RESTRICTIONS ON TECHNOLOGY TRANSFER AMONG ACADEMIC RESEARCHERS

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Restrictions on Technology Transfer
Among Academic Researchers--Will
Recent Changes in the Export Control System Make a Difference?

In 1985, university researchers welcomed changes to two major components of the United States export control system.1 In June of that year, Congress enacted the Export Administration Amendments Act of 1985 (EAA 1985).2 Six months earlier, changes in the International Traffic in Arms Regulation (ITAR)3 went into effect.4 Although international trade law and regulations would seem to have little significance for academic communities, academicians had worked diligently, along with people in the business community and government agencies, to induce the changes.5

Beginning early in the 1980's, scholars, particularly those at major research universities, grew aware of an increase in government controls on the East-West transfer of information and technologies between scholars and researchers.6 The controls, designed to protect national security while promoting the export of United States goods,7 were viewed by the United States government as necessary for maintaining a lead in technology over the Soviet bloc.8 To some observers, the Soviet Union and its allies were acquiring Western technology too easily--through subterfuge, by "dual-use technology",9 or by foreign availability.10
Concern arose among scholars when the United States government attempted to enforce the controls in a setting that was usually immune from government interference—the university. The centerpiece of the controversy was the Export Administration Act of 1979 (EAA), which is the authority for the Export Administration Regulations (EAR). The EAA is a complex law with a complex history. Like its earlier counterparts, it had licensing provisions for commodities and technical data and carried civil and criminal penalties for violations. The EAA, however, introduced and emphasized the concept of "critical technology," and Congress directed the Secretary of Defense to draw up a militarily critical technologies list (MCTL). The emphasis on critical technology as opposed to the prior emphasis on end-products precipitated the new restraints felt by universities.

The Arms Control Act and its accompanying regulations, ITAR, also precipitated restraints. The regulations cover exports defense articles and services, and a "Munitions List" (ML) identifies the services and articles that are regulated. The word, "export," has a broad definition under ITAR. The definition includes not only the traditional one of shipping goods from the United States, but also the transfer of technical data to a foreign person, whether the transfer is made in or out of this country.

A third point of controversy was Executive Order 12356, by which President Reagan granted authority to a number of federal agencies to classify information. Under this order, information
may be classified if its disclosure "reasonably could be expected to cause serious damage to the national security." Results of research done under government contracts and grants are included for classification.

Each of these controls resulted from changes in U.S. foreign policy and national security objectives. While those changes were occurring, university research entered new areas of research, which created an environment for imposing export controls. This paper first briefly examines the evolution of the U.S. export control system, the evolution of national security controls at universities, and the difficulties encountered by universities under the controls. The paper then explains the 1985 amendments to the EAA and the changes to ITAR and analyzes their implications for university researchers.

I. The Evolution of the U.S. Export Control System

Although the United States historically had restricted technology transfer during times of war and national emergency, in 1949 Congress enacted the first export control act in reaction to the communist cold war threat. A virtual embargo on industrial and military commodities to communist countries began, and exports of some consumer goods were halted. Later, a shift in foreign policy that encouraged trade with communist, as well as other, countries resulted in new legislation, the Export Administration Act of 1969. With that Act, granting of export licenses no longer depended solely on whether the export was destined for a communist or noncommunist country, and exports to the Soviets increased dramatically.
In the following decade, however, foreign policy and national security concerns shifted again, and in 1977, a Defense Science Board Task Force issued a report, commonly called the Bucy Report, that had a significant effect on export controls.\textsuperscript{36} The premise of the report was that for the United States to maintain a lead in critical technological areas, it must, first, ban exports to a country when the export represented a revolutionary (rather than evolutionary) advance for the receiver. Second, the United States and allied nations must strengthen export control laws for critical technologies.\textsuperscript{37}

The Department of Defense accepted the Bucy Report as official policy in 1977,\textsuperscript{38} and two years later Congress included it in the EAA.\textsuperscript{39} That new Act concentrated on critical technology rather than end-products for national security purposes.\textsuperscript{40} The end-product approach had proven cumbersome, and sometimes key technologies had managed to slip through the license screening process.\textsuperscript{41} Universities soon realized that adoption of the, however, critical technologies approach meant that export controls were to be imposed more stringently on researchers than at anytime in the past.

II. The Evolution of National Security Controls

at Universities

National security controls at universities began during World War II.\textsuperscript{42} The government conducted secret war research on campuses while training Army and Navy personnel in the classrooms. The
universities' successful record of maintaining security was admired, but soon after the war's end, most major classified projects were moved from campuses and from under university management.  

During the postwar period, the relationship between government and universities became one of "benign sponsorship." Impressed with the achievement of universities during the war, the government deliberately decided to nurture basic research at universities with federal funding and to aid universities in reestablishing their graduate programs in science and technology. The government recognized special characteristics inherent to universities—those that called for academic freedom and the choice to admit qualified students; therefore any controls were primarily on the access to hardware and technical information. Regulations, secrecy requirements, and intrusions by the government were minimal, and researchers were largely free to pursue projects in productive, creative ways.

The success of that benign sponsorship is apparent. Research universities now account for more than one-half of the basic research in the country, and university scientists and engineers comprise most of the researchers that furnish academic, government, industrial, and military needs. Nevertheless, the openness that fostered the successful working arrangement between government and research universities became an object of alarm to the government as the dividing line between basic research and military application blurred. Although the published results of basic scientific research have little direct impact on military application, university research had moved into areas that included practical technical information that could provide
valuable data in military design and production. Two reasons for the increase in applied research were: (1) university research had moved closer to engineering design and product development to get funding from industry, and (2) equipment and processes that were developed to conduct basic research frequently extended to the manufacture of the researched item.

Another object of alarm to the government was the difference between the method of transfer of applied research and that of the usual written form of basic scientific research. To obtain practical "know-how" about applied research frequently entails on-site visits and hands-on working experience. Because the Soviets were eager to have access to rapidly evolving high-technology research, the U.S. government saw the university as a threat to national security through university exchange programs and the possible transfer of technical data during university visits by foreign scientists. As a result, restrictions were imposed.

III. Difficulties Under the Previous Regulations and the Reactions of the Academic Community

Some of the more overt controls imposed on universities in the early 1980's dealt with State Department requests to limit the studies and activities of visiting scientists and foreign nationals. For example, in 1981 the State Department requested Cornell University to restrict a Hungarian scientist to the classroom, with no outside discussions, for his study of electronics, and the universities of
Stanford, Wisconsin, Ohio State, and Auburn were requested to restrict the activities of a visiting Soviet scientist. In addition, several university research centers received State Department requests to provide information about the study programs of their foreign science students.

Restrictions on technology transfers were also evident at scholarly conferences. In February 1980, the sponsors of the International Conference on Bubble Memory learned that an export license was required before admitting Communist bloc scientists to the meeting. That same month, the State Department informed the organizers of a conference on inertial-confinement fusion research that eight Soviet scientists would be denied visas to attend the meeting. Later that year, the Department of Defense released a memorandum stating that export controls might be used to regulate the dissemination of unclassified technical research data and that access to research supported by the Department of Defense might be restricted to only United States citizens and immigrant aliens.

Universities and researchers balked at the restrictions. Following the Department of Defense memorandum, presidents of five major universities sent a letter in 1981 to the Secretaries of State, Commerce, and Defense that stated concern about the government's increasing control of scientific communication. Officials assured them that any extension of export rules would not apply to basic theoretical work. A year later, Pentagon officials blocked papers submitted to the annual
international symposium of the society of Photo-Optical
Instrumentation Engineers because of national security reasons
and the presence of foreign nationals at the symposium. 66

Academicians argued that as a practical matter, these export controls
applied to university activities limited U.S. scientific development
and that the constraints on the traditional free exchange of ideas
blocked additional scientific research. 67 In addition, they believed
that restrictions on intellectual exchange with foreign nationals
resulted in a loss of significant talent and contributions of both
students and faculty. 68 As a further practical matter, they argued
that increased controls on scientific communication would be too difficult
to enforce, especially controls affecting contact with foreign
students and researchers.

Employment figures for science and engineering foreigners
with Ph.D.s in 1981 shows that about fifty-five percent worked in
educational institutions. 69 In the 1982-83 academic
year twenty-seven percent of all students earning doctorates at
U.S. universities were foreign students. 70 Controlling the type
of contact or transfer between foreign nationals and their American
colleagues would be particularly difficult for universities. For
example, a foreign student could receive information on advanced tech-
nology in a regular classroom or in casual conversation with other
students, as well as in the employ of a university research center.
Policing activities or trying to apply uniform standards of conduct
in diverse situations would inflict an enormous burden on university
operations.

Apart from the practical implication of the controls, the academic
community questioned the constitutionality of the controls as to
"an academician's interest in free speech, personal fulfillment,
and liberty to carry on a profession." Restrictions on expression that are before-the-fact, such as those imposed by a licensing system, can be the least tolerable of limitations on the freedom of speech. The basis for the assumption is that, while subsequent sanctions may chill communication, prior restraint may freeze it completely. Because researchers might be cautious in publishing or discussing findings for fear of noncompliance, scientific discourse could be deterred.

To the researchers and universities, the licensing requirements of the export controls suggested prior restraint and infringement of speech. Speech is unprotected by the first amendment if its purpose is to incite imminent, lawless action and is likely to result in that action. The test for determining whether the government has authority to regulate unprotected speech is the "clear and present danger" test set forth in Schenck v. United States. The government must have a compelling interest in the restriction, and the restriction itself must provide a minimal amount of intrusion on the protected right. As a restriction moves towards action and experimentation, however, only a rational basis is required to sustain the constitutionality of the restriction.

Technical information, however, is different from the usual mode of expression that purportedly "needs" protecting—political speeches, personal opinions, scholarly writings, and the like. The transfer of technical information is more than the transfer of ideas. It can provide the recipient with knowledge to carry
out plans or construct hardware with power for destruction. That argument assumes, however, that the recipient cannot get the capability for performing the destructive acts from any other source. The argument also ignores the reason for conducting basic research at universities—"research for its own sake, ideas stimulated by ideas, and serendipitous discovery." The task of suggesting how to balance the competing national objectives of national security and open scientific communication was given to the National Academy of Science Panel on Scientific Communication and National Security. The panel was created in 1982 after discussions among officials of the National Science Academy and the Department of Defense. Under the aegis of the panel's standing Committee on Science, Engineering, and Public Policy, the panel's charge was to "examine the relation between scientific communication and national security in light of the growing concern that foreign nations are gaining military advantages from such research." The panel concluded that while the problem of technology transfer was real and that a significant portion of the transfer had been damaging to national security, any impact from universities and open scientific communication was negligible. The panel further concluded, that, undoubtedly, some things by their very nature must be secret, such as properties of actual weapons systems. Those secrets should be classified strictly and then carefully guarded.

In gray areas of research--research areas that are hard to categorize as either basic or applied research--classification
was deemed inappropriate by the panel. A relatively small handful of such technologies exist and the time from discovery to application is usually short. The panel suggested four guidelines for classified and gray-area research.

1. University basic or applied research should be unrestricted unless it is a rapidly developing technology, is a process-related or production technique that is dual-use or has direct military applications, gives the U.S.S.R. a significant near-term military advantage, and is known only in the United States or in a friendly nation with a secure control system.

2. Classification should be considered if government-supported research will lead to military products in a short time.

3. If the criteria is met, but classification is unwarranted, written agreements can prohibit direct participation in government-supported research by nationals of designated foreign countries, but not the physical access to university facilities or study.

4. The government should be obligated to record regularly written agreements that impose restrictions on scientific communication.

IV Amendments and Revisions to the Export Controls

Congress struggled two years to enact EAA 1985; the Department of State took more than four years to revise ITAR. Neither the amendments nor the regulations make sweeping
changes; however, each contains segments that have the potential to remedy the restraints academicians felt under the former law and regulation. The EAA amendments address the issue of academic freedom in a policy statement and in an exemption from prior reporting. The ITAR regulations soften disclosure requirements to foreigners in an academic setting.

A. EAA 1985

The United States wants, by way of the EAA, to exert restrictions when necessary to protect its national security, foreign policy, and economic objectives. The need to protect national interests mandates some kind of basic regulatory procedure; therefore, the House subcommittee members focused on efficiency and procedural requirements when they began working on the amendments to the EAA. Procedure, however, must maintain a difficult balance to allow trade to function as freely as possible, and the committee members provided special measures that allow communication between university researchers.
Scientific Communication Policy Statement

EAA 1985 adds a policy statement to the EAA that expresses an intent by the United States to preserve free communication among scientists and scholars:

It is the policy of the United States to sustain vigorous scientific enterprise. To do so involves sustaining the ability of scientists and other scholars freely to communicate research findings, in accordance with applicable provisions of law, by means of publication, teaching, conferences, and other forms of scholarly exchanges. ²⁸²⁸

In explaining the Act's new policy statement, the Conference Committee made special mention of the findings of the 1982 NAS study panel.²⁷ The Committee agreed that long-term security is best protected when "traditional scientific communication activities of universities and the academic community, such as basic research, publications, and exchanges in the open classroom and among scholars should be free from restriction..."¹⁰⁰ The Committee qualified that statement, however, by adding that restrictions were appropriate if the scientific information was
"...subject to security classification under the President's Executive Order 12356" or if "its availability in the United States is limited by government contract controls or proprietary or trade restrictions."\textsuperscript{101} 

The committee suggested that science and national security are not antagonistic to each other and that both scientists and government leaders realize that the national security concept includes economic, cultural, and other considerations as well as military applications and preparations.\textsuperscript{102} The committee recognized that the government must oversee areas of legitimate concern about the transfer of scientific communication that could damage national security.\textsuperscript{103} The conferees believed, nevertheless, that existing provisions of control were sufficient.\textsuperscript{104} The committee relied on provisions that give authority to declare material classified, to control work performed under contracts, and to limit the entry to and movement within the United States of foreign nationals.\textsuperscript{105} The conferees concluded that any deviation from those provisions to restrict traditional scientific communication would bear "a heavy burden of justification to the Congress."\textsuperscript{106} 

Section 105

Section 105 of EAA 1985\textsuperscript{107} contains provisions that pertain to national security control. Included are policy toward individual countries,\textsuperscript{108} export licenses,\textsuperscript{109} multilateral export controls,\textsuperscript{110} commercial agreements with certain countries,\textsuperscript{111} and negotiations with other countries.\textsuperscript{112}
The conferees emphasized that, with one exception, educational institutions are subject to the same controls and license requirements of technology transfers as any other exporter. That one exception for educational institutions is in section 105(a) of the EAA 1985 Act, commercial agreements with certain countries.\textsuperscript{113} The section expands the category of agreements by requiring a firm or enterprise to report to the Secretary any unpublished technical data of United States origin that would be an export as part of an agreement calling for technical cooperation with a government agency of a controlled country.\textsuperscript{114} The section, however, retains the exemption in current law for educational institutions to report export technical data.\textsuperscript{115}

The Conference Committee's concern of possible prior restraint of scientific discourse prompted the continued exemption. The committee cited \textit{Trane Co. v. Baldridge}\textsuperscript{116} as its basis, noting that courts have generally recognized a freer standard for academic discourse than for commercial.\textsuperscript{117} Therefore, the committee concluded it was appropriate to require prior reporting of commercial agreements with foreign agencies, while excluding "colleges, universities, and other educational institutions."\textsuperscript{118}

The educational institutions must, nevertheless, obtain appropriate licenses before exporting any controlled technology, technical data, or goods, and an institution that has a research contract with a United States government agency must report to
the Secretary of Commerce any agreement with an agency of a controlled country that might involve technology transfer.\textsuperscript{119}

The committee expressed concern that the Department of Defense had imposed restrictions on the exchange of information through international conferences and scholarly activities.\textsuperscript{120} It stated that the Defense Department did not have unilateral authority to either determine what activities at educational institutions require export licenses, to impose prior reporting, or to censor scientific meetings unless the information involved was under a Defense Department contract that stipulated the actions.\textsuperscript{121}

**ITAR Revisions**

The primary cause of conflict between academics and the government was the controls imposed upon the export of unclassified technical data.\textsuperscript{122} The definition of "technical data"\textsuperscript{123} was a key source of controversy.\textsuperscript{124} In 1978, the Ninth Circuit upheld the constitutionality of ITAR in *United States v. Edler Industries, Inc.*\textsuperscript{125} The court recognized that the definition of technical data\textsuperscript{126} was "susceptible to an overbroad interpretation"\textsuperscript{127} when applying it to scientific communication, but it read into the regulations a scienter requirement that the defendant must know or should have reason to know that the technical data would be for a prohibited military use.\textsuperscript{128} The court also added a condition. The technical data transfer of which the defendant is accused must be "directly and significantly related" to an item on the Munitions Control List.\textsuperscript{129}
In revising the regulations, the State Department clarified the language to address the academics' concerns that the definition of technical data was overly broad. First, the new definition, following Edler, restricts unclassified information to information "directly related to" defense articles and defense services. Second, the broad provisions regarding new art restricts unclassified information to "information which advances the state of the art of articles on the U.S. Munitions List." Finally, the definition "does not include information concerning general scientific, mathematical, or engineering principles."
Although the definition of the word, "export," remains broad, the ITAR revision provides some relief in disclosures to foreigners in an academic setting. Disclosures are exempt from the licensing requirements of ITAR if the disclosure is made (1) in the United States, (2) to a "bona fide and full time regular" employee whose permanent abode during employment is in the United States, (3) who is not a national of a designated communist country, and (4) who has been advised in writing by the university that he or she may not transfer the data to other foreigners without the prior written approval of the Office of Munitions Control.

The Gray Areas

The comments expressed in the policy statement of EAA of 1985, the continuance of exemptions from prior reporting, and the concessions set forth in the definitions of ITAR narrow the range of First Amendment and academic freedom issues for researchers. Substantial tensions, however, will probably continue in the area of technology transfer controls. For example, the classification of research projects and regulations concerning foreign nationals will likely remain topics for disagreements much the same as before the enactment of the new regulations.

Gray research areas, where some form of restriction could be justified, are also of particular concern. Dale Corson, chairman of the Panel on Scientific Communication and National Security, predicted that if the government extended further the concept of grayness, export controls would result in the exclusion of foreigners from university research. He also
predicted that major research universities would abandon any research area where classification might be imposed.\textsuperscript{147}

A number of universities, including those among the top recipients of federal research funds, do not accept classified work on campus.\textsuperscript{148} In addition, Executive Order 12356 provides that basic scientific research not clearly related to the national security may not be classified.\textsuperscript{149} Reclassification, however, is a possibility. The executive order authorizes the President or agencies to reclassify information previously declassified and disclosed if it is determined that the information requires protection for national security and if it can be reasonably recovered.\textsuperscript{150} Classification or reclassification is also authorized if an agency receives a request for it under the Freedom of Information Act\textsuperscript{151} or the Privacy Act of 1974.\textsuperscript{152}

Economic considerations and vulnerability compound the researchers' dilemma.\textsuperscript{153} The government is the largest single patron of research and research training at universities.\textsuperscript{154} In fiscal year 1979, funds from government support for university research surpassed $3 billion.\textsuperscript{155} The National Science Foundation alone spent about $400 million that year for all university research.\textsuperscript{156}

The dollar figure from the military will likely grow. The Defense Department has a shopping list for special projects\textsuperscript{157} that appeal to academics who must live within budget constraints. The projects also appeal to the usually inquisitive researcher; creativity and novelty are the major elements of the wide breadth
of projects. Another is a National Science Foundation grant to four university campuses to set up national supercomputer centers.

The projects in the preceding paragraph are unclassified, yet the gray area category of most of this work causes anxiety for both researchers and agency officials. The situation is still unclear about the participation of foreign nationals, and researchers fear that the restrictions of the EAA will be invoked. Recently, the Department of State and Defense proposed to restrict access by Soviet-Bloc and Chinese researchers to the supercomputer centers funded by the National Science Foundation by inserting restrictive language in the contracts. Government officials argue that efforts to stop the flow of technology, especially supercomputers, to communist countries would be hampered by unlimited access to the machines. Furthermore, any unchecked technology transfer would be all at government expense.

V. Balancing Academic Freedom and National Security

The dilemma of striking a balance between academic freedom and national security may be impossible to solve. Part of the difficulty is in defining the boundaries of academic freedom; its legal source, scope, or even its existence is uncertain. The situation is somewhat like that of the famous judge in the obscenity case who said he could not define obscenity but knew it when he saw it. Most academics would be hard pressed to define academic
freedom, but they know violations of it when they see them.\textsuperscript{167}

The term "national security" is not as difficult to define;\textsuperscript{168} however, it, too, is open to various meanings and opinions. Inman\textsuperscript{169} said that the tension between technological expression and national security was inevitable. He said it resulted on the one hand, from the scientist's desire for unconstrained research and publication, and on the other, from the government's need to protect certain information from potential adversaries who might use the information against the United States. Since both are powerful forces, the task of finding a workable, just balance is difficult.\textsuperscript{170}

Whether or not the EAA of 1985 and the revisions to ITAR present a workable, just balance is still to be determined. Movement, at least, seems to be in the right direction. The new policy statement in EAA 1985\textsuperscript{171} limits scientists and scholars to communicate research findings "in accordance with applicable provisions of law."\textsuperscript{172} The remainder of the statement, however, allows scholars "freely to communicate ... by means of publication, teaching, conferences, and other forms of scholarly exchange."\textsuperscript{173} As a statement of congressional policy and nothing more, the statement has no direct effect on the extent to which the regulations apply to scientific exports.\textsuperscript{174} As a strong statement of Congress's intent, however, it lessens considerably the possibility of requiring export licenses for exchanging information at seminars, in classrooms, or through publication. Scientific research and progress are the heart of
the technology that the export controls seek to protect under the rationale of national security. If the government hampers research by exerting excessive export controls, scientific progress is hampered, also. The Conference Committee was "deeply concerned" about government overreaching and specifically singled out the Defense Department as having been overly intrusive into the exchange of information between scholars. Now, with the policy statement, universities have a definitive, legislative shield that should help to protect against further intrusions from governmental departments and agencies.

Congress's act of continuing exemptions from prior reporting for universities of published or unpublished technical data of United States origin should also be welcomed by scholars. A new requirement for United States business firms is that they must report unpublished technical data that is part of an agreement with a government agency of a foreign country. Any similar requirement for universities was deemed possible prior restraint. The exemption for educational institutions provides legislative backing to court holdings that academic communication is subject to fewer controls than that of commercial communication.

Controls, if any, on academic publications needed to be drawn carefully for reasons other than prior restraint or academic freedom issues. As the NAS Panel pointed out, more than 2,000 reputable scientific journals form an international communications channel among scientists; however, the number of articles by U.S. authors is only about thirty-seven percent of
the total number published. The Panel also mentioned that an analysis of citations of journal articles shows that U.S. researchers rely on foreign research results to a marked extent, indicating that a rush of basic or applied militarily critical technological secrets from U.S. university researchers is more imagined than real, at least in published form. The Panel on Scientific Communication and National Security recommended that voluntary publication controls be considered in limited situations. Under the EAA 1985 amendments, however, prior reporting and publication controls for universities still apply only when the research has an identifiable direct military application or if it is dual-use and involves process or production-related techniques.

Researchers concerned with government restraints on communication with foreign nationals also have some relief with the new ITAR regulations that provide guidelines for foreign national employees; but universities still face control problems with foreign nationals who are not university employees. Scientific seminars, exchange programs, and travel abroad are important in communicating research results. These formal and informal meetings naturally bring foreign and U.S. researchers together in situations where the foreigner is not an employee and can result in an exchange of information. The increased likelihood that information will be transferred in face-to-face meetings will probably be a primary factor for the government to continue restrictions on the access of foreigners to university research, particularly in dual-use areas. To help
resolve the issue of dual-use research and to provide further
guidance to Congress, a complementary study to the 1982 NAS panel
report is underway. The study panel's task is to weigh the
costs and benefits of controls that limit or eliminate the
transfer of dual-use technologies to possible adversaries. The
panel also plans to investigate alternate control measures and
set priorities among them. 182

Whatever the outcome of that study and regardless of the
interdependence between government and the university, tension
will likely always exist. Government "can be, and often is, at
one and the same time a patron, adversary, buyer, and
regulator." 183 As the largest patron of universities, it
habitually provides funds for university research. Some
researchers may have believed that the reason for the good
fortune of money was merely because they deserved it, but the
patronage is not entirely beneficence. In funding research to
solve the government's and the public's problems, whether for
defense, space exploration, or health care, the government
acquires a proprietary interest in the university. When the
government has a direct proprietary interest in the university,
it constitutionally is allowed to impose restrictions on research
findings, 184 and in the absence of express contractual
provisions, the government may use its power to classify
information in which it has a proprietary interest. 185
Therefore, in making contractual agreements to do government
research, researchers become subject to the same regulations to
which the industrial and business communities are subject, and
the government is really not beholden to universities to make any
concessions in the proprietary sense.

At least one writer\textsuperscript{186} says that pressures on researchers to
introduce new commercial and military products is transforming
the research process, as well as research data, into intellectual
property, which can be owned or possessed. Traditionally,
researchers have believed that research processes and data that
were funded by grants, rather than by contracts, belonged to the
researcher.\textsuperscript{187}

The researcher, therefore, was in control of the time and
manner of disclosure. Extending the concept of intellectual
property rights to research data and processes, however, creates
a broad arena for competing claims and possibly more external
restrictions to be exerted by the government.\textsuperscript{188}

Academic freedom is also essentially a concept of control,
but it is less controversial than that of research as a property
right. Property rights raise the spectre of external control, a
force that researchers regard as a "threat to the quality and
integrity of research."\textsuperscript{189} The unique situation of the
university researcher working in a combination of education and
research promotes scholarly investigation into ideas that could
be blocked if creativity must always be preceded by regulation.
Issues of academic freedom have survived a number of tests since
the first of the century.\textsuperscript{190} Its most recent success is shown by
Congress's response to university needs in its balancing of
academic freedom with national security in forming the new EAA
1985 amendments and ITAR regulations. That attempt at balancing provides a map for future excursions into conflict solution of government-university tensions. When universities are alert to spot intrusion by regulations that distort the university's unique purposes and subsequently set about delimiting the regulation through studies such as the NAS panel, government leaders are likely to respond to protect both the public interest and the integrity of the university.

Conclusion

Controls placed on university research by way of regulations intended for primarily commercial transactions arguably infringed researchers' First Amendment rights and their traditional rights of academic freedom. The long-awaited amendments to the EAA provided universities with a strong congressional policy statement, but the Act significantly leaves the basic structure of U.S. export controls intact. Gray-area research will remain in a delicate balance as government and universities each seek their own ends.

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1. Export controls are of four general types. This paper addresses the first two:


3. 22 C.F.R. 120-30 (1985) [hereinafter ITAR]. The regulations implement the export of defense articles and defense services under the Arms Export Control Act, 22 U.S.C. § 2778 (1982). They are primarily administered by the Director of the Office of Munitions Control, Bureau of Politico-Military Affairs in the Department of State.


As a workable tool, the Export Administration Act of 1979 (EAA) particularly had its faults and detractors. For exporters it was a maze of regulations that hampered competitiveness, and for enforcement agencies, it was a law that lacked force to reach all violators. Overly, supra note 5, at 445-46. And for some members of Congress, it was a grant of too broad an authority to the President to control exports. 131 Cong. Rec., H2005 (daily ed. April 16, 1985).

6. **No** Between 1972 and 1974 eleven bilateral agreements in interacademy science and technology went into effect between the United States and the Soviet Union. By 1982, however, the agreements were either cancelled or not renewed. Among the reasons given are the Soviet-supported

7. The general policy of the EAA is to protect the economy from the excessive drain of scarce materials, to further foreign policy and fulfill international responsibilities, and to exercise vigor to maintain and protect national security. 15 C.F.R. § 370.1(a).

8. Open trade had been the touchstone of detente in the 1970's, and considerable technology, especially computer hardware and ball-bearing grinder machinery that could be used for military purposes, entered Soviet hands. NAS, supra note 6, at 101.

9. "Dual use" items or technology can be used for either peaceful or military use. L. Melvern, Techno-Bandits. How the Soviets are Stealing America's High Tech Future, 273-4 (1984).

10. Foreign availability is determined by whether the same or a comparable commodity is available from other non-Communist countries. 15 C.F.R. 370.1(i) (1985).

11. Alexander, supra note 5, at 174-5. Since World War II, the government's relationship with universities had been one of "benign sponsorship." See notes 42-48 infra and accompanying text.


14. The EAA has 24 sections with subject matter that ranges from "Unprocessed Red Cedar," EAA supra, note 2 at § 7(i) to "Countries Supporting International Terrorism," EAA, supra note 12, at § 6(i).


16. EAA, supra note 12, at § 5(e).

17. Id. at § 11.

18. Id. at § 5(d). "Critical technology" is defined by the Defense Department as: classified and unclassified nuclear and non-nuclear unpublished technical data, whose acquisition by a potential adversary could make a significant contribution, which would prove detrimental to the national security of the United States, to the military potential of such country--irrespective of whether such
terminology is acquired directly from the United States or indirectly through another recipient, or whether the declared intended end-use by the recipient is a military or non-military use. Overly, supra note 5, at 424 n. 2.

19. EAA, supra note 12, at § 5(d)(2). The MCTL is a reference list of technology goods and information subject to export controls. The public version of MCTL was released in November 1984. It contains about 250 pages and does not list technologies classified as secret that are listed in the full version. Research & Development, Feb. 1985, at 76, col. 1.

The EAA also has a Control List (CL). EAA, supra note 12, at § 4(b). The CL lists more than 300 entries of items that require an export license. The specific commodities that are listed cover a range of articles from shoelace-tipping machines to lasers. Yore, Free Trade and National Security, 5 Cal. L. Rev. 46, 47 (1985).

20. See generally Overly, supra note 5, at 431.


23. A defense article is any item designated on the Munitions List. See note 24, infra. The term includes models and other items that reveal technical data directly relating to those items. 22 C.F.R. § 120.7 (1985).

The term, "defense service," means to give assistance with defense articles to a foreign person; for example, in training, overhauling, or processing the article. The term also means to give technical data to any foreign person. 22 C.F.R. § 120.8 (1985).
24. 22 C.F.R. 121.1(b) (1985). The ML has twenty-one categories, such as "military and space electronics."


26. A "foreign person" means a person who is not a citizen or national of the United States unless the person is a permanent resident in the United States. 22 C.F.R. § 120.11 (1985).

27. 22 C.F.R. § 120.10 (1985).


29. Id. at § 1.1(a)(1)(2)(3).

30. Congress had legislated some export controls shortly after World War II, but the Export Control Act was the first comprehensive legislation to control exports in peacetime. Alexander, supra note 5, at 173. See also Overly, supra note 5, at 426.


In 1949 the United States also joined with six allies to form the Coordinating Committee on Export Controls.

32. The rationale was to prohibit anything that might enhance the economic or military potential of the Communist countries. Overly, supra note 5, at 427.

33. Presidents Nixon, Ford, and Carter directed policy that offered expanded trade to the Soviets in return for constrained activism in international affairs. NAS, supra note 6, at 103.


35. Overly, supra note 5, at 430.

36. The Bucy Report recommended strict control over three types of exports: "(a) arrays of design and manufacturing know-how; (b) 'Keystone' manufacturing, inspection, and test equipment; and (c) products requiring sophisticated operation, application, or maintenance know-how."

NAS Report, supra note 6, at 31.

37. Id.

38. Id. at 32.

39. EAA, supra note 12 and accompanying text. See also NAS Report, supra note 6, at 32.
National security controls differ from foreign policy controls in their philosophy and purpose. The goal of national security controls is to stop the transfer of exports that may have military applications. Foreign policy controls stop specific goods or focus on actions of specific countries. Alexander, supra note 5, at 194.

Id.


Id. at 118. The Applied Physics Laboratory continued under the management of John Hopkins University and the Los Alamos Laboratory remained under the direction of the University of California.

Id.

Id. Europe was no longer the source of a steady stream of basic research results. The universities in the United States had almost shut down graduate programs during the war; therefore, fellowships were needed to fill the gaps. Nat'l. Acad. of Sci., Com. on Sci. and Pub. Pol'y Federal Support of Basic Research in Institutions of Higher Learning 35 (1964) [hereinafter NAS Higher Learning].

Killian, supra note 42, at 118.

Id.
46. In the United States, the university combined basic research, a mixture of applied research, and undergraduate education in the same place and done by the same people, a departure from the system of other nations. Rosenzweig, The Research University and Their Patrons, The Regents of Southern California, 3 (1982).

49. NAS Report, supra note 6, at 22. Depending on how "major research university" is defined, between fifty and one hundred and fifty major research universities are in the United States. Id.

50. Id.

51. Id. at 42.

52. Id. An example of basic research that could provide early military application is the area of microelectronics.

53. Id.

54. "Recipe" specification was a special concern. In some cases, the researchers must develop a series of practical steps to apply a scientific principle to manufacture a product. The resulting "recipe" becomes the information that requires protection, because the scientific principle has little use without it. Id.

55. Id.

56. Id. at 101.

57. Id.
58. The Hungarian cancelled his trip when he learned he could not attend private seminars or read pre-publication copies of research papers. Sullivan & Bader, supra note 5, at 454-54. See also Alexander, supra note 5, at 175, n. 7.

59. The Soviet was a robotic expert visiting each campus. The restrictions would have reduced the scientist's work to the theoretical level and denied him access to industrial facilities and unclassified research funded by the Department of Defense. The universities indicated that the restrictions conflicted with open scientific communication and attempts at compromise between the government and universities failed. NAS, supra note 6, at 103-4.

60. The University of Pittsburgh cooperated with the request by mailing a copy of the physics department catalogue that described the courses because "... all of our graduate students are treated the same way." Alexander, supra note 5, at 175 n. 6 (quoting Edward Gerjuoy of the University of Pittsburgh in Anderson, Keeping High-Tech Secrets, Newsweek, Jan. 25, 1982, at 34).

61. The sponsors, the American Vacuum Society received the notice from the Department of Commerce one week before the conference was to start. Because of practical difficulties, the sponsors requested that the Communist
Bloc scientists not attend. Sullivan & Bader, supra note 5, at 453. See also Nelkin, supra note 5, at 77-8; NAS Report, supra note 6, at 104.

62. Organizers of the conference were the Optical Society of America and the Institute of Electrical and Electronics Engineers. NAS Report, supra note 6, at 103.

63. The director of the Very High Speed Integrated Circuit (VHSIC) program of the Department of Defense released the memorandum. NAS, supra note 6, at 104.

64. Id. at 136-39. The presidents of Stanford University, M.I.T., Cornell University, the California Institute of Technology, and the University of California wrote:

    . . . Restricting the free flow of information among scientists and engineers would alter fundamentally the system that produced the scientific and technological lead that the government is now trying to protect and leave us nothing to protect in the very near future . . . the only realistic way to "contain" VHSIC research is to classify the whole program. . . . In our view this would be a self-defeating effort: the science underlying high technologies cannot be put back into the bottle. . . . Id. at 138.

65. Nelkin, supra note 5, at 87-8.

66. Although the reviewed papers were only of work supported by military contracts, over 150 of a total of 626 papers were withdrawn. Id. See also NAS, supra note 6, at 107; Sullivan & Bader, supra note 5, at 452.
67. Alexander, supra note 5, at 176. Science is an "intensely social enterprise." Piel, Scientific Research, Determining the Limits, in Regulation of Scientific Inquiry, at 41, 44 (1979). The value of the scientist's research correlates with the understanding and reordering of the research done before and after, as well as that carried on by the scientist's contemporaries. Id.

Research at MIT's Sloan School of Management show that communication patterns differ between scientific (science) and engineers (technology). While scientists in the study concentrated on literature and colleagues outside their organization for exchange of information, the engineer relied most heavily on colleagues, including vendors and customers that were unused by scientists. Thomas J. Allen, Managing the Flow of Technology: Technology Transfer and the Dissemination of Technological Information Within the R&D Organization (1977).


69. NAS Report, supra note 6, at 128. About thirty-seven percent worked in business and industry, a little over two
percent worked for nonprofit organizations, and slightly over one and one-half percent worked for the U.S. government. Most of those working for the U.S. government worked in bioscience, physics, or chemistry. Id.


72. Alexander, supra note 5, at 177. In addition to an interest in maintaining open scientific communication, the researcher has a professional stake in having his results publicized. With publication comes peer recognition and job security, and thus it is also a vehicle for personal fulfillment. Id.

73. NAS Reports, supra note 6, at 33.

74. Id.

75. Alexander, supra note 5, at 177. First amendment protections do not invalidate all governmental efforts to control the flow of technical data. NAS Reports, supra note 6, at 33.

76. See generally Alexander, supra note 5, at 208-27. The Constitutional issue was recognized by the Justice Department in 1978. That Department sent a memorandum addressed to then scientific advisor to President Carter, Dr. Frank Press. The memorandum concluded that the ITAR licensing requirements were a prior restraint prohibited by the first amendment and violated first amendment doctrines of overbreadth and vagueness. Sullivan & Bader, supra note 5, at 458-59.
Holmes's opinion states that the question of "clear and present danger" is one of "proximity and degree." Id. at 52.

Green, The Boundaries of Scientific Freedom in Regulations of Scientific Inquiry, Societal Concerns With Research, 139 141.

The prevailing judicial attitude is that where the government is under no constitutional limitation, the courts will not "second-guess the legislature as to the wisdom, desirability, or necessity for regulation." Id. at 141.

Alexander, supra note 5, at 208.

Id.

Research & Development, Sept. 85, p. 11.

NAS Report, supra note 6, at ix.

Id. The discussions were precipitated by government announcements calling for tighter controls on all technology transfer, including publication in scientific journals and research visits.

Id.

Id. at 19, 41.

Id. at 48.

Id. at 49-51.
97. Id. at 49. The panel gave examples of research that would not meet all four criteria. It said that monoclonal antibody research is developing rapidly, but it appeared that that area of research could never result in a significant military advance. Also, although aerodynamic design research would probably possess military significance, it was a mature, slowly evolving field; therefore, it too should have no controls.

90. The panel noted that most universities will not undertake classified work. Id.

91. Id. at 150. The panel said that the government had authority to limit visas to foreign nationals who are suspected of wanting skills that would damage national security. In extraordinary circumstances, the government could "seek to ensure" that resources provided by the government were not used to support foreign nationals of "specified countries" who want to work in "specified programs." Id.

92. Id. The panel recommended accurate record keeping to help officials supervise the gray-area research criteria and to analyze the long-term effects of any restrictions on gray-area research. Id.

93. The EAA had expired in March 1984, and President Reagan, under the authority of the International Emergency Economic Power Act (IEEPA), reimposed its provisions.

On the first day of the 99th Congress, the bill was introduced under the leadership of Congressmen Bonker and Roth of the House Foreign Affairs Committee. A conference committee settled final disagreements, and each House passed the Act on June 27, 1985. 131 Cong. Rec. S. 8924 (daily ed. June 27, 1985). The President signed the Act on July 12, 1985.


95. Hirschhorn, supra note 94, at 675. See also Harris & Bialos, Congressional Balancing Act Benefits Exporters, Legal Times, Aug. 5, 1985 at 17, col. 1.

96. EAA, supra note 12, at § 3(2).

97. 131 Cong. Rec. H2010 (daily ed. April 16, 1985) (statement of Rep. Roth). The Conference Committee set four goals: (1) reduce the number of items subject to export controls; (2) improve the security of any foreign sales of militarily critical technologies; (3) expedite the licensing process; and (4) establish a set of criteria and procedural requirements to govern foreign policy controls. Id.
EAA 1985 addresses all four goals. It: (1) decontrols low-technology efforts; EAA 1985, *supra* note 2, at § 105(b)(2) (amending EAA, *supra* note 12, at § 5(b)).

2(a) strengthens sanctions, EAA 1985, *supra* note 2 at § 112(a) (amending EAA, *supra* note 12, at § 11(a)); (b) creates a new criminal offense, EAA 1985, *supra* note 2, at § 112(b) (amending EAA, *supra* note 12, at § 11(b)); and (c) enhances enforcement, EAA, 1985, *supra* note 2 at § 113 (amending EAA, *supra* note 12, at § 4(a)).

(3)(a) provides new license options; EAA 1985, *supra* note 2, at § 104(a) (amending EAA, *supra* note 12, at § 4(a)); and (b) speeds up licensing. EAA 1985, *supra* note 2, at § 111 (amending EAA, *supra* note 12, at § 10); and

(4) strengthens the enforcement authority of the coordinating committee (CoCom); EAA 1985, *supra* note 2, at § 5 105(f) (amending EAA, *supra* note 12, at § 5(i)).

In addition, the EAA 1985 Act limits the President's authority to impose controls; EAA 1985, *supra* note 2, at § 108(d)(e)(f) (amending EAA, *supra* note 12, at § 6).


100. Id.

101. Id.

102. Id.

103. Id.
104. Id.
105. Id.
106. Id.
107. EAA 1985, supra note 2.
108. EAA 1985, supra note 2, at § 105(b) (amending EAA, supra note 12, § 5(b)).
109. EAA 1985, supra note 2, at § 105(d) (amending EAA, supra note 12 at § 5(e)).
110. EAA 1985, supra note 2, at § 105(f) (amending EAA, supra note 12, at § 5(i)).
111. EAA 1985, supra note 2, at § 105(g) (amending EAA, supra note 12 at § 5(j)).
112. EAA 1985, supra note 2, at § 105(h) (amending EAA, supra note 12, at § 5(k)).
113. EAA 1985, supra note 111.
114. Id.
115. EAA 1985, supra note 2, at § 105(g) (amending EAA, supra note 12, at § 5(j)(2)). "The provisions . . . shall not apply to colleges, universities, or other educational institutions." Id.
116. 552 Fed. Supp. 1378, aff'd 728 F.2d 915 (1982). The plaintiff corporation wanted to respond to questionnaires submitted by Arab countries concerning the company's business relationship with Israel, but was forbidden to do so by the EAA, supra note 12. The Court held that the plaintiffs did not have a First Amendment right to answer the questionnaire.

118. Id.

119. Id.


121. Id.

122. Hirschhorn, supra note 94, at 682.

123. 22 C.F.R. § 120.21 (1985). The old ITAR's definition of "technical data" included "any unclassified information that can be used, or be adapted for use in the design, production, manufacture, repair, overhaul, processing, engineering, development, operation, maintenance, or reconstruction of" items on the Munitions List.

Another portion of the old definition defined "technical data" as "any technology which advances the state-of-the-art or establishes a new art in an area of significant military applicability in the United States." Published information was excluded, but information that was only indirectly related to any of the items on the Munitions List or communicated in a noncommercial setting could be within the definition. Hirschhorn, supra note 94, at 682.

125. 579 F.2d 516 (9th Cir. 1978). The defendant corporation instructed a French missile company in unclassified techniques to produce carbon/carbon composites after the State Department denied its application.

126  Id. at 519.

127.  Id. at 520.

128.  Id. at 521. The techniques used by the defendant corporation had various civilian as well as military uses. Carbon/carbon technology is used in the manufacture of golf club shafts in addition to missile components.  Id.

129.  Id.  See also Sullivan & Bader, supra note 5, at 459.

130.  See supra note 125 and accompanying text.  See also 49 Fed. Reg. 47, 683 (1984); Hirschhorn, supra note 94, at 682.
131. ITAR § 120.8. The term, "defense services," was not defined in the superseded ITAR.


133. Id.

134. 22 C.F.R. § 120.10 (1985). See supra note 24 and accompanying text.


136. Id. See Hirschhorn, supra note 94, at 638 n. 103.

137. See EAA 1985, supra notes 98-106, and accompanying text.

138. See EAA 1985, supra notes 107-121, and accompanying text.

139. See EAA 1985, supra notes 122-36, and accompanying text.

140. Hirschhorn, supra note 94, at 683.

141. Id.


143. NAS Report, supra note 6, at 66. Gray areas are those in which all of the criteria for controls listed by the NAS Panel are met, but in which classification is unwarranted.

144. Research & Development, July 1985, p. 44.


146. NAS Report, supra note 6.

147. Green, supra note 145.

148. Stanford University, The Massachusetts Institute of Technology, and the California Institute of Technology do not accept military contracts for classified work on
campus, although they are among the top ten recipients of Department of Defense Funds.

149. E.O. 123567, supra note 27, at § 1.6(b).

150. Id. at § 1.6(c). Mandatory review procedures for declassification are in §§ 3, 4 of Executive Order 12356, supra note 27.


152. Id.

153. Nelkin, supra, note 5, at 85.

154. Rosenzweig, supra note 48, at 15. During the Vietnam War period of student protests, the relationship between government and universities was a polarizing issue on campuses. Now, however, universities and the military are again searching for a workable partnership. Green, Senators and Scientists Object to SDI Costs and Uncertainties, Physics Today, July 1985, at 56.

155. Rosenzweig, supra note 48 at 16. In 1940, funds for scientific research in universities from all sources totaled $31 million. Aside from inflation, one reason for the smaller dollar figure is that prior to the 1950's, faculty at only a handful of universities were expected to engage in original research. A major exception is the field of agricultural research to which the government and, especially, land grant colleges were committed. Id.

156. Id.

157. Strategic Defense Initiative (SDI) requires improved lasers, advanced optical and interferometric sensors,
microelectronics, megavolt accelerators, supercomputers, and software that contains 10 million lines of error-free code in addition to a vast array of other technical items for a space defense system. Green, supra note 145, at 56.

158. Id.

159. The Office of Innovative Science and Technology (IST) finances the six research consortia. The contracts award $62 million over periods ranging from three to four years for basic research on subjects ranging from non-nuclear space power to chemical-laser exhaust problems. Anticipating pessimism and opposition to its program, SDI set up IST to "reach out to the scientific research community, located especially in Academe." Green, Senators and Scientists Object to SDI Costs and Uncertainties, Physics Today, July 1985, at 57.

160. In March 1985, the National Science Foundation announced plans to distribute $200 million to the University of Illinois, Champaign-Urbana; Cornell University; Princeton University; and the University of California, San Diego. Research & Development, Sept. 1985, at 11.

161. Robert Hughey of DOE's San Francisco Field Office said that some research begun openly might eventually be classified. Dwight Duston, an aide to IST's director, James A. Ionson, said that the issue of secrecy for academic research "has driven us up the wall." Green, supra note 145, at 56.

162. Id.
163. After negotiation, the contracts stated that the question of restriction will be decided later after government review. The Centers at Cornell University and the University of Illinois have refused to sign, questioning whether independent research would be impaired by signing. Research & Development, Sept. 1985, at 64-5.

164. Id.

165. A recent study commissioned by the Pentagon showed that Western Allies spend from $40 to $50 billion a year in military disbursements to compensate for inadvertent technology transfers to the Eastern Bloc. The report is called a forerunner of a more inclusive study, but Pentagon officials believe it answers a part of the earlier criticisms of the National Academy of Science. Research & Development, Price Tag Put on Damage From U.S. Tech Transfer, Feb. 1985, at 75.

166. Alexander, supra note 5, at 227. No precedent or legal authority "clearly supports the proposition that there is a constitutionally protected right to pursue knowledge or to engage in scientific knowledge." Green, supra note 145, at 139-40.
167. Alexander, supra note 5, at 227 (quoting Searle, Two Concepts of Academic Freedom, in The Concept of Academic Freedom (1975)).

168. The Department of Defense has defined "national security" as a "condition provided by: (a) a military or defense advantage over any foreign nation or group of nations, or (b) a favorable foreign relations position, or (c) a defense posture capable of successfully resisting hostile or destructive action from within or without, overt or covert." Overly, supra note 2 at 424, n. 4.


170. Id.

171. EAA 1985, supra note 2, at § 103.

172. Id.

173. Id.

174. Harris & Bialos, supra note 95, at 18, col. 1.


176. EAA 1985, supra note 2, at § 105(g) (amending EAA, supra note 12, at § 5 (j)).

177. EAA 1985, supra note 2, at § 105 (g) (amending EAA, supra note 12, at § 5(j)(2)).
Papers by U.S. scientists account for twenty-one percent of the chemistry articles and thirty percent of the physics articles. *NAS Report*, supra note 6, at 24.

*NAS Report*, supra note 6, at 223. Voluntary control mechanisms exist for cryptography, but the panel concluded that they are unlikely to be applicable to other research areas that bear on national security.


ITAR, supra note 135 and accompanying text.


Rosenzweig, supra note 48 at 19.

Alexander, supra note 5, at 239. The funding agency must write any restriction in the contract. It must also have the authority to impose the restriction. *Id.*

*Id.* Also, information developed by use of classified data may be classified.

Nelkin, supra note 5, at 4.

An exception was classified military research. *Id.*, at 5.

*Id.*

Scientists follow the concept of "individual sovereignty" as a guide to scientific behavior. *Id.*

In the early part of this century opponents to academic freedom were disturbed by "unorthodox" ideas and theories.
among university scholars. Later attacks focused on research in genetics as a matter affecting race and on military research. D. Bok, *Beyond the Ivory Tower* 21 (1982).

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