form of parent participation and its role in enhancing school achievement and adjustment. Similarly, there is minimal research regarding the impact of parental employment on parents' involvement in the school. . . .

* * * * *

As family employment patterns change and the number of two-earner families and employed single parents increases, intuition suggests that parent involvement in a child's school activities will diminish. The extent to which the level or nature of parent participation in school activities changes with entry into the labor force has not been addressed, and data examining the process are not available. There is anecdotal evidence that schools are responding to the reduced availability of working and single-parent families via policy changes that include evening and weekend parent-teacher conferences and more frequent reporting to parents by mail or telephone. At this point, it seems that even these obvious modifications are occurring on an individual basis rather than as widespread policy. . . .

[Research] findings suggest that other family patterns and values besides employment status are predictive of parental involvement in children's school-related activities. . . . [T]he working mother who is "time poor" seems to work harder at maintaining some level of activity involving children and spouse, eliminating personal leisure time instead. What might be expected among working parents, then, is a decline in parent-school activities that do not include the child or allow for contact with the child. Given time conflicts, working parents may be less visible and active in school activities during the day. Careful analyses of the nature of parent-school involvement and parent-child educational activity may reveal individual family modifications following a change in employment status. For example, the father may become more active in school participation or the family may attempt to work out alternative scheduling of teacher conferences or conduct these over the telephone.

In light of the available data relative to maternal employment status, it seems unlikely that work status in and of itself accounts for a significant portion of the variance in student achievement or level of parent participation in school. Furthermore, the family's mode of adaptation to change in employment status and the child's perception of the change may be more

important variables. It is less likely that the level of parent-school involvement will be altered significantly and more likely that the form or modes of contact may change. . . .

Community Resources

Victor Rubin, University of California, Berkeley

(This paper draws principally on the Children's Time Study survey of sixth-grade public school students and their mothers in Oakland, California, in 1976.)

The most basic conclusion . . . is that maternal employment did not, by itself, create significantly different levels of contact with community institutions for either parents or children. The services and facilities played at least a small part in the out-of-school lives of most of the children, regardless of background. The analysis also suggests, however, some hidden (or at least usually unexamined) costs and inequalities that were faced by families with working mothers. When those families relied more heavily on sixth graders as baby-sitters or maintained a comparable level of parental facilitation and volunteering despite a tighter schedule, pressure was created on their remaining time. A casualty of this pressure may have been the less organized, less goal-oriented but still meaningful time that parents and children can spend together. This may have been a contributing factor to the statement from more than 80 percent of all children that they "would like to spend more time doing things with [their] parents."

* * * * *

Most of the systematic variations in children's access to community services were based on ethnic, sex, or socioeconomic differences. Efforts to reduce those barriers to access have been slowed, and in some cases even reversed, by the fiscal stresses faced by community services. At present the agencies are planning more for simple survival than for improved or expanded services. . . . From the limited amount of comparative evidence available, there appears to be a common "politics of austerity" encompassing the out-of-school services, regardless of the proximate cause of

the austerity. Reports . . . reveal roughly similar budget priorities for similarly situated communities, and an almost universal tendency for recreation and library budgets to be the most severely affected.

* * * * *

Families in which all the adults are employed will be a key force in shaping community institutions serving children in the 1980s. As their numbers grow, social awareness of their time management problems is increasing. They are becoming a potentially powerful political constituency and also a significant market for new services. The ways in which community institutions respond to both potentials will have important consequences for the children of those families as well as for all others.

Children of Working Parents: Experiences and Outcomes. Panel on Work, Family, and Community, Committee on Child Development Research and Public Policy. Cheryl D. Hayes and Sheila B. Kamerman, eds. (1983, 288 pp.; ISBN 0-309-03348-9; available from National Academy Press, $16.50).

Engineers Call for Increased Emphasis On New Manufacturing Technologies

THE INTERNATIONAL position of the U.S. manufacturing industry comes in for both critical and hopeful analysis in the recently published proceedings of the 1982 annual meeting of the National Academy of Engineering. Critical in that U.S. industry is experiencing a lower rate of productivity growth than any of its major trading partners excepting Great Britain, hopeful because it still leads in overall productivity and because civilian R & D expenditures as a percent of Gross National Product have begun to move up more rapidly than those of Japan and the larger European competitors.

In his chairman's introduction, Erich Bloch, vice president, technical personnel development, IBM Corporation, highlighted one of the major concerns of the meeting: that the employment of scientists and engineers in the manufacturing component of industry is barely holding its own just as we are "seeing on the horizon, and . . . already being implemented in isolated applications, the necessary technologies to proceed [to] the total integration of the manufacturing process."

The technology is here, he maintained, to bring continuous-mode flow processing to the manufacture and assembly of discrete parts. The impact of this development on manufacturing, he declared, would be as significant as that of the Industrial Revolution. "In the latter case," he said, "it was the harnessing of power; today it is the harnessing of information."

The current status of the U.S. manufacturing industry and its impact on

U.S. Leadership in Manufacturing. National Academy of Engineering (1983, 137 pp.; available from NAE).

the national welfare was reviewed in depth in a keynote address by James Brian Quinn, William and Josephine Buchanan Professor of Management, Amos Tuck School of Business, Dartmouth College. Professor Quinn was optimistic over the long pull but had glum observations about some near-term situations.

He pointed out the "surprising shift" of the workforce from goods production to service activities, now at 19% and 74% respectively, with the remainder in agriculture. "From a strategic viewpoint," he asked, "how much below its current 19 percent . . . can the United States shrink without sacrificing (1) the vital challenges a strong manufacturing sector poses in maintaining the health of the nation's science, engineering, technical, business services, and education sector; (2) the essential jobs that manufacturing provides for the less skilled; and (3) the strategic independence and stability manufacturing offers for the United States in world affairs? To the extent that these values benefit society rather than producers, it may be necessary to provide compensation to keep manufacturers alive. This is the choice European countries have made for steel and other vital sectors."

Next he reviewed the changes that had occurred in the management pattern of U.S. industry, each having an enormous impact on such competitive factors as quality control, technological innovation, and the like. During the period of diversification and acquisition, he recounted, financial managers came to replace manufacturing and technical managers in top positions. "Few of these top managers had the intuitive feel for their process or product technologies or deep experience in technological innovation that bred comfort with major technical risks. Instead financial allocation and control systems tended to emphasize near-term, surer prospects whose results were more quantifiable and predictable.

". . . These control systems often undercut more basic technology building, quality improvement, and human and organizational development activities that would have given future strength. Most devastating was the effect on the not immediately measurable aspects of product quality. . . . Few U.S. manufacturers chose to understand W. E. Edwards Deming's maxim that, properly managed, high quality can actually cost less. And they gave up their market share and profit margins to those who did."

Next he looked to relative rates of productivity increase. Although the U.S. still leads the world in productivity as measured by Gross National Product per person employed, the decade of the 70's saw Japan, France, and West Germany begin to catch up. As U.S. productivity grew by 28 percent, Japan's grew by 102 percent, France and West Germany by some 60 percent.

That trend, he noted, is likely to continue—at least with respect to Japan and West Germany. Both still spend a higher percentage of their

GNP on civilian R & D, and both have been producing more engineers per capita in recent years.

Nonetheless, Quinn rejected the pessimism prevalent in many quarters. "The best-managed U.S. companies," he said, "are still in the vanguard worldwide. These companies have found ways to maintain their vision, entrepreneurial vigor, and capacities for change. The United States enjoys preeminent positions in many fields, including such key fields for the future as semiconductors, computer hardware and software, biogenetics, communications, aerospace, energy, pharmaceuticals, and medical equipment."

"In addition," he noted, "the United States has some impressive structural strengths for industrial strategies. It has the world's largest truly integrated market, with special transportation access, cultural understanding, and psychological advantages for its own companies."

These circumstances have too often led to complacency and parochialism, he continued, but "a significant change in management outlook seems to be taking place in response to current competitive pressures. "In the past, when the U.S. industrial system has been sufficiently pressed, it has proved itself capable of an awesome response."

Technical sessions that followed dealt with new manufacturing technologies and integration of the manufacturing system. The concluding session asked a number of authorities to look to the future. A sampling of their responses:

Irving Bluestone, University Professor of Labor Studies at Wayne State University: "There are two fundamental issues from a labor point of view that must be considered and on which action must be taken. One is to introduce vast training and development programs for those whose jobs are being deskilled, for those whose operations will require enhanced skills. . . . The second is not to overlook while you are inventing new ways, new means of creating greater efficiency, [that] there is also the problem of redundancy, and those who are adversely affected will be insisting upon a system . . . that will ensure lay-off avoidance."

Peter Scott, executive vice president, United Technologies Corporation: "Lip service related to retraining for a technology that is so foreign to the individual he cannot cope with it—that is the real problem . . . . Obviously, if you look at the long-term unemployment forecast and couple it to the whole issue of retraining, the problem . . . is bigger than . . . we think."

George S. Ansell, dean of engineering, Jonsson Engineering Center, Rensselaer Polytechnic Institute: "I think it is . . . very dangerous [to assume that the service sector will absorb the shift in employment from the manufacturing sector] . . . . [T]he very improvements and changes in automation, which are information-based, have had more effect in the

service sector to date than they have had in . . . manufacturing . . . . We must start recognizing that one of the benefits of automation, both in the manufacturing and service industries, is the reduced demand on the working life of the individual. It is a bonanza rather than a hindrance. We have treated it so far as a disaster."

Jordan J. Baruch, president, Jordan Baruch Associates, Inc.: "[T]he decline in the number of people . . . in the agricultural sector of our economy . . . is an artifact of a bad measurement system [which] does not include all the people in the manufacturing sector who are designing reapers, threshers, plows . . . and other machines, . . . who are making pesticides [and] feeds . . . . We have similarly bad measurements in the manufacturing section . . . . The second fallacy inherent in the question is [that] we have not recognized that manufacturing is part of the service sector."

John K. Castle, chief operating officer, Donaldson, Lufkin, & Jenrette, Inc.: "As the financial expert on the panel, I think that venture capital is one very important form of creating and funding new technology and creating new jobs . . . . [W]e should be very concerned about having a lower capital gains tax rate to make it attractive for people to put money in speculative businesses . . . . There is room for even additional increases in the tax credits that go for incremental R & D efforts. . . ."

Allen Newell, U.A. and Helen Whitaker University Professor of Computer Science, Carnegie-Mellon University: "It is clear . . . from everything that was said today that manufacturing is going to get intimately involved with . . . information processes . . . . There are at the moment few people devoted to understanding those kinds of systems . . . . One thing we must do is to see if we can find a way to create in the scientific world, on the campuses, the notion of manufacturing as a fit topic for scientific study . . . ."

—H.J.L.

Technology and Employment Symposium

FACTORIES without workers—science fiction or a real possibility?

Some two decades ago workers were afraid that automation would make their jobs obsolete. Instead, technology created new industries and with them new jobs. While labor demands in the older industries decreased, the service and high technology industries expanded, and the labor force grew.

Again, workers are anxious. Technological advances in computers, telecommunications, lasers, and other fields are changing the way goods are produced and information is handled in factories and offices. The new processes offer relief from dangerous and mind-numbing work, but they also require new skills and, for older workers, retraining.

The National Academy of Engineering will investigate what the new technologies hold for workers and employers at a symposium on "The Long-Term Impact of Technology on Employment and Unemployment" in Washington, D.C., on June 30. Speakers from management, labor, and academe will identify the major issues implicit in current technological trends and suggest areas in which government policy might aid the transition. The review also will address the ability of the nation's schools to equip workers with the necessary skills and the attitudes of older workers toward retraining.

Wassily Leontief, director of the Institute for Economic Analysis, New York, will be the keynote speaker. Chairing the steering committee is N. Bruce Hannay, foreign secretary of the National Academy of Engineering.

The session, scheduled for 1:30 p.m. in the National Academy of Sciences auditorium, 2100 C St., N.W., is open to the public. No advanced registration is necessary, but individuals planning to attend are requested to contact the National Academy of Engineering 2101 Constitution Ave., N.W., Washington, D.C. 20418.

Fellowships Help Minority Scholars Into Academic Mainstream

JOHN G. RATCLIFFE credited the environment at the Institute for Advanced Study at Princeton, New Jersey, with his achieving "two-to-three years' research in one year" in his fellowship studies on the geometry of three-dimensional spaces. Now back at the University of Wisconsin, he has written four papers and is working on three more.

Carol C. Hunter was too busy teaching freshman composition at a junior college to pursue her interest in American Indian literature. She spent her fellowship year in research at the Newberry Library and University of Illinois in Chicago and now is teaching and writing at the University of Oklahoma. "I finally have a voice," she exclaimed.

Joseph F. Aponte's fellowship year at the University of North Carolina, Chapel Hill, allowed him to forget administrative duties and redirect his career into research on mental health issues associated with minorities. Following his return to the University of Louisville, he has worked with graduate psychology students on projects related to this research. He reported "a renewed sense of vigor" in his teaching.

These scholars have several things in common. All held postdoctoral fellowships supported by the Ford Foundation and administered by the National Research Council. All are members of ethnic minorities. And all testify that the fellowship experience changed the direction of their careers.

Most academic careers need recharging from time to time. Minority scholars are particularly vulnerable to becoming sidetracked outside the mainstream of their disciplines because of added duties associated with their race and culture. For example, counseling of minority students, either on assignment or voluntarily, often claims time that might otherwise be spent in research and writing.

For whatever reason, minority representation in science and engineering remains disproportionately small. To help overcome such limitations in minority scholarship—in the words of Ford Foundation President Franklin Thomas, "to broaden opportunities for those historically excluded in U.S. society"—the Foundation established a $1.2 million-a-year postdoctoral fellowship program. Every year 35 black, Mexican-American / Chicano, Puerto Rican, and native American scholars receive grants to pursue independent research in association with a mentor or distinguished colleague and unfettered by administrative or teaching responsibilities. The National Research Council elects the fellows and administers the program; recipients for the 1983-84 academic year will be announced in June.

Three groups of scholars—105 in all—already have received fellowships. To evaluate the program, the Ford Foundation has asked the National Research Council to find out how the scholars fared. Did most return to their former employers? Have their careers changed? Was the Foundation's modest post-tenure research grant helpful during the transition period?

Such questions will be asked of three successive groups of awardees as part of a three-year longitudinal study. This summer questionnaires will be sent to fellows who did their postdoctoral during the 1980-81 academic year.

Many recipients have expressed a desire to meet one another to share experiences and discuss common interests. A conference, convened in November 1982 by the National Research Council and sponsored by the Ford Foundation, provided the forum. It also served as a guide for designing the study. Another conference will be convened this Novmeber.

During the 1982 conference distinguished senior minority scholars addressed another serious concern of the young scholars—how to maintain momentum when the fellowship year is over and they have to find research support in a highly competitive environment. The seniors' prescription: Explore opportunities in fields often avoided by minorities.

Robert Stepto, a Yale University English professor, observed that English departments are looking for minority Americans to fill positions in traditional fields, even though openings in black or Afro-American literature are decreasing. "I see this as a healthy development," he said. "The healthiest and most stimulating campus environments for minority faculty and students [are those] where minorities are situated in many different positions . . . . I'd rather see a minority be head of the library than chairman of urban studies," he added.

Cora Marrett, a University of Wisconsin-Madison sociology professor, told fellows to use their recent experiences to broaden their ideas about their discipline and their own skills, to "move outside traditional opportunities" and "be creative."

Eugene Cota-Robles, provost of Crown College, biology professor at the University of California, Santa Cruz, and a member of the National Science Board, reminded fellows that "once you have the union card of tenure, then you need to think of service." Only when minorities are represented on faculties in all departments will institutional policies change in ways that will encourage greater minority participation, he said.

A Cherokee Indian urged other native Americans not to allow themselves to be confined to "reservations of the mind." Rayna Green, a 1982 fellow in anthropology at the Smithsonian Institution, Washington, and a member of the Dartmouth College faculty, noted that "even in a minority gathering, there is a majority." She asked other ethnic groups "to remember the rest of us . . . so we can really be in this together."

—P.L.

Small Coal Mines, Greater Risk

MINERS WORKING in small, underground coal mines face a risk of death in a mining accident two- to three-times greater than their colleagues in larger mines. This finding from its 1982 report, *Toward Safer Underground Coal Mines,* led the National Research Council Committee on Underground Coal Mine Safety to examine the distinguishing features of small mines and consult with their owners in an attempt to find the causes of these dramatic differences in fatality rates. The committee has now concluded that the quality of equipment, worker health, and the company's financial status combine to create a more dangerous work environment in the smaller mines.

The fatality rate in small mines (those with 50 or fewer employees) averaged about 0.15 from 1975

Fatalities in Small Underground Coal Mines. Committee on Underground Coal Mine Safety (1983, 30 pp.; available free from Publications Distribution Section, U.S. Bureau of Mines, 4800 Forbes Ave., Pittsburgh, PA 15213).

through 1980, compared with a rate of 0.05 for mines hiring more than 250 employees and 0.10 for mines hiring between 51 and 250 workers. (The rate is based on the number of fatalities during 200,000 hours worked.) Of the 111,000 fulltime (equivalent) coal miners working underground in 1980, about 15 per cent worked for mines with 50 or fewer workers.

Data did not substantiate the committee's initial assumption that accidents peculiar to small-mine operations accounted for the higher death rate. Neither did data show a correlation between age and fatality rate, although the committee found that a disproportionate number of young miners suffer disabling injuries.

Small mines, the committee found, often used second-hand equipment that may not be well maintained, frequently employ miners with health problems that would disqualify them from working in larger mines with more stringent personnel standards, and may not have the money to invest in safety equipment and worker safety awareness programs. Furthermore, the committee noted that the intermittent nature of small operations, in contrast to the continuous working of larger mines, may be more dangerous because day-to-day changes within the mine may not be detected.

Eighty-five per cent of small mines are located in Kentucky, Virginia, and West Virginia. The committee recommended that these state governments provide technical assistance to help mine owners improve their operations and to instruct individual miners in safer work procedures. It also suggested that the federal Mine Safety and Health Administration aid the states with financial grants-in-aid and technical assistance to help reduce small mine casualties.

—P.L.

New Academy Members and Foreign Associates

SIXTY new members and 12 foreign associates were elected to the National Academy of Sciences April 26 during the Academy's 120th annual meeting in Washington, D.C. Those newly elected were chosen by the current members in recognition for their contributions to original research. This election brings the Academy membership to 1,415 and the number of foreign associates to 216.

Newly elected members, with affiliations at the time of their nominations, are:

DENNIS B. AMOS, chief, division of immunology, Duke University Medical Center.

EDWARD M. ARNETT, R.J. Reynolds Professor of Chemistry, Duke University.

CHARLES J. ARNTZEN, director, MSU-DOE plant research laboratory, Michigan State University.

RICHARD AXEL, professor of biochemistry and pathology, Institute of Cancer Research, Columbia University.

RICHARD E. BELLMAN, professor of mathematics, electrical engineering, and medicine, University of Southern California.

GUNTER BLOBEL, professor of cell biology, Rockefeller University.

FELIX H. BOEHM, professor of physics, California Institute of Technology.

MARTIN J. BUKOVAC, professor of horticulture, Michigan State University.

GUILIO L. CANTONI, chief, laboratory of general and comparative biochemistry, National Institute of Mental Health, Bethesda.

MINOR J. COON, chairman, department of biological chemistry, University of Michigan School of Medicine.

ALLAN MC. CORMACK, University Professor, Tufts University.

GEORGE B. CRAIG, JR., Clark Distinguished Professor of Biology, University of Notre Dame.

RONALD W. DAVIS, professor of biochemistry, Stanford University.

MICHAEL J. S. DEWAR, Robert A. Welch Professor of Chemistry, University of Texas at Austin.

THOMAS M. DONAHUE, chairman, department of atmospheric and oceanic science, University of Michigan.

RAYMOND L. ERIKSON, professor of pathology, University of Colorado Health Science Center.

LEOPOLDO M. FALICOV, professor of physics, University of California, Berkeley.

RICHARD F. FENNO, JR., Don Alonzo Watson Professor of Political Science, University of Rochester.

JAMES L. FLANAGAN, head, acoustics research department, Bell Laboratories, Murray Hill, N.J.

DAVID GALE, professor of mathematics, operations research, and economics, University of California, Berkeley.

JOHN GARCIA, professor of psychology and psychiatry, University of California, Los Angeles.

WILFORD R. GARDNER, head, department of soils, water, and engineering, University of Arizona.

EUGENE A. HAMMEL, professor of anthropology, University of California, Berkeley.

STANLEY R. HART, professor of geochemistry, Massachusetts Institute of Technology.

RICHARD J. HAVEL, director, Cardiovascular Research Institute, University of California, San Francisco.

CARSON D. JEFFRIES, professor of physics, University of California, Berkeley.

HARRY KESTEN, professor, department of mathematics, Cornell University.

PAUL E. LACY, Mallinckrodt Professor, Washington University School of Medicine.

DAVIS S. LANDES, professor of economics, Harvard University.

MELVIN LAX, Distinguished Professor of Physics, City College of New York.

RACHMIEL LEVINE, medical director and director of research, emeritus, City of Hope Medical Center, Duarte, Calif.

FRANK LILLY, chairman, department of genetics, Albert Einstein College of Medicine.

WILLIAM C. LINEBERGER, professor of chemistry, University of Colorado.

SAMUEL MCD. MCCANN, chairman, department of physiology, Southwestern Medical School, University of Texas.

LYNN MARGULIS, professor of biology, Boston University.

JEROME NAMIAS, resident meteorologist, Scripps Institution of Oceanography, La Jolla, Calif.

NORMAN F. NESS, chief, laboratory for extraterrestrial physics, Goddard Space Flight Center, National Aeronautics and Space Administration, Greenbelt, Md.

LINDSAY S. OLIVE, University Distinguished Professor of Botany, University of North Carolina, Chapel Hill.

LEO A. PAQUETTE, Kimberly Professor of Chemistry, Ohio State University.

MARY LOU PARDUE, professor of biology, Massachusetts Institute of Technology.

DOMINICK P. PURPURA, dean, Stanford University School of Medicine.

MURRAY RABINOWITZ, Louis Block Professor of Medicine and Biochemistry, University of Chicago School of Medicine.

CHARLES C. RICHARDSON, E. S. Wood Professor of Biological Chemistry, Harvard Medical School.

MORTON S. ROBERTS, director, National Radio Astronomy Observatory, Charlottesville, Va.

ISADORE RUDNICK, professor of physics, University of California, Los Angeles.

HOWARD L. SANDERS, senior scientist, Woods Hole Oceanographic Institute, Woods Hole, Mass.

ANTHONY SAN PIETRO, Distinguished Professor of Plant Biochemistry, Indiana University, Bloomington.

THOMAS J. SARGENT, professor of economics, University of Minnesota at Twin Cities, Minneapolis.

STANLEY SCHACHTER, Robert Johnston Nivens Professor of Social Psychology, Columbia University.

PHILLIP A. SHARP, associate professor, Center for Cancer Research, Massachusetts Institute of Technology.

JOAN A. STEITZ, professor of molecular biophysics and biochemistry, Yale University.

DENNIS P. SULLIVAN, Albert Einstein Professor, City University of New York.

GARETH THOMAS, professor of materials science and mining engineering, University of California, Berkeley.

WILLIAM P. THURSTON, professor, department of mathematics, Princeton University.

ALAR TOOMRE, professor of applied mathematics, Massachusetts Institute of Technology.

GEORGE H. TRILLING, professor of physics, University of California, Berkeley.

SIDNEY VERBA, professor of government, Harvard University.

SHERMAN M. WEISSMAN, professor of medicine and molecular biophysics and biochemistry, Yale University School of Medicine.

DAVID T. WILKINSON, professor of physics, Princeton University.

JEAN D. WILSON, professor of internal medicine, Southwestern Medical School, University of Texas.

Foreign Associates

The newly elected foreign associates are:

VLADIMIR I. ARNOLD, professor of mathematics, Moscow State University, Moscow, USSR.

WILLIAM IAN AXFORD, vice chancellor, Victoria University, Wellington, New Zealand.

MAX L. BIRNSTIEL, professor and head, Institut fur Molekularbiologie II der Universitat Zurich, Zurich, Switzerland.

JEAN PIERRE CHANGEUX, chief, laboratory molecular neurobiology, Pasteur Institute, Paris, France.

MICHAEL E. FISHER (United Kingdom), Horace White Professor of Chemistry, Physics, and Mathematics, Cornell University.

JOHN HESLOP-HARRISON, Royal Society Research Professor, University College of North Wales, United Kingdom.

KIMISHIGE ISHIZAKA (Japan), O'Neill Professor of Medicine and Microbiology, The Johns Hopkins University School of Medicine.

IKUO KUSHIRO, professor of petrology, University of Tokyo, Tokyo, Japan.

GUIDO PONTECORVO (Italy), consultant geneticist, Imperial Cancer Research Fund Laboratories, London, United Kingdom.

KAI M. SIEGBAHN, professor, University of Uppsala, Uppsala, Sweden.

JOHN ROBERT VANE, group research and development director, Wellcome Research Laboratories, Kent, United Kingdom.

DOUGLAS FREW WATERHOUSE, chief of the division (retired), division of entomology, CSIRO, Deakin, Australia.

Letters . . .

To the Editor:

Reference the brief summary in Volume XXXII #2, February 1983, on the U.S. machine tool industry. I wonder if the reluctance in the past for the U.S. industry to seek export markets is in any way related to the fact that most of the world uses the metric system whereas we still adhere to the English system. Now that NC machines are standard rather than the exception, this barrier should no longer exist since the drives are controlled by software rather than fixed gears. Did McClure's committee consider this point?

HAROLD M. AGNEW, president
GA Technologies, Inc.
San Diego

Dr. McClure responds:

. . . I would propose that the converse is probably true. I think the disinterest of the machine tool industry in competing in foreign markets leads to disinterest in changing over to the metric system. As you know, machine tools with electronic readouts are indifferent to units used.

Thank you for your interest and comments.

RAY MCCLURE, leader
Precision Engineering Program
Lawrence Livermore National Laboratory

Items . . .

New Projects

The following projects have been undertaken by the National Academy of Engineering, Institute of Medicine, and units of the National Research Council.

NIH Structure To Be Examined

A proposal to establish an institute of arthritis within the National Institutes of Health (NIH) nearly passed in the last Congress and has been reintroduced in the current Congress, despite the fact that arthritis already occupies a conspicuous niche in the National Institute of Arthritis, Diabetes, and Digestive and

Kidney Diseases. Arthritis sufferers and their families, like victims of other serious illnesses, are lobbying for a separate institute dedicated to their disease because they believe that is the path to increased funding and new hope for a cure. The quest by special interest groups for new institutes has become so pervasive that congressional insiders have dubbed the pattern the "disease of the month."

NIH's $4 billion budget and its consistently generous support by Congress also has inspired campaigns to place other health-related agencies under NIH protection. A bill now before the Senate would bring the National Institute of Mental Health into the fold.

Since 1975, when it established the National Institute on Aging, Congress has resisted attempts to add more institutes to the 11 that now comprise the NIH. However, the Fiscal Year 1983 NIH authorization bills of both houses of Congress proposed studies of the structure of the mammoth research complex for the purpose of recommending criteria for establishing new institutes or realigning existing units. The Institute of Medicine has now been asked by the Department of Health and Human Services to conduct such a study. James D. Ebert, president of the Carnegie Institution and a member of both the IOM and the National Academy of Sciences, will chair the study committee. Committee selection is underway.

The study will explore the evolution of the NIH—how and why it was established and how particular diseases fared after they became the focus of a separate institute. It will investigate whether other important research was neglected because it did not fit into the structure.

Issues that cut across organizational lines also will be examined. The committee will seek answers to such questions as: How is priority assigned? Do research opportunities or the burden of illness carry the greatest weight? How does NIH respond to a new disease like acquired immunodeficiency? Who is responsible for preventive medicine? For nutrition? How does research training fit into the research picture? Does the current structure meet the nation's needs?

Representatives of the NIH advisory bodies, Congress, health, education, and scientific organizations, and other interested groups will be asked to address these questions during public meetings. Commissioned papers and interviews with knowledgeable individuals will explore other aspects of the agency.

The study is expected to be completed in the fall of 1984.

Wind Shear Hazards

What most aviation meteorologists and pilots term wind shear is an abruptly encountered change in wind velocity, and failure to anticipate it can be deadly. An airplane stalls—loses lift—if the onrush of air is less than the plane's flight characteristics require; the airspeed below which a plane stalls varies with the combination of bank angle, pitch angle, aircraft configuration (i.e., whether flaps are extended and landing gear are down), loading, and aircraft design. The plane that stalls on take-off or on approach to landing has scant or no altitude within which to maneuver to regain flying speed. The headwind that suddenly becomes a crosswind or tailwind can make the critical difference, especially at low airspeeds during takeoff and landing. Pilots are taught the conditions in which low-altitude wind shear is likely—high surface winds and thunderstorm gust fronts, for example. Many major U.S. airports have low-altitude wind-shear warning systems. Wind shear still can be a factor in airplane crashes—among them, as the National Transportation Safety Board concluded last month, the 1982 New Orleans jetliner crash that took 153 lives. Adequacy of detection systems, warning procedures, and flight rules to deal with low-altitude wind shear, and meteorology itself, have been brought into question.

At Congressional request, National Research Council panels will review current meteorological understanding of low-altitude wind shear and will assess the state of wind-shear detection and aircraft performance and operations in low-altitude wind shear. The study is being organized jointly by the Aeronautics and Space Engineering Board and the Board on Atmospheric Sciences and Climate. Chairing the joint Committee on Low-Level Wind Shear and Hazards to Aviation is John W. Townsend, Jr., of Fairchild Space and Electronics Co. Louis J. Battan, of the University of Arizona, chairs the Panel on Low-Level Wind Variability. Kenneth F. Holtby, of Boeing Co., chairs the Panel on Aircraft Performance and Operations. The work is sponsored by the Federal Aviation Administration.

The study is expected to be completed this September.

Committee on Military Nutrition Research. Chairman: Robert O. Nesheim, vice president, science and technology, Quaker Oats Co. Sponsor: Department of the Army.

Committee to Plan a Joint Public-Private Institution for Medical Technology Assessment. Institute of Medicine. Chairman: Jeremiah A. Barondess, professor of clinical medicine, Cornell Medical College. Sponsors: several government agencies and private companies and associations.

Indicators of the Status of Precollege Science and Mathematics Education. Chairman: Lyle V. Jones, director, L. L. Thurstone Psychometric Laboratory, University of North Carolina. Sponsor: National Academy of Sciences.

Panel on Statistical Assessments as Evidence in the Courts. Committee on National Statistics and Committee on Research on Law Enforcement and the Administration of Justice. Cochairmen: Stephen E. Fienberg, Carnegie-Mellon University, and Samuel Krislov, University of Minnesota. Sponsor: National Science Foundation.

Statistical Requirements for Natural Gas Data in a Deregulated Environment. Chairman: Gordon Kaufman, Sloane School of Management, Massachusetts Institute of Technology. Sponsor: Department of Energy.

Study on Fields of Excellence in Soviet Science. Executive Board, Office of International Affairs. Sponsor: National Science Foundation.

Study to Review Effects and Alternatives of the Niagara River Ice Boom. Water Science and Technology Board. Chairman: Harry L. Hamilton, Jr., chairman, department of atmospheric science, State University of New York. Sponsor: International Joint Commission—United States and Canada.

New Publications

For documents shown as available from the National Academy Press (NAP) or from a specific unit of the National Academy of Sciences, National Academy of Engineering, Institute of Medicine, or National Research Council, write to the listed source at 2101 Constitution Avenue N.W., Washington, D.C. 20418. Other documents are available from other sources as noted. For current NTIS prices and NTIS documents, write to the National Technical Information Service, Springfield, Va. 22161. Prices and availability of all documents are subject to change.

Statistics in Fertility Research: Values and Limitations

"Computers are essential to modern fertility researchers who deal with large data sets and complicated models. The computer's impact, already great, can only increase. Computers provide numerous opportunities: simulations may be run, parallel analyses may be carried out easily and completely, complicated quantities may be evaluated, and sensitivity studies may be done. Large-scale (interactive) computer packages of statistical routines are now available, including . . . programs specifically intended for demographic estimation . . . . The user should not forget, however, to inquire into the numerical accuracy of such programs as implemented on the computer being employed. Because of the fact that computers work with a finite number of digits, round-off error can occasionally make the computed results wildly incorrect. It may also be noted that with the opportunities arising from the existence of modern computing facilities, there also arise new concerns: it has never been simpler or less costly to carry out inappropriate anlyses."

David R. Brillinger, Report No. 19, Panel on Fertility Determinants, Committee on Population and Demography (1983, 40 pp., available from NAP, $7.50).

Assessment of Constraints on Space Shuttle Launch Rates.

See pp. 7 ff. in this issue of *News Report*.

Children of Working Parents: Experiences and Outcomes

See pp. 16 ff. in this issue of *News Report*.

Community Oriented Primary Care: New Directions for Health Services Delivery

Proceedings of a Conference, March, 1982, convened by the Institute of Medicine (1983; 299 pp.; ISBN 0-309-03339-X available from NAP, $18.50).

Current Status of Facilities Dedicated to the Production of Synchrotron Radiation

Solid State Sciences Committee (1983, 49 pp.; available from the committee).

Dynamic Compaction of Metal and Ceramic Powders

Committee on Dynamic Compaction of Metal and Ceramic Powders, National Materials Advisory Board (1983, 103 pp.; available from NAP, $12.00).

Estimating the Short-Term Producibility of Oil and Gas

Committee on Producibility of Oil and Gas, Board on Mineral and Energy Resources (1983, 134 pp.; available from the committee).

An Evaluative Report on the Institute for Computer Sciences and Technology, National Bureau of Standards, Fiscal Year 1982

Evaluation Panels for the National Bureau of Standards (1983, 13 pp.; available from the panels).

An Exploratory Study of the 'Synthesis Framework' of Fertility Determination with World Fertility Survey Data

Report No. 18, Committee on Population and Demography (1982, 39 pp.; available from World Fertility Survey, 35-37 Grosvenor Gardens, London SW1W OBS, UK).

Fatalities in Small Underground Coal Mines

See pp. 27 ff. in this issue of *News Report*.

Fertility Decline in Indonesia: Analysis and Interpretation

Report No. 20, Committee on Population and Demography (1983, 15 pp.; available from NAP, $13.50).

The Influence of Computational Fluid Dynamics on Experimental Aerospace Facilities: A Fifteen Year Projection

Committee on Computational Aerodynamics Simulation Technology Developments, Aeronautics and Space Engineering Board (1983, 109 pp.; available from the committee).

Levels and Recent Trends in Fertility and Mortality in Brazil

Report No. 21, Committee on Population and Demography (1983, 179 pp.; available from NAP, $16.50).

Metallized Coatings for Corrosion Control of Naval Ship Structures and Components

Committee on Thermal Spray Coatings for Corrosion Control, National Materials Advisory Board (1983, 113 pp.; available from the board; supply limited).

A Study of the Isolation System for Geologic Disposal of Radioactive Wastes

See pp. 3 ff. in this issue of *News Report*.

Research and Information Needs for Management of Oil Shale Development

Committee on Onshore Energy Minerals Management Research, Board on Mineral and Energy Resources (1983, 61 pp.; available from the board).

Seismograph Networks: Problems and Outlook for the 1980s

Report of a workshop; Committee on Seismology, Geological Sciences Board (1983, 80 pp.; available from the board).

Research Concerning Metrology and Fundamental Constants

Committee on Fundamental Constants, Numerical Data Advisory Board (1983, 49 pp.; available from the board).

Science for Non-Specialists: Proceedings of Three Hearings

("Undergraduate Science Education," Nov. 14-15, 1980; "Improving College Science Education," Dec. 16, 1980; and "Understanding the Science Knowledge Needs of the Non-Science Professions," Mar. 20, 1981)

Committee for a Study of the Federal Role in College Science Education on Non-Specialists, Office of Scientific and Engineering Personnel (1983, 232 pp.; available from the office; supply limited).

Urban Transportation Planning in the 1980s (Special Report 196)

Steering Committee to Develop the Conference on Urban Transportation Planning Methods, Transportation Research Board (1983, 52 pp.; available from the board, $7.50).

U.S. Leadership in Manufacturing

See pp. 21 ff. in this issue of *News Report*.

Late Notices

This schedule lists public meetings and includes other special announcements of units of the National Academy of Sciences, National Academy of Engineering, Institute of Medicine, and National Research Council. Details are subject to change and should be checked directly with project offices as noted below. Any written submission should be sent directly to the listed unit at 2101 Constitution Avenue N.W., Washington, D.C. 20418.

Associateship program. Office of Scientific and Engineering Personnel, National Research Council (NRC), is accepting applications for the October 1983 review of NRC research associateships in the National Aeronautics and Space Administration, Air Force Systems Command, Army Research and Development Command, Environmental Protection Agency, Army Missile Command, and Naval Air Development Command programs. Opportunities for basic research in the natural sciences and engineering are available to recent recipients of doctorates, to senior investigators, and in most instances to non-U.S. citizens. Write to: Associateship Programs, JH 608-D, NRC, 2101 Constitution Avenue N.W., Washington, D.C. 20418, for applications and program details; specify field of interest. Applications must be postmarked by August 15, 1983. For further information: A. Crump, 202/334-2760.

News Report
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