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MEMORANDUM

TO: Committee on Science, Engineering and Public Policy (COSEPUP)

FROM: Mitchel B. Wallerstein, Office of International Affairs
Lawrence E. McCray, Commission on Physical Sciences

SUBJECT: Update of the Corson Report

As requested at the November COSEPUP meeting, we have prepared an updated account of issues related to the findings and recommendations of Scientific Communication and National Security (the "Corson Report"), which was completed under COSEPUP auspices in September 1982.

This account is based on the collection of available documents and interviews with persons who have been following events in this field closely. We have not consulted with members of the original Corson Panel or with officials of the Academy complex; the views expressed are ours alone!

Attachment

Scientific Communication and National Security: The Issues in 1984*

Mitchel B. Wallerstein

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January 31, 1984

Contents

Preface

Summary

I. The Situation in 1982: Origins of the Corson Study

II. Key Findings and Recommendations of the Corson Report

III Reactions to the Corson Report

IV. The Situation in 1984

V. An Update of the Key Issues

VI. Conclusions

*A staff report to the members of the Committee on Science, Engineering, and Public Policy, and their Panel on Scientific Communication and National Security, and to officers of the National Research Council.

Scientific Communication and National Security: The Issues in 1984

SUMMARY: In September 1982 the National Academies' Committee on Science, Engineering, and Public Policy released Scientific Communication and National Security (The "Corson Report"). This study assessed the costs and the benefits of government attempts to restrict scientific activities associated with the unwanted transfer of technology that provides military advantages to Eastern bloc nations. It also provided 15 specific recommendations. This memorandum, compiled by Corson Panel staff members, reviews developments since the report was completed, including the disposition of its recommendations.

I. THE SITUATION IN 1982: ORIGINS OF THE CORSON STUDY

In recent years, America's national security has come to depend increasingly on US lead time over its adversaries in areas of high technology -- that is, areas in which technological progress is closely related to new U.S. scientific advances. Furthermore, an increasing number of these technologies -- high-speed electronics and computer-based encryption techniques are examples -- have commercial as well as military applications, meaning that research funded by non-military sponsors frequently has military implications. These trends led some in the past and current Administrations to fear that the characteristically open U.S. research community could become a route of leakage of militarily significant technology to the Soviet Union.

Such concerns were reflected both in policy proposals and public pronouncements aimed in part at the scientific community. Policy proposals included expanded classification criteria, broadened application of export control regulations to cover research results, and government pre-publication clearance of research papers. Public statements in early 1982 included warnings by senior officials in DoD, the Department of Commerce, and the CIA that Soviet military intelligence efforts might find too easy access to sensitive information through what one of them called the "soft underbelly" represented by the American academic community.

Many in the U.S. research community reacted to these government initiatives with alarm. Some doubted that technology loss is, in fact, a serious problem; others stressed that freedom of communication among scientists was both a Constitutional privilege and a key to U.S. scientific (and, therefore, technological) pre-eminence. Mutual feelings of uneasiness grew between strong proponents of military security and strong proponents of scientific freedom.

Discussions between representatives of NAS and DoD led to the establishment, in spring 1982, of an ad hoc panel chaired by Cornell University President-emeritus Dale R. Corson. The panel included eminent scientists, former senior defense and national security officials, and research administrators in industry and universities. Its charter was to examine both the evidence on technology leakage and methods for controlling it, and to seek policy measures by which the competing national goals of national defense and intellectual freedom could be satisfactorily accommodated. Support for the six-month project was provided by DoD, NSF, an internal NAS fund, AAAS, and two professional societies.

II. KEY FINDINGS AND RECOMMENDATIONS OF THE CORSON PANEL

After reviewing evidence on the benefits and costs of control measures the Panel drew the general conclusion that a national strategy of "security by secrecy" has the major flaw that, because there is no practical way to restrict international scientific communication without also disrupting domestic scientific communication, such a strategy weakens American military (as well as civilian) technological capabilities. A national strategy of "security by accomplishment" -- one that emphasizes protecting the U.S. technology lead by promoting scientific productivity -- seemed to be a better alternative to the Panel.

More specific conclusions and recommendations were as follows:

A. Evidence on the Extent of Unwanted Technology Transfer via Scientific Communication

The Panel heard extensive briefings by the intelligence community, some at high levels of classification. While noting that the available evidence left much to be desired, the Panel reported that it had found no case of significant damage to security associated with research dissemination and concluded that:

> "in comparison with other channels of technology transfer, open scientific communication . . . does not present a material danger from near-term military implications"

However, the Panel added two caveats. First, it observed that the evidence on leakage and the associated damage to U.S. security was still only fragmentary and anecdotal, in part because the problem had only recently been identified. Second, it noted that Soviet intelligence efforts were extensive, and that universities and other research sites were indeed targeted. It also noted (but took no position on) intelligence community arguments that research facilities are likely to be more heavily targetted in the future.

The Panel noted that the class of research information of greatest potential concern is not the explicit findings in research reports, but rather "know-how" -- the detailed understanding of equipment use or operational procedures normally gained only by direct participation in a research project. It follows that protection of sensitive research information is achieved better by preventing sustained access to research projects than by preventing dissemination of written research reports.

B. The Workability of the Current System of Controls

The Corson Panel examined each of 5 types of controls:

- Classification
- Export Control Regulations
- Restrictions in Government Funding Contracts
- "Voluntary" Prepublication Clearance
- Controls on Foreign Visitors

Its general review of government policies and practices led the Panel to two broad conclusions:

(1) Where controls are deemed necessary, the government should use contract restrictions in preference to export control regulations. The contract mechanism has the advantages of informing a researcher of his/her obligations in advance while leaving application in the hands of the most technically qualified government personnel. Export controls, devised for controlling the movement of tangible objects, are ill-suited to the control of information flow.

(2) The government's effort is uncoordinated and spread too broadly across many diverse technologies. An effort spread this thin cannot be effectively administered, and raises unnecessary fears among researchers working in areas of no military relevance. The Corson Panel suggested that the government adopt a strategy of building "tall fences around narrow areas"; contract controls, for example, should be restricted to a few "grey areas" defined as those in which <u>all</u> of four criteria apply:

- 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 advantage; and
- The United States 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.

Similar criteria should be used to narrow the range of technical fields for which export controls are applied.

C. <u>Mutual Accommodation Between Science and Government</u>

The Corson Panel met with representatives of the scientific community and with officials associated with several federal efforts to prevent unwanted technology transfers. It concluded that, perhaps because the

national objectives of intellectual freedom and national security had just recently been seen to come into conflict, there was a need for mutual accommodation and open-mindedness on both sides. Some in the research community doubted that the government could justify a case for controls on scientific communication; some felt that the federal control programs had been designed with very little awareness of the adverse effects of controls on scientific and technological progress; and some noted that the uncoordinated nature and unrealistically broad reach of federal enforcement efforts unnecessarily subjected many researchers to uncertainty about their legal obligations. Some government officials cautioned that the scientific community remains naive about the massive Soviet intelligence collection effort and that some scientists are too reluctant to admit that scientific freedom does pose risks.

The Panel therefore recommended measures to ensure mutual appreciation of the concerns of government and science, including (a) establishment of a new forum under the auspices of the Academy complex to facilitate informal communication, and (b) establishment of an academic advisory group to assist government decision making on international scientific exchanges.

D. Improving Government Decisions

The Panel concluded that the dimensions of the technology transfer problem were not yet well understood. Two types of government decision -- (a) priority setting and resource allocation within the highly disaggregated federal control effort and (b) the disposition of individual cases -- could be much improved if a better factual basis were provided on the actual effectiveness and costs of government controls.

The Panel therefore recommended that the government establish -- preferably within the OSTP -- a focal point for evaluating the actual benefits and costs of existing or proposed restrictions on scientific communication.

III. REACTIONS TO THE CORSON REPORT

The Corson report was released on September 30, 1982. William Clark, then National Security Advisor, attended the pre-release briefing and indicated that he would present its implications to the President. Presidential Science Advisor George Keyworth issued a favorable statement, and NSF Director Edward Knapp also made favorable comments. In December 1982 the President directed the National Security Council to lead a two-month interagency review of the technology transfer problem. The effort was to be tied closely to ideas contained in the Corson Report.

Over the following weeks and months the Report was endorsed by

- The DoD-University Forum and its Working Group on Export Controls;
- The Council of Scientific Society Presidents;
- The Science and Research Committee of the Association of American Universities;
- The board of directors of the American Chemical Society; and
- The Committee on Academic Freedom and Tenure of the AAUP.

Misgivings about the report were of two types. One concern was that, by adopting an approach of evaluating alternative control mechanisms rather than one of investigating whether scientific openness contributes to or detracts from national security, the Panel may have in effect accepted as a given the government's case that controls are warranted. It was suggested that a fifth criterion be added for defining areas of science that are subject to control -- namely, that the possible damage to national security exceed the adverse effects of restrictions on scientific freedom, economic advance, etc.

A second misgiving was that the Corson Report's proposed "grey areas" for which unclassified information may require special controls could provide a dangerous invention. Although the Report emphasized that such grey areas -- as defined by the four criteria -- are very narrow, some feared that in practice the new category, once established, would be used much more liberally to apply the special controls to many scientific fields.

IV. THE SITUATION IN 1984

The immediate period following the release of the Corson report can be characterized as one of optimistic expectation on the part of the research community that the troubles which had led originally to the creation of the panel finally might be resolved and a new working accommodation developed. At this writing, however, more than sixteen months have elapsed since the issuance of the report. Much of the initial hope has evaporated, and there have been a number of major new policy thrusts:

- ITEM: The interagency effort begun with National Security Study Directive NSSD 14-82 (now renumbered as NSSD 1-83), issued by President Reagan, has yet to be completed. The terms of reference for the interagency exercise have twice been altered in the interim and there have been multiple changes of personnel at OSTP, which is responsible for the coordination of a major section of the report. Because the study has been conducted at the classified level -- and without the benefit of outside input -- it is not known how the present product, which is reported to be nearing completion, differs in scope or substance from the original effort requested by William Clark. OSTP officials see an advantage in release of some sort of unclassified document, but they are still unsure as to either the date of its public availability or its comprehensiveness.

- ITEM: Under a new Presidential directive, "Safeguarding National Security Information" (NSDD 84), issued in March 1983, government officials and those who have undertaken work on contract to the government involving access to Sensitive Compartmented Information (SCI), which is information classified at levels above top secret, will be required to submit for pre-publication clearance all books, articles, etc. which they write that bear upon national security matters. The application of this directive with respect to an individual is not time-bounded, so it presumably applies throughout a person's lifetime. The regulation is currently in abeyance for six months as a result of an amendment attached to a Senate authorization bill by Charles McC. Mathias, and it is not known whether the Congress will act to modify or prohibit eventual implementation.

- ITEM: Given the delays encountered in the inter-agency policy review, the Department of Defense (DoD) has moved to complete an internal policy review which was begun in 1981. Accordingly, a Steering Committee on Technology Transfer was established within DoD consisting of six subcommittees each looking at a separate issue: contracts, visa controls, emerging technologies, scientific conferences, publications, and rules for exemption to the Freedom of Information Act. The work of the Steering Committee and its subpanels has now been largely completed and its recommendations are expected to be implemented shortly. (The specific dimensions of the Steering Committee's work applicable to scientific communication are discussed later in this memorandum.)

- ITEM: A provision included in the 1984 Defense Authorization Act permits the Secretary of Defense to protect certain kinds of <u>unclassified</u> technical data in the possession or under the control of the DoD that otherwise would be

subject to release to foreign nationals under the terms of the Freedom of Information Act. Additional proposals have been circulated within the DoD to seek broader authority to protect sensitive technical data produced by other federal agencies (e.g., NASA, DoE, etc.) by facilitating their transfer to DoD control.

While the various intra- and interagency policy studies have been under development and discussion, there has been a continuing series of "incidents" over the past sixteen months -- of varying degrees of seriousness -- similar to those that provided the original impetus for creation of the Corson panel. The principal distinction from the pre-Corson environment is that most of the known incidents relate to the withdrawal of papers from meetings, rather than other forms of scientific communication. In fact, the only situation which is at variance with this trend concerns a "short course" (2-5 days) on "Metal Matrix Composites" which is to take place June 11 - 15, 1984 under the auspices of the UCLA Extension Program, that has been advertised as restricted to "US Citizens Only."

The course is to be co-sponsored by UCLA and the Metal Matrix Composites Information Analysis Center (MMCIAC), a subsidiary of the Defense Department, and is to be held in an open, on-campus conference facility. The involvement of the MMCIAC necessitates the use of the "US Citizens Only" restriction, reportedly because the material to be distributed involves technical data appearing on the Munitions Control List that would be subject to export control under the ITAR. What is new about this situation is that it would appear to be the first known instance where a front-rank research university has offered a course dealing with militarily-sensitive technology in an unsecured, on-campus facility and has advertised the program as offered on a restricted basis.

Among the more significant recent examples of contractually-imposed restrictions on conference paper presentations are the following:

- Society of Photo-Optical Instrumentation Engineers; 26th Annual International Technical Symposium; September 4-6, 1982; San Diego, California

More than 100 technical papers scheduled to be presented were withdrawn at the request of the Pentagon because they were said to contain "technical information that could not, by law, be exported to America's adversaries." Although most of the papers had been approved for presentation at lower levels of the DoD, these clearances were subsequently overruled and papers modified or withdrawn with only ten days remaining before the meeting.

- Electrical and Aero Space Systems, I.E.E.E.; Electrical Aero Space Conference; September 20, 1982; Washington, DC

It is reported that just before the opening of the conference the chairman was asked by an Air Force representative to destroy all records, abstracts, and papers and to cancel all presentations of certain papers that were considered to be "compromising national security." The chairman responded that the I.E.E.E. would comply if the Air Force would bear the cost (estimated at between $25,000 - $50,000). A day later the Air Force representative withdrew the request.

- I.E.E.E.; International Test Conference; November 16-18, 1982; Philadelphia, Pennsylvania

Five days before the conference (and after abstracts had already been printed), an official of Texas Instruments requested that three papers on VLSI, prepared by TI engineers, be withdrawn because the company had been notified by the Air Force that their release might be potentially damaging to US interests. After much adverse publicity (the papers had all been cleared for release), the Air Force re-reviewed the papers and approved their presentation at the conference.

- US Organizing Committee, Polar Research Board, NAS-NRC; 4th International Conference on Permafrost;University of Alaska, Fairbanks; July 18-22, 1983

Of the 290 papers submitted for publication in the conference proceedings, 24 were from the US Army Cold Regions Research and Engineering Laboratory. It is reported that prior to the conference six of these papers were withdrawn without explanation. Conference organizers were puzzled to see that most of the papers withdrawn concerned topics where the United States holds a dubious or non-existent lead over the Soviet Union.

- American Vacuum Society; Annual Meeting; November 3, 1983; Boston, Massachusetts

Alfred Zehe, an East German physicist and exchange scholar at the University of Puebla, Mexico, was arrested during the meeting and charged with espionage (although the specific charges stemmed from matters unrelated to the AVS conference). A week before the conference, an FBI agent had visited the AVS office and requested complimentary badges to permit six agents to attend the meeting under false names. Shortly after Zehe was arrested, the FBI requested a list of the 2600 individuals who had attended the meeting and threatened a subpoena if the list was not supplied. The AVS responded that it would not do so voluntarily but that it would comply with a subpoena. The FBI reportedly chose not to pursue the matter.

- American Ceramics Society; 8th Annual Conference on Composite and Advanced Ceramic Materials; Cocoa Beach, Florida; January, 1984;

Included with the announcement of the above cited conference of the ACS was a notice of a second, contiguous meeting entitled, "A Symposium on Composite Materials," which was sponsored separately by DoD and NASA and restricted to "US Citizens Only." Although the announcement of the second meeting was printed on a different color paper and displayed the NASA and DoD logos, the fact that the two sessions were to be held in the same hotel rooms apparently led to substantial confusion, particularly in Japan. A Japanese newspaper, the Nihon Keizai Shinbum, reported that the US Government was allegedly in the process of restricting Japanese access to certain "high technology information", including the use of export control regulations to bar Japanese membership in "academic societies concerning composite materials technology" and the denial of research papers. The former allegation subsequently proved to be false, and the latter is still under investigation.

The overall pattern of policy initiatives and restrictive actions taken since the publication of the Corson report suggests that the problem of unwanted technology transfer -- including that which occurs through open scientific communication -- remains a subject of substantial concern both within the Reagan administration and among the American scientific and engineering committies. Far from the hoped-for "cooling off" period after the

release of the Panel's findings, during which rational choices could be debated, it appears that policymakers in the Defense Department and elsewhere are moving forward to implement new regulations in advance of a consensus on government-wide policy.

As a result, some members of the scientific community remain uncertain as to their rights and obligations concerning the publication and/or public communication (e.g., through conferences, seminars) of sensitive technical data. There are also indications of growing alarm within the scientific establishments of other Western, industrialized countries. This impression is difficult to verify empirically. However, a limited staff survey of some of the key American professional societies revealed the following anecdotal information:

- Institute of Electrical and Electronics Engineers - reports some cases of forced withdrawal of papers from conferences and excision of papers from conference proceedings (see earlier itemization of incidents). Also reports some increased reluctance to host foreign visitors.

- American Chemical Society - reports no present drop-off either in technical manuscripts submitted for publication or in papers proposed for meeting presentation.

- American Geophysical Union - reports no comments from its membership either pro or con on government restrictions since the release of the Corson report. Speculates that, because AGU members often work in applied areas, they may be more used to dealing with sensitive areas of research.

- American Vacuum Society - reports a significant reduction in the number of papers presented at meetings of its Fusion Technology Division:

1981	78 papers presented
1982	58 papers presented
1983	35 papers presented

Clearly, these reports do not constitute an identifiable trend. They do suggest, however, that the recommendations contained in the Corson Panel's report have not succeeded in removing the uncertainties related to open publication in certain scientific fields.

V. AN UPDATE OF THE KEY ISSUES

A. Evidence on the Extent of Transfer via Scientific Communications

In late December and early January, we were briefed at the top secret level by representatives of the intelligence community. We can report on this basis that the state of empirical knowledge about technology leakage and its effects on national security has not changed significantly in the 18 months since the Corson Panel was briefed by the US intelligence community. The principal activity in recent months has been the largely qualitative matter of identifying the many ways in which leakage can occur in order that a comprehensive control effort can be fashioned. It appears that no major initiative has been undertaken to characterize better either the overall leakage problem (e.g., the relative importance of various sources, channels, and types of information) or the relative significance of scientific communication within the larger picture. Evidence thus remains largely anecdotal.

The intelligence community reports no discoveries during this period of cases in which loss through the U.S. scientific community has led to identifiable damage to national security. However, intelligence officials remain concerned about what it still sees as the "small percentage" of Soviet intelligence acquisitions that involve the American research community. Some in the DoD argue that, given the planned expansion of federally-sponsored applied research in US universities, the number of such acquisitions would grow in the future unless something is done.

Two other developments may be noted. First, as discussed below, the number of foreign scientific visitors has declined substantially in 1982 and 1983, somewhat alleviating concerns about this source of potential leakage. Second, the National Security Agency has increasingly emphasized the problem of Soviet acquisition of computer data bases, including those used in scientific research, and has begun to develop and promote measures (like the wide use of public key encryption devices) to thwart such losses.

B. Workability of Controls

1. Classification - There is now better information on the extent to which military research is classified or otherwise restricted. As part of the report of the Subcommittee on Publications of the internal DoD Steering Committee on National Security and Technology Transfer, a study was undertaken to determine how publications in federal information centers were being treated in terms of the frequency of classification or dissemination restrictions by subject area or document source. Data were drawn from the Defense Technical Information Center, the Department of Energy's Technical Information Center, and the NASA Scientific and Technical Information Center.

Analysis of the data supported the contention that universities are responsible for less sensitive research than is done in other settings, no matter what field of technology is involved (See Table 1). University-originated reports accounted for approximately 19 percent (23,119) of the 123,328 of the DoD-sponsored reports included in the study; only 1.3 percent were classified and 3.5 percent had any distribution limitations (see Table 1a). The study also found that every classified report and approximately 50 percent of the limited reports were generated in off-campus facilities affiliated with the universities. An additional 33 percent of the limited reports from on-campus projects were judged to be restricted primarily in order to protect the university's proprietary interest. As might be expected, technical reports tend to be more available from NASA and DoE than from the DoD, which is consistent with the different missions of the three agencies. In NASA, for example, 93 percent of all reports on aeronautics are available to the public compared with 34 percent of those from DoD.

The internal DoD study concludes that "classification of publications is still a viable option as long as guidelines are produced that define very specifically what elements of a technology are really militarily critical and the operational threshholds beyond which the information should be classified. Classification will be a useful approach only if used very judiciously in clearly identified areas and in accordance with the existing Executive Order." Meanwhile, through Executive Order 12356, issued in April 1982, the Administration has changed the thrust of its classification policy, stating that restrictions are to be imposed in cases where reasonable doubt exists. It also expanded the number of categories of classifiable information and made it possible to reclassify information previously made public.

Finally, although not strictly a classification matter, the Administration has continued to press its efforts to enlarge the scope of government restraint on the free flow of unclassified information by adding new protective exemptions to the Freedom of Information Act (FOIA) to permit the withholding of militarily-sensitive technical data held by federal agencies. (In fact, the DoD has proposed that it be permitted to become a repository for the sensitive documents of the DoE, NASA, etc. so that they too might be protected.) Administration attempts to amend the FOIA failed to gain Senate approval in 1983, but the executive branch has proceeded anyway to adopt a conservative approach to the approval of FOIA requests.

2. Export Controls - The Export Administration Act (EAA), and the attendant Export Administration Regulations (EAR), remains the principal regulatory instrument for controlling trans border flows of sensitive technical data. During the first session of the 98th Congress, the EAA came up for renewal. A number of bills were introduced in both Houses of Congress, with the Senate version tending to be more restrictive than the House. Because the Senate failed to complete work on a new export act, the EAR have continued in force on the basis of emergency authority pending final resolution in the next congressional session.

Meanwhile, efforts continue at a slow pace within the Department of Commerce to comply with the 1979 congressional mandate to incorporate the Militarily Critical Technologies List (MCTL) into the Commodity Control List (CCL), which is the basis for the administration of the EAR. As of this writing, a preliminary draft exists for only one CCL category, electronic components, and it appears likely that it may be another year or more before the massive MCTL document is incorporated fully within the CCL. Moreover, although a sanitized, unclassified version of the MCTL is said to exist in draft form within the DoD, little has been accomplished apparently to act upon the Corson Panel recommendation to streamline the overall list. In fact, given the multiple uses to which the MCTL is put within DoD, it is somewhat unlikely that such internal streamlining may ever occur.

While the outcome of the EAA revision is being debated in Congress, the Administration has proceeded in a rather vigorous manner with efforts to control unwanted technology transfer. It can be stated in general that the Department of Commerce presently considers scientific communication to be a relatively small -- albeit significant -- aspect of the overall technology transfer control problem. There are no known examples since 1982 where the EAR have actually been invoked to prevent the dissemination of basic research results. On the other hand, there are recent indications that draft technical data regulations under consideration for incorporation into the EAR would dramatically alter this situation by removing the general licensing exemption granted to "scientific and education data." They would require a validated license for the export of virtually all "critical technical data." Since the definition of "export" includes such things as presentation of papers at symposia where foreigners are present, the hiring of a foreign researcher, and so on, the proposed rules seem to have the potential to have a significant effect on the US scientific enterprise.

The Administration has also stepped up its export control enforcement efforts, principally through two channels: (1) "Operation Exodus" -- an effort by the Customs Service underway since late in 1981 to spot check high technology goods being readied for shipment, which has resulted in the detainment and seizure of some 2,300 foreign-bound shipments worth approximately $149 million and eventual indictments in 221 cases (although only 28 involved so-called "dual use" technology); and (2) creation of a new post within the Commerce Department, known as the Office of the Deputy Assistant Secretary for Export Enforcement, which was responsible in fiscal 1983 for the referral of 37 dual-use technology export cases to the Justice Department for prosecution. This two-track approach reflects uncertainty between the Customs Service of the Treasury Department and the Export Administration of the Commerce Department over which agency has lead responsibility for export enforcement.

The other principal export control mechanism is the Arms Export Control Act and the attendant International Traffic in Arms Regulations (ITAR). Revisions of the ITAR, which has been pending for more than two years, still have not been completed, although a legal draft of the revised regulations is now said to exist. A likely target period for release of a new ITAR is

mid-1984. The ITAR is administered on the basis of the Munitions Control List, maintained by the Defense Department, which has been augmented in the past year by the addition of most aspects of the DoD VHSIC program. However, there appear to have been no instances in which the ITAR has been applied to written or oral scientific communication since the release of the Corson report.

3. Visa and Exchange Restrictions - When the question first arose of using visas to restrict or deny access to the US on the basis of concern about technology transfer, there was substantial uncertainty within the Department of State (DoS) as to the proper interpretation of the relevant law, the Immigration and Nationality Act. There is a recognition within the DoS that the visa process is generally a clumsy mechanism for controlling technological loss and that better risk assessment information is required from US embassies.

In May 1983, after an inter-agency review, UnderSecretary of State William Schneider articulated a new visa policy for handling cases of individuals suspected of technology acquisition. Schneider essentially reaffirmed that the existing visa law can and should be used to limit the loss of information in areas of science and technology regulated by: (a) the Atomic Energy Act, (b) the Arms Export Control Act, (c) the Export Administration Act, or (d) by Executive authority (i.e., classification). Moreover, he indicated that action may now be taken on a visa solely on the basis of the potential for technological loss. Depending on the nature of the risk identified, an individual applicant may be: (1) denied a visa, (2) offered a conditional visa, or (3) given an unconditional visa. In cases of conditional visas, the restrictions may be imposed either by the relevant country desk or by the Immigration Service of the Department of Justice - outside of the visa process - as a condition of entry.

The principal concern is with commercial trade visits, with only a secondary focus on those involved in academic research. Again, depending on the assessment of the risk involved, a sponsor may be asked to modify a visitor's program or alternatively, the visitor's freedom to travel may be restricted. Because the Visa Bureau of the DoS still does not track technology transfer cases per se, it is not possible to provide accurate numbers of scientific visit requests approved, denied or made conditional.

However, the data in Table 2 provide an indication of the trend in COMEX recommendations between 1981-1983. This period may be somewhat anomalous, due to rising tensions with the Soviet Union and East Europe over Poland and other matters, but the data reveal: (a) an overall decline in the total number of cases reviewed, (b) a slight decline in the percentage of cases in which significant concern was expressed, (c) a slight (but erratic) decline in the percentage of cases recommended for visa denial, (d) a slight (but erratic) increase in the percentage of cases recommended for program modification, and (e) a slight (but erratic) decline in the percentage of cases recommended for outright approval. While it must be emphasized that COMEX recommendations are not necessarily adhered to by the DoS in all cases, they do prevail in the majority. Table 3 also provides information on the number of Soviets and East Europeans rejected by the NAS, and visa versa, for exchange visits during the period from 1979-1983. As may be observed, the numbers are too small and erratic to be of any real significance.

One other interesting aspect of the visa and scientific exchange matter involves the Peoples Republic of China (PRC). The COMEX data reveal that between 11% and 25% of the cases from 1981-1983 in which significant concern about technology loss was expressed by the committee involved Chinese students or scientists. But, because visa and export control policies towards the PRC have been liberalized substantially, none of the COMEX recommendations for visa denials involved the Chinese. The programs of some visiting Chinese were, however, recommended for modification. As one State Department official put it: "The visa process for Chinese -- especially for graduate students -- is very complicated and tends to overwhelm the system. The Chinese do not understand or accept delays, and it is doubtful whether they themselves actually know the areas in which their visits are proscribed."

4. Contract Controls - One of the major recommendations of the Corson Panel was that, where controls on unclassified scientific information are warranted, they can best be accomplished by means of a priori contract constraints. This mechanism has been examined in the work of the DoD Steering Committee on National Security and Technology Transfer, and the result has been the emergence of a new policy on "international transfers of technology, goods, services and munitions" (DoD Directive 2040.2, superceding the so-called 2040.XX memorandum) which articulates a number of new mechanisms for

establishing standard definitions of what is militarily sensitive and for resolving appeals of contractually imposed restrictions. The Directive establishes the Panel on International Technology Transfer to be chaired by Richard Perle, Assistant Secretary of Defense for International Security Policy, as the highest level appeal mechanism for resolving differences within the DoD on technology transfer policy, and it creates two subpanels: (1) Export Control Policy - a first level structure, chaired by Stephen Bryen, Deputy Assistant Secretary of Defense for International Security Policy for developing coordinated DoD positions on export control policy matters, and (2) Research and Development - a first level structure, chaired by Dr. Edith Martin, Deputy UnderSecretary of Defense for Research and Advanced Technology, for resolving differences on technical standards, definitions, and the dissemination and exchange of technical information, including appeals of "technology transfer research cases."

With regard to sensitive research undertaken specifically in academic settings, the DoD Steering Committee has made a number of additional recommendations. First it has clarified policy on review of research papers produced by DoD contractors, distinguished by budget category (i.e., 6.1, 6.2, or 6.3) and by "sensitive" vs. "non-sensitive" (i.e., a distinction drawn according to the definition contained in the preface to the MCTL [similar in most respects to the definitions contained in the Bucy Report of the Defense Science Board]). These policies are set forth in the matrix below. It should be noted that the point of these policies is to give the researcher written notice of paper review procedures before he or she signs a DoD contract.

	Non-Sensitive Research	Sensitive Research
6.1 Budget Item (Basic Research)	Simultaneous submittal to contract officer and to publisher. DOD has no right to require changes or to restrict publication.	Manuscript must be submitted to contract officer 60 days prior to submittal to publisher. Researcher retains option of whether or not to publish.
6.2 and 6.3 Budget Items (Non-Basic Research)	Same rules as for 6.1	Submit manuscripts to contract officer 90 days prior to submittal to publisher. DoD retains right to require changes before allowing publication or to block publication outright.

Two aspects of the matrix merit special attention: (1) the 60-day prior review requirement on sensitive 6.1 research is more restrictive than recommended by the Corson Panel, which called for simultaneous review by the publishers and DoD, and (2) the 90-day prior review and right to require changes in sensitive 6.2 research are also far more restrictive than the Corson Panel, which did not distinguish between 6.1 and 6.2 research in its recommendations.

Second, the DoD Steering Committee has recommended the permanent implementation of a series of six "dissemination control" stamps, already approved on an interim basis by Secretary of Defense Caspar Weinberger, that will clarify the standards used in determining the extent of circulation of unclassified documents produced through Defense contracts (or at government laboratories) and held by the Defense Technical Information Center (DTIC) and of other secondary distribution facilities. The range of markings are reportedly as follows: (1) release only on approval of originator, (2) release within DoD only, (3) release to DoD and DoD contractors (who must apply for formal approval) only, (4) release to U.S. Government only, (5) release to U.S. Government and DoD contractors only, and (6) release to the general public.

It is argued that these new distinctions will circumvent export licensing requirements and should actually result in broader document dissemination than at present. On the other hand, if a conservative approach is adopted towards the categorization of documents, further constriction of information availability could result. Finally, it is useful to note that COMEX is currently updating an existing DTIC data base, reported now to be about 60 percent completed, that will make it possible to determine quickly the number and type of DoD contracts in force on a given university campus and their level of classification or restriction and to make researchers aware of each other's work.

5. Voluntary Pre-publication Review - With regard to the agreement for voluntary submittal of papers for simultaneous review by the National Security Agency and professional journals, developed by the Public Cryptography Study Group of the American Council on Education and the NSA, it appears that the mechanism is working in a manner that is reasonably satisfactory to all parties. The NSA reports that 175 papers have been submitted for review since

completion of the agreement. Of this total, 9 papers have been challenged, 6 have been modified and 3 withdrawn. Pursuant to the agreement, a 6 member appeals committee has been established, consisting of 4 academic researchers and 2 former NSA officials. To date, there have been no appeals of the NSA review decisions.

6. Implementation of "Grey Area" Criteria - Perhaps the major recommendation of the Corson Panel concerned the need to build "tall fences" around narrowly circumscribed technologies that could be identified as meeting the four principal criteria set forth in the report. Pending the public release of the inter-agency NSSD exercise, coordinated by the OSTP, it is impossible to determine with certainty the extent to which these recommendations have been adopted as official policy. However, there are indications that the government is moving toward the adoption of a more restrictive approach than was recommended by the Corson report. Witness the following factors: (1) there has been little or no progress in streamlining the MCTL, (2) a new unclassified Militarily-Significant Emerging Technologies Awareness List (METAL) is being created which will identify "frontier technologies" just appearing on the horizon but not yet embodied, (3) definitions established by the Subcommittee on the Monitoring of Emerging Technologies of the DoD Steering Committee on National Security and Technology Transfer for identifying militarily significant emerging technologies are more comprehensive than the Corson Panel criteria (see below), and (4) continuing efforts are underway within CoCom to identify additional technologies that may not be exported to Warsaw Pact countries.

The DoD Subcommittee on Monitoring of Emerging Technologies has made the following recommendations for defining militarily-significant emerging technologies:

> "Militarily Significant Emerging Technology is an emerging technology (not the early 'first proof of principle' experiment in the Scientific and Technical Knowledge Stage), which is perceived to have significant military impact [emphasis original] (which is generally understood to mean that potential military uses have been identified and the subject technology meets one (1) or more of these threat assessment factors: technology is not possessed or available to the Soviet bloc; if possessed, the subject technology and state of the art lags West (U.S.); technology provides advantage in performance, reliability, maintenance or cost; and technology relates to specific known deficiencies in Bloc capabilities)."

The Subcommittee went on to recommend that, with certain exceptions, the "region of emergence be drawn at the 6.1/6.2 [budget categories] Program Element Line. Since 6.2, exploratory development, is usually the category where science is transitioned into Militarily Significant Emerging Technologies, the subcommittee recommends that all 6.2 contracts and work units be screened on a case-by-case basis." Clearly, this approach is far more comprehensive than that envisioned by the Corson Panel. This is demonstrated particularly by two facts: first, that the Subcommittee urged the creation of a new preliminary screening list, the METAL, to which a technology might be assigned prior to its movement to the 6.2 or 6.3 category; second, that the "threat assessment factors" used in selecting technologies for the METAL are far more restrictive then the Corson "grey area" criteria. By DoD's estimation, it would take three or four years before technologies listed on the METAL (never more than 7 - 10 at any given time) would come to be controlled under the MCTL, but the entire process would be far more likely to include additional marginal technologies than to rule them out.

C. Mutual Accommodation Between the Government and the Scientific Community

It became clear during the Corson Panel investigation that a substantial portion of the problem between the government and scientific research community stemmed from a combination of ignorance of each other's mindset and working environment and lack of channels through which to communicate. Accordingly, the Panel made several recommendations to increase the level of interaction and exposure among the various interests both to improve general awareness and to resolve specific problems. These recommendations have been implemented through the creation of a variety of permanent and ad hoc mechanisms.

1. DoD University Forum, Working Group on Export Controls - Already in existence prior to the creation of the Corson Panel, the DoD-University Forum Working Group has continued to be the principal venue through which the academic research community could offer input into the ongoing DoD policy review on technology transfer. The Forum is constituted at an extremely high level on both sides, yet it is still difficult to determine the actual extent of its influence and impact. Certainly the Working Group has made a valuable contribution to the deliberations of the DoD Steering Committee, and it has been kept reasonably well informed on the work of the Steering Committee's subpanels. It has been made clear repeatedly, however, that the Steering

Committee's recommendations are not subject to outside review or veto since they concern internal DoD procedures. Despite the fact that the Forum has been given an initial lifespan of two years, some have questioned what future role it can (or is likely to) play as a standing mechanism for the exchange of information and ideas.

2. COMEX (Committee on Exchanges) Academic Advisory Group - The Corson Panel recommended that the interagency committee responsible for issuing advisory opinions to the State Department on visa approval, denial or conditionality for scientific visitors from potential adversary countries would benefit from outside academic input. Accordingly, COMEX is now in the process of establishing a 15 member panel intended: "to help [us] avoid misunderstandings, provide a forum wherein we can explain the Government's technology transfer concerns, foster discussion leading to more effective and less intrusive ways for COMEX to do business, help those of us in government better understand the 'realities' of the university environments, and promote discussions among academic and government experts regarding national security significance of developing areas of technology." To date, 16 of the 20 academicians invited to participate have accepted.

3. Government-University-Industry Research Roundtable - A third permanent mechanism, recommended by the Corson Panel, is a roundtable constituted at the highest levels of government, industry and academia that has recently been established in the Academy complex and is chaired by Dale R. Corson. Invitations to membership on the Roundtable are still being extended, and it is hoped that the first meeting will occur in March 1984. Thereafter, the Roundtable is to meet approximately 4-6 times annually. Its specific agenda will be determined by the chairman in consultation with the multi-faceted membership.

4. Ad Hoc Mechanisms and Activities - Since the release of the Corson study, there have been a number of ad hoc activities to broaden the frame of reference for discussion of the issue of scientific communication and national security. In May 1983, a symposium was convened at the annual meeting of the AAAS, entitled "How Much Science is Secret?: National Security and Scientific Communication". Among those serving on the panel to discuss the Corson study and the general problem of scientific communication were a number of individ-

uals who have had central roles in the debate, including: Stephen Unger, a Columbia University professor who has written widely on the topic; Harold Shapiro, President of the University of Michigan and a member of the Corson Panel; David Wilson, Co-Chair of the Working Group on Export Controls of the DoD-University Forum; Rosemary Chalk, Staff Director of the AAAS Committee on Scientific Freedom and Responsibility; and Louis Montulli, then chair of the NSC working group addressing scientific communication.

During the October 6-7, 1983 meeting of the NATO Science Committee, a forum discussion was held on open communication in science. In attendance were the science representatives of the NATO countries. No clear consensus emerged from the discussion, but there was general agreement on the importance of open communication, while the necessity of controls in some cases was acknowledged. Where lack of consensus emerged was on the subject of what should be controlled and how and by whom such controls should be imposed?

Finally, there has been continuing media attention, and periodic Congressional oversight, on the matter of scientific communication and national security that has served to raise the level of public awareness of and attention to the problem. Among the most recent Congressional hearings to take up the subject were those conducted on November 2-3, 1983 by the Subcommittee on Courts, Civil Liberties and the Administration of Justice of the House Judiciary Committee, chaired by Representative Robert S. Kastenmeier, entitled: "1984: Civil Liberties and the National Security State." Included among those invited to testify were: Frank Press, President of the NAS; C. Peter McGrath, President of the University of Minnesota; Karl Willenbrock, Chairman of the IEEE Technology Transfer Committee; and others. Witnesses were unanimous in their condemnation of restrictions on scientific communication as an infringement of civil liberties. Throughout the period since the release of the Corson report, there has also been a limited but steady flow of articles in major U.S. newspapers and magazines. Some of the more significant examples include the following: Rosemary Chalk, "Security and Scientific Communication,"Bulletin of the Atomic Scientists (August/September 1983); Floyd Abrams, "The New Effort to Control Information," The New York Times Magazine (September 25, 1983); and Jon Zonderman, "Policing High-Tech Exports", The New York Times Magazine, (November 27, 1983).

D. Improved Decisionmaking for Control of Scientific Communication

One other major finding of the Corson Study was the need to develop reliable data on which to base a net assessment of the damage to U.S. national security from losses occuring through open scientific communication. In 1984, the situation remains essentially the same: there is still no net assessment capability. The internal DoD policy review undertaken by the Steering Committee on National Security and Technology Transfer is intended to help standardize definitions, heighten awareness of emerging technologies, and facilitate more uniform control decisions. Moreover, it is assumed that the NSC policy exercise, if it is carried through to completion, presumably will encourage other agencies to do the same. But the fact remains that major changes in U.S. technology transfer policy are being considered and decided on the basis of incomplete - and possibly erroneous - information on the extent and seriousness of the loss of scientific and technological information.

VI. Conclusions

A. The government has not found it possible to act in a manner compatible with the major Corson Report principles. In particular, although the government has apparently accepted the Report's conclusion that the best form of control is the research-funding contract, both the stringency and the substantive reach of restrictions now proposed or in force go considerably beyond what was recommended in the report. Moreover, if recent reports are accurate regarding the draft technical data regulations under consideration for incorporation into the EAR, it would appear to mean that, contrary to the findings and recommendations of the Corson Panel, the EAR could supplant DoD-imposed contractual restrictions as the principal (and most restrictive) mode of control.

The nature of the contract restrictions spelled out by the DoD is substantially more restrictive than the Corson Panel recommendations. With respect to DoD budget category 6.2 (applied) research taking place in universities, for example, the Corson report suggests as a maximum restriction the concurrent submission of research papers to the DoD contract officer (for

comment only) and to the prospective publisher. In contrast, new DoD policy requires that the researchers receive an affirmative clearance before submitting papers for publication. DoD restrictions for 6.1 (basic) research are also somewhat more stringent than those the Corson Panel recommended.

Furthermore, the Corson Report contemplates that such restrictions be applied only to a few specific grey areas of research (perhaps no more than five) defined by the four explicit criteria. While the range of application under DoD policy is still unclear, there is at present no indication that it will be possible to restrict its scope as a matter of principle. DoD reports that it found the four Corson criteria impracticable, and there has been no public commitment by the government to the idea of raising "tall fences around narrow areas" for the MCTL, the METAL, or the CoCom lists.

B. The continuing lack of effective government-wide coordination raises important risks, including:

- disparate agency policies that do not adequately balance national goals
- wasteful allocation of national resources among programs of varying effectiveness
- confusion and skepticism in the research community.

A central finding of the Corson Panel was that national policies for controlling unwanted technology transfer touch directly on several competing national goals: national security, economic competitiveness, domestic scientific and technological productivity, and freedom of expression are among them. It follows that national policy should be set according to a process that permits these objectives to be balanced carefully. It was at first hoped that the NSC review would be such a process -- and that it would be able to capitalize on the broad consensus reached in the Corson Report.

Given the successive delays in the NSC review, policy initiative has naturally reverted back to the individual agencies (most notably the Department of Defense), whose missions typically reflect only one among the many relevant national objectives. Once put into place, these uncoordinated initiatives may be difficult to adjust.

The government's lack of central coordination also represents a missed opportunity to set reasonable priorities among the many offices (OSTP counted 44 of them) responsible for addressing the many parts of the technology transfer problem.

There is a danger that the lack of effective government-wide coordination (and, more specifically, the failure to acknowledge or address the main recommendations of the Corson Report) will undermine the perceived legitimacy of government programs among the research community.

C. <u>There is little progress toward an improved objective understanding of the technology leakage problem and the effects of control measures</u>.

Our review revealed almost no improvement in (and little consciousness of) the state of knowledge about the actual effectiveness or adverse effects of controls. National policies necessarily rest on assumptions about the relative importance of various leakage channels, about the capacity of control measures actually to inhibit the Soviet collection effort, and about the extent to which controls on international dissemination impede domestic scientific progress. If these assumptions are in error, there could be large costs to the nation. However, there appears to be no concerted effort to examine them empirically.

D. <u>For most aspects of the technology transfer problem, we seem to have moved from a period of public controversy to a more subdued period of policy development and implementation. However, continuing incidents regarding international scientific conferences remain a source of current acrimony</u>.

The years 1981 and 1982 were marked by several well-publicized contretemps. These included controversies over particular scientific exchange visitors, military research restrictions, the obligations of cryptography researchers, and high rhetoric in public statements. Since late 1982, the overall rate of such incidents appears to have declined. Most of the recent incidents have involved difficulties with international scientific meetings. This mode of scientific communication may now require special attention.

It is possible that, once there is a broader understanding within the scientific community of the recent changes in DoD contract policies and the draft changes under consideration regarding the EAR, the prevailing calm of the present climate may well be altered.

E. There is little doubt that one useful development since the Corson Panel was established has been an enhanced ability to distinguish between the general problem of unwanted technology transfer from all sources and those aspects that pertain to the open communication of scientific information. Despite the possibility of increased targeting in the future, unclassified scientific communication continues at present to be a small part of the overall problem.

TABLE 1

Distribution Restrictions on DoD, DoE, & NASA Reports by Source and by Field, FY 1979 - 1963

	DoD Labs	Universities	Industry	Non-Profit	Total
Number of Reports	61,694	23,119	32,806	5,609	123,328
Percent Classified*	12	1.3	21	17	13
Percent Limited	44	3.5	35	15	33
Percent Public	44	95.2	44	68	54

The twenty-two major subject fields, listed in order of percent withheld from automatic public release, are:

Field (Number of Reports)	% Classified	% Limited	% Public
Missile Technology (2,524)	57	32	11
Ordnance (6,740)	32	47	21
Military Sciences (8,099)	38	33	29
Navigation, Communication, Detection & Countermeasures (13,490)	40	28	32
Aeronautics (5,082)	13	53	34
Propulsion & Fuels (3,252)	14	48	38
Space Technology (905)	17	44	39
Nuclear Science & Technology (1,259)	24	34	42
Energy Conversion (non-propulsive) (1,055)	3	54	43
Electronics & Electrical Engineering (12,424)	3	50	47
Materials (5,643)	1	46	53
Methods & Equipment (2,288)	3	42	55
Agriculture (82)	1	44	55
Mechanical, Civil, Industrial & Marine Engineering (9,284)	5	35	60
Biological & Medical Sciences (10,093)	1	32	67
Physics (12,812)	6	25	69
Behavioral & Social Sciences (10,529)	2	20	78
Earth Sciences & Oceanography (4,671)	1	21	78
Atmospheric Sciences (3,078)	1	16	83
Chemistry (4,042)	-	14	86
Astronomy & Astrophysics (584)	-	13	87
Mathematical Sciences (5,292)	-	5	95

*Generated at "research institutes" associated with the universities

Source: Report of the Subcommittee on Publications, DoD Steering Committee on National Security and Technology Transfer, November 9, 1983, pp. 23-24.

TABLE 1a

University-Generated Reports - Number of Documents (%)

FY 1978 - 1983

	DoD	NASA	DOE
Classified	302 (1.3%)	156 (1.0%)	NA
Limited	823 (3,5%)	1,318 (8.8%)	NA
Public	21,994 (95.2%)	13,568 (90.2%)	NA

Source: Report of the Subcommittee on Publications, DoD Steering Committee on National Security and Technology Transfer, November 9, 1983, pp. 23-24.

TABLE 2

COMEX Individual Program Recommendations

1981 - 1983

	1981	1982	1983
Number of Final Actions	372	148	194
Cases of Significant Concern	172 (46%)*	66 (44%)	81 (41%)
PRC Cases of Significant Concern	96 (25%)	16 (11%)	39 (20%)
Cases Recommended for Denial (no PRC)	55 (18%)	35 (24%)	28 (14%)
Programs Recommended for Approval with Modification (includes PRC)	225 (60%)	57 (39%)	133 (69%)
Programs Recommended for Approval	92 (25%)	56 (38%)	33 (22%)

Source: Based on data provided by the Committee on Exchanges, Technology Transfer Intelligence Committee

* All numbers in parentheses are percentages calculated on the basis of total final actions for that year.

TABLE 3

Proposed Soviet, East European and American Scientific Visitors Rejected, 1979-1983

Foreigners to U.S.	1979	1980	1981	1982	1983
Soviets	0	4	4	4	1
East Europeans - Total	1	4	10	4	5
- Bulgaria	0	0	1	1	1
- Czechoslovakia	0	2	3	1	1
- Hungary	0	1	0	0	0
- Poland	0	0	1	0	0
- Romania	0	0	0	0	2
- Yugoslavia	0	1	0	0	0
- GDR	1	0	5	2	1
Americans to the USSR	0	2	0	5	0
Americans to East Europe - Total	6	1	2	3	0
- Bulgaria	0	0	0	1	0
- Czechoslavkia	3	0	1	0	0
- Hungary	0	0	0	0	0
- Poland	0	0	0	0	0
- Romania	0	0	0	0	0
- Yugoslavia	0	0	0	0	0
- GDR	3	1	1	2	0

Source: Advisory Committee on the USSR and East Europe, Office of International Affairs, NAS/NRC.