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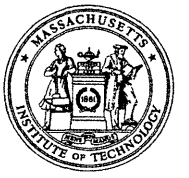

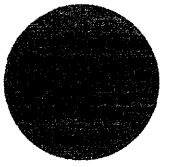

TECHNOLOGY TRANSFER IN A CHANGING NATIONAL SECURITY ENVIRONMENT

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I. INTRODUCTION

For over twenty years, the U.S. national program for export control, critical technologies, and technology security developed in an environment characterized by a deep adversarial relationship with the Soviet Union, an evolving but mostly adversarial relationship with the PRC, U.S. dominance of critical areas of technology development, a major U.S. positive trade balance with the free world, and U.S. political leadership of the industrial West. In the last decade this environment has changed as U.S. dominance has diffused across a broad community of nations and cultures. The purpose of this paper is to revisit the policy and technical bases of the older export control policy and, reflective of the significant changes in the U.S. position in all facets of the international environment, review the policy and technical framework within which DoD executes current policy and responses to new initiatives toward meeting its inter-agency, national and international responsibilities.

This paper examines technology transfer, with particular emphasis on technical aspects of U.S. export control: its history and results. It places these matters in a framework of historical evolution, and then makes some observations about trends which are most likely to be important factors in assessing future events. It concentrates on considerations which are of particular interest to the United States and Japan. These two nations are the major industrial powers of the Pacific Rim. However, their bilateral interests are best examined in the broader context of the increasingly technology-oriented world economic system and the attendant growth of interdependencies. Therefore, the economic and social importance of the nations of Europe and the balance of the Pacific Rim must be included as vital parts of the equation. They, along with Japan and the United States, form the bulwark of the free world economic system.

Simultaneously, it is important to note the dramatic changes which are taking place elsewhere. The rapidly paced events in Eastern Europe raise broader questions of technology transfer than were commonly addressed only a few months ago. The economic opportunities of all of the free world nations are increasingly linked to complex and rapidly changing technological phenomena which are often characterized so that their importance is obscured. The industrial progress and general welfare of many nations to include major democracies and newly industrialized, emerging nations are tied to the careful screening

and successful application of advanced techniques for production of a broad spectrum of material goods and services. Therefore, this paper is best considered in a broad context of current and historical events.

Our present policy has evolved from such historical events based on recognition of practical parameters and changes in the political world. We appreciate that the promising technology of today will take some time before it produces the superior military system of tomorrow. We recognize that we cannot totally stop the flow of advanced technology to a determined adversary; however, we seek to slow the rate of leakage. The United States perceives that the preservation of national security and harnessing of American skills deserves no less. We have treated export control primarily in terms of national security over the last several decades. For some other countries, export control has traditionally been primarily a trade issue. The successful blending of these two perspectives can, we believe, result in a policy which achieves both the required level of national security and a vibrant world economy.

II. BACKGROUND

A. CONCEPT OF DUAL USE TECHNOLOGIES

Advancing technology has had a major effect in blurring distinctions between military and civilian uses of technology. For those who have been used to thinking of military technology as somehow unique, the concept of "dual-use" can be difficult to grasp. It is difficult to understand, for example, how the technologies of a golf club and a military helicopter might relate, or how technologies for commercial telephone service might contribute to military command and control. Yet such understandings are essential to developing sound export controls to protect national security. Specifically, The United States' goal must be to protect national (and free world) interests while facilitating international commerce to the maximum extent possible consistent with those interests.

Key to the understanding of "dual-use" technology is an understanding of what we mean by "technology" itself. Within the arena of national security alone one can find several different definitions. All definitions, however, agree in making clear the distinction between technology as a means for attaining a given end, and the ends (products, services, etc.) themselves. This view of technology as a means to an end is critical to the concept of dual use. Specifically, in national security export control parlance, the term "dual-use" has come to apply to products or technologies that can be readily used for either civilian or military purposes.

The strategic threat posed by exports of end-items is effectively bounded by the number and life expectancy of the products involved. When we transfer technology, however, we confer an inherent capability to replicate and extend the performance of products. The specified end use cannot, therefore, be our only concern. We must also be concerned about other uses that might threaten our military or economic security.

The following examples are intended to provide an understanding and appreciation for the many diverse ways in which the concept of dual use applies. At the end-item/product level, one can find a number of civilian products that can be directly incorporated, with little or no modification, into operational military systems. For example:

- Ring laser gyros, initially developed and fielded for commercial aircraft navigation, are now finding extensive applications in military aircraft, marine platforms, and land vehicles, and as mid-course guidance subsystems in

weapons themselves. The ability to navigate with precision, and without reliance on external measurements (e.g., doppler radar) or navigation resources (e.g., GPS) is key to significant increases in mission survivability in a hostile environment.

- Microelectronics chips are also clearly dual-use items. Of note is that many of the emerging technologies being developed for commercial reasons (e.g., GaAs technology for higher speed, higher density integration for cost/producibility) have inherent performance characteristics of strategic concern. For example, GaAs offers inherently superior radiation resistance; higher level integration provides inherently greater speed and lower power consumption critical to implementing smart weapons.
- Radar designed for air traffic control directly contributes to a national air defense structure, and a number of the small, airborne radars designed for search and rescue have been derived from, and have performance characteristics equivalent to, radars designed for periscope detection. Moreover, there is a clear trend towards incorporation of automatic detection and tracking features in such radars, and towards more compact systems. These features make the systems ideal test beds for development of active anti-surface target seekers. (If necessary, these radars could even be adapted and incorporated as front-end sensors in an operational missile system.)

In terms of underlying materials and production technologies, the range of dual-use concerns becomes even greater:

- High strength composites are critical to both the performance and survivability of modern military aircraft. A classic dual-use technology, the use of fiber-reinforced composites is also pervasive in such diverse applications as golf clubs, tennis rackets, automobiles, yachts, commercial aircraft, and space-launch vehicles.
- Superalloys, and related processing technologies such as rapid solidification and superalloy coating technology, support performance advances, improved reliability and specific fuel consumption in both commercial and military jet engines.
- Semiconductor processing pervades virtually all aspects of civilian and military applications. Materials processing and quality control techniques to attain uniform high quality defect-free wafers are essential for fabrication of large IR focal plane arrays. The technologies that support higher levels of integration and producibility in general purpose VLSI also provide real-time processing and increased functionality in military applications specific integrated circuits (ASIC).
- Fiber optic technologies, now being actively pursued for commercial high bandwidth telecommunications, provide an EMI/EMP-resistant, rugged, and

highly survivable means of real-time data transfer in military platform command and control applications.

In most of the areas cited above, requirements specific to the civil sector are driving most critical technologies to perform at levels beyond those being incorporated in current operational military systems. These technology developments could contribute directly to the superior ability of free world weapon systems to operate effectively and survive in a hostile environment. This observation is not to suggest that all such products and technologies should be embargoed. It is, however, imperative that export control and technology transfer policy be based on a clear understanding of the implication and potential impact of releases of such technologies. Export control policy should be applied with a conscious and clear understanding that the resulting risks are acceptable.

The free world, in adapting to the dramatic changes in the Communist Bloc, will face many complex and difficult decisions with respect to national security, export control, and trade policy. It appears that there is promise of real change leading to the prospect of a stable and lasting peace. To realize this promise, however, we must be willing to take certain risks. Paradoxically, furthering peace may require that we share technologies that could be misused to further the war-making capability of the recipients.

The difficult question facing Japan and the West is what and how much of its dual-use technology should be shared and what should be withheld and protected. Those concerned with defense and national security matters tend to look at dual-use technology quite differently from those who sell it for strictly commercial purposes and monetary gain. Those who call for controlled trade cite national security as the paramount concern, while those who are free trade advocates believe the interests of Japan and the West could be better served by allowing the exchange of all goods and services, except those having only military value. Either way of thinking is too simplistic and fails to address key points in the discussion; the long-term cost to national security and a nation's ability to defend itself if its principal threat is militarily strengthened through uncontrolled transfer of technology.

One problem facing those primarily concerned with Japan's national security and corresponding controls on trade is how to determine which dual-use technologies would be serve Soviet and Chinese military modernization and improvement objectives. Some educated guesses can be made on the types of technologies that the Soviets and/or the Chinese are currently or will be targeting in Japan and the United States. Examples include:

- Gas and oil technologies;

- Coal and nuclear power technologies;
- Strategic mineral production and processing;
- Metallurgy and material science innovations;
- Computer systems and associated electronics;
- Automated machinery and new manufacturing techniques;
- Telecommunications equipment;
- Laser technologies;
- Robotics;
- Fiber optics;
- Superconductivity; and
- Biotechnology.

Japan and the United States agree that direct application of high technology exports can and has played a significant role in the buildup of Soviet military capabilities. However, the two nations continue to debate the extent to which export of dual-use technologies and commodities with an indirect application to military weaponry is inherently dangerous and should be controlled. Japanese officials believe that the COCOM dual-use list is too broad, that it includes items of marginal strategic significance that can be easily obtained from non-COCOM sources, and that it is too big for effective enforcement.

The above discussion summarizes and illustrates some of the key national security issues involved in dual-use technologies. It does not argue for (or against) such transfers, but points to the need to analyze and understand--if only for national security contingency planning purposes--the potential risks involved.

B. U.S. EXPORT CONTROL PRIOR TO 1976

As the United States entered into the 1950s, the nation was recognized as preeminent in the world in terms of military might, economic viability and technological evolution. This dominant technical and industrial position was accompanied by a political structure founded in the principles of democracy which were to become popularized throughout much of the world in the coming years. However, grave concern for protection of this system against the perceived threat from monolithic Communism led the U.S. to implement a series of export controls. First unilaterally, and then through the cooperative international forum of COCOM, substantive steps were taken to preclude or delay the acquisition of advanced technology by a variety of Communist adversaries. This system

was intended to deny to U.S. adversaries any opportunity for access to advanced technologies which might help reduce the relative disadvantage of their more primitive production systems. As export controls were implemented, broad restrictions to technical exchange were imposed. They forbade any technical trade, exchange or other contact with nations adversarial to the United States and is allies. Such a policy worked reasonably well while the U.S. was a leader in advanced technologies. However, the progress of historical events demanded broad evolutionary changes to this stance.

Gradually, as technological development spread, both the precepts and the mechanisms became more complex and difficult to implement. As technologies became more widely available, and as economic power spread, technology control, of necessity, became more specific and narrowly defined. The need for change was underscored by the industrial emergence of many European countries, Japan and other nations of the Pacific Rim. As industrial infrastructure became profitable and research and development activities were fostered, there evolved a wider availability of technological expertise. The latent capabilities of Japan, Germany and other countries projected these nations into leadership roles in technical specialties and sources of industrial output. The world changed: it was no longer possible for the United States to isolate certain nations deemed to be hostile through unilateral actions.

Prior to 1975 export control policies focused primarily on the control of end products. This was not due to a lack of appreciation for the importance of technology and production facilities, but emerged from the fact that only in the early seventies did detente with the Soviet Union become a national policy objective. Prior to 1970, there was almost an absolute prohibition against any form of exports to the USSR. Therefore, there was little need to place bounds around an area of control which was to be prohibited. After detente began to take shape with accompanying overtures to the Soviet Union, technical and policy studies were undertaken, both within and outside of the Government, to identify the products and technologies which were of concern and which were to be controlled.

From this effort a policy view evolved which was used as a basis for decisions on export control issues. This view sought to limit the availability to Communist countries of superior, lower cost Western products and technologies in order to preclude their use in military systems. Such limitations sought to raise the costs and restrict the freedom with which these countries could develop, produce, and manage military systems, or to improve the productive capability of those civilian sectors which supported the military sector. It was felt that these limitations would also deny to these countries the option of satisfying civilian objectives with fewer resources, permitting the savings to be applied to military

programs. To accomplish these goals, the export of dual use end products and their technologies (production tools, test equipment and processes) were to be regulated consistent with demonstrated Communist capabilities. The view was that withholding technology, since it was equally applicable to civil and military programs, was more effective than end product controls because the development of an indigenous production capability would remove Western control over the application of the products of the technology.

In a set of steps which are roughly analogous to the alliance strategies employed in political and military arenas, the United States turned to free world international actions to prevent movement of technologies to adversaries. Both bilateral agreements and multinational structures were so employed. The most influential of these, the Coordinating Committee on Multilateral Export Control (COCOM), was a Paris-based non-treaty organization made up of those countries who were members of NATO, less Iceland plus Australia and Japan. Today, that organization embodies the most effective and far reaching organ of export control. In essence, COCOM member countries agree through a negotiating process on which technologies and items should fall within the categories appropriate for export control. It is then left for each nation to implement such control through the laws and procedures created by each nation for that purpose.

III. EVOLUTION OF EXPORT CONTROL IN THE UNITED STATES

A. AWARENESS OF NEED FOR CHANGE IN POLICY

In 1968 the United States reassessed the merits and benefits, both politically and economically, of expanding Western trade with the Communist countries. To do so, the cooperation of the COCOM member governments was needed to insure continued control of their rapidly advancing technological base. Therefore, the goal of U.S. policy was to permit an "acceptable level of trade" in advanced products within which Western manufacturers could develop and exploit trade opportunities in the Communist Bloc countries with little, if any, significant impact on Communist military capabilities. This "acceptable level of trade," in the form of specific export controls, was based on a balancing of Western security concerns against foreign policy and economic goals, and the administrative burdens placed on governments and manufacturers in regulating the trade in strategically significant commodities. These specific export controls had to be credible to the governments and their manufacturers, both in light of the contribution of these exports to Communist military capabilities and in providing viable commercial opportunities based on available Western products.

An important example of Western concerns regarding technology transfer relate to computer technology. For computers, foreign policy and economic goals played a particularly important role because at that time the U.S. dominated the free world market and increasing market for computers in the Communist Bloc. The U.S. dominance of this industry and its rapid technological advancement had limited the growth and independence of Western European and Japanese national manufacturers by limiting the resources available for continued indigenous research and development. This had led to a continued need for government subsidies, a dependence on U.S. technology, and a need to obtain U.S. approval of certain exports to meet important national internal or foreign policy objectives that could differ from U.S. policy goals. The Communist Bloc countries offered the Western European and Japanese manufacturers (and their governments) a growing market in which they could successfully compete because access to more advanced U.S. products was restricted for U.S. national security reasons. Experience at that time seemed to indicate that Western European and Japanese manufacturers were willing to sell or

license much of their indigenous equipment and technology. Therefore, the policy of an "acceptable level of trade" was shaped to provide markets for Western European and Japanese products while restricting essentially all significant militarily technology transfers.

The increased demand by Communist countries during this period for advanced Western products and technology for ostensibly civil uses significantly taxed the Western countries administratively, causing difficulties for manufacturers in satisfying sales agreements and some direct financial losses. This was caused in part by a lack of growth in administrative budgets, in part by the increased complexity of equipment and variety of transactions being considered for export, and in large part by the need to maintain for countries that did not have effective and cooperative export controls the same level of COCOM controls as used for the Communist countries. This was further exacerbated by the growing use of computers in previously unembargoed Western products and the availability of products superior to Communist capabilities in the Western consumer "over-the-counter" market.

Finally, it was recognized that export controls could not be static. They had to change to reflect the demonstrated growth in Communist capabilities, the changes in industry and market structure, the changes and diversity of the products available from industry, and the changes necessary for their economic and timely administration. Further, the specific export controls had to be credible in light of the commonly perceived Communist technological and military capabilities, the contribution of regulated products to these capabilities, and the inability to control advanced Western products when exported to non-cooperating free world countries or when available from these countries.

By the mid 1970s there was a common understanding and general agreement among the COCOM member countries as to the contribution that exports of advanced Western products and technologies made to Communist military capabilities. Within a narrow range of differing views, neither the arguments for the loss in Western security nor the Western economic gains of exports were overwhelming. Export control procedures, established at a time of low levels of trade and of clear Western technological superiority, came under serious question in an attempt to reduce the products under control and the burdens and delays in administering the export of those that remained. These were driven in large part by the need to relax controls to non-cooperating free world countries.

B. THE DEFENSE SCIENCE BOARD REPORT ("BUCY" REPORT[1])

At this time the U.S. Department of Defense (DOD) undertook a reassessment of its export control policies because of expressed concerns that it was not adequately controlling the exports of critical technologies while exports of less critical products were being overly scrutinized. The Defense Science Board Report called for a new approach in controlling technology exports, one that would focus on technology, not end-products of the technology, except for certain critical items of intrinsic military utility. It identified the control of design and manufacturing know-how equipment as the principal goals of an effective policy. The report differentiated the degree of effectiveness of a range of technology transfer mechanisms emphasizing that the more active the relationship between the supplier and recipient, the more effective transfer mechanism. The report also identified keystone manufacturing equipment and sophisticated operation and maintenance know-how as other significant categories to be controlled. It further observed that for the most critical technologies, the U.S. should not release know-how beyond its borders and then depend on COCOM agreements for control, and should release technologies to "neutral countries" only if willing to assume the technology was vulnerable to transfer directly to Communist countries. It strongly indicated that efforts to preclude diversion of manufacturing equipment and know-how and, to a lesser extent, end-products for military purposes, were relatively unreliable.

Based on this report, the United States refocused its efforts and concerns, particularly related to the risk of third party transfers through non-cooperating free world countries and the questionable effectiveness of undertakings not to divert technologies and products intended for civil applications to military use. The former of these two particularly bothersome issues had for many years conditioned the U.S. implementation of COCOM agreements. It forced regulation of exports to non-COCOM countries to the same levels as for the Communist countries because of the lack of local government imposition of effective controls on further transfers. This was viewed by industry as hindering their export opportunities to non-allied countries because of licensing delays not experienced by the industries of the other COCOM member countries.

The latter of these two issues, the use of "safeguards," had developed over the previous five years as a mechanism for dealing with "landmark" exports justified in part for

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[1] "An Analysis of Export Control of U.S. Technology: A DOD Perspective", 4 February 1976, Office of the Director of Defense Research and Engineering, J. Fred Bucy, Chairman.

political or foreign policy reasons. While such undertakings were reasonably effective for the exports and circumstances to which they were applied, specifically end-products going to open scientific and government institutions and to civil production plants. They were considered less effective in dealing with the export of intangibles such as know-how or for manufacturing equipment going to unmonitored production facilities.

Over the next several years this effort, with the assistance of government agencies and defense industries, led to the identification of technologies that were militarily critical. This cooperative effort between the defense industrial sector and government was vital to the development of a reasonable and effective list. Other broader efforts were ongoing within the government to improve export administration including the establishment of an interagency steering group,[2] drawing on the resources of government,[3] and industry,[4] to identify dual-use technologies. These actions developed into a program that was ultimately supported by the Congress in the Export Administration Act of 1979.

C. THE EXPORT ADMINISTRATION ACT OF 1979

The Export Adminstration Act of 1979, as amended in 1985 and 1988, forms the legal basis for export control in the United States. This Act developed in an environment of strong industry desires to improve their competitive positions by reducing the licensing delays which they felt were hindering their marketing efforts in COCOM and non-COCOM free world countries. Their experience seemed to indicate that other COCOM member countries were able to more rapidly process export requests or issue licenses to their manufacturers than the U.S. was able to do for them. They also felt, along with some members of the Congress and other government agencies, that the U.S. interpretation of COCOM agreements were overly restrictive and that industry should have a greater voice in the setting of technical limits and administrative procedures. These concerns were voiced during hearings which preceded enactment of the legislation and shaped the final form of the Act.

The Congress, in its findings, first expressed the view that exports contributed to the economic well-being of the nation and the stability of the world economy, but later that exports without regard to their contribution to the military potential of certain countries might adversely affect U.S. national security. It also affirmed in the Act the need to control

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2 The Critical Technology Interagency Implementation Task Group (CTIITG).

3 The Interagency Technical Task Groups (TTG) that supported the COCOM List Review process.

4 The Critical Technology Export Groups (CTEG) set up by industry at DoD's request.

exports of technology which could make a significant contribution to that military potential. However, in its policy declaration, the Congress stated that export controls should only be used "...after full consideration of the impact on the economy of the United States and only to the extent necessary ... to restrict the exports of goods and technology ... which would prove detrimental to the national security of the United States."

The Secretary of Defense was given primary responsibility for developing a list of military critical technologies with emphasis on those not possessed by countries to which exports were controlled. This was the Congressional implementation of the earlier DoD technology control initiative.

The Act gave the Secretary of Commerce the authority, in consultation with appropriate agencies and industry, to review the foreign availability of controlled products and technologies to countries to which exports are controlled and to remove them from control if such availability existed. The President was empowered to negotiate with the COCOM member countries at more senior levels than has been the case historically to make COCOM a more open process, to reduce the scope of the controls to a level enforceable by all, and to increase the effectiveness of the enforcement process. The Secretary of State was empowered to conduct negotiations with other countries regarding their cooperation in restricting the export of goods and technology to limit foreign availability of controlled goods and technologies.

The Congress then went on to strengthen the role of Technical Advisory Committees (TACs), which are charged to advise both the Secretaries of Commerce and Defense on technical matters, worldwide availability and utilization of controlled products and technologies, and revisions of the international export controls. Thus, what had been perceived as an almost unilateral review and control of exports by DoD, was tempered by the strengthening of the roles of Secretaries of Commerce and State, and of industry through the TACs.

D. THE IMPACT OF CONFLICT IN AFGHANISTAN

In December of 1979, just as the United States was beginning to implement the EAA of 1979, the Soviet Union intervened militarily in Afghanistan, and on January 4, 1980, the President imposed a series of economic restrictions which included, among other actions, a ban on the licensing of high technology and other strategic exports, a partial embargo on grain exports, and a boycott of the 1980 Olympics, and requested that the COCOM member countries take similar actions. Although the United States received some

sympathy for these actions, it could not achieve complete agreement. Then the United States unilaterally imposed a "no exceptions" policy in COCOM. That is, the United States stated that it would not approve any exceptions to the controls that had been agreed in COCOM; a procedure that normally required unanimous consent of the member countries before such an export could be made. The COCOM members did agree not to take commercial advantage of the United States' "no exceptions" policy and to tighten the licensing procedures for exports to the Soviet Union. It is not clear that they were able to fully comply with such a strong undertaking.

The Afghan issue essentially froze many of the liberalizations contained in the Export Administration Act of 1979. Events in the People's Republic of China (PRC), however, took a different course.

E. CHINA AND EXPORT CONTROL

The Soviet invasion of Afghanistan accelerated the normalization of trade relations with the PRC that had started in the late seventies. In July 1979, the PRC was granted "most favored nation" tariff status and access to Export-Import Bank credits. After the invasion, the PRC was permitted to purchase dual use products and military support equipment and an export category, separate from the Soviet Union and the Eastern Bloc, was established. With these liberalizations, the United States initiated a series of negotiations in COCOM which led to an easing of export controls for the PRC; a separate differential "China" control list.

These relaxed controls placed the PRC in an extremely favorable position, *vis-à-vis* the Soviet Union, to receive advanced technology exports from the COCOM member countries. These exports required only national licensing, statistical reporting to COCOM, and import certificates verifying that the Chinese government authorized the import. Later DoD officials stated that "(t)his is to ensure that the goods intended for China are under government authority and will not be diverted."[5]

F. THE EXPORT ADMINISTRATION AMENDMENTS ACT OF 1985

The 1985 amendments strengthened enforcement and increased penalties for violations of export controls, upgraded support of COCOM, and directed streamlining of the licensing process. One of its primary goals was to eliminate export licensing to

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5 "The Technology Security Program," A Report to the 99th Congress, Second Session, Caspar W. Weinberger, Secretary of Defense, 1986; pp. 64-65.

COCOM members for lower level products and automatic approval for higher level goods if the Secretary of Commerce does not deny the license in 30 days. It also provided for granting "COCOM-like" treatment to other countries which the United States has negotiated agreements to apply export restrictions comparable in practice to that maintained by COCOM members. The Act also provided that the Secretary of Defense review changes in U.S. export regulations but need not concur before their issuance. Finally, the Act reaffirmed the need for the MCTL but required: that each item be reviewed on the basis of foreign availability and be included only if it were not available in fact from uncontrolled sources; and that as controls on critical technologies and keystone equipments are implemented, the controls on products of those technologies and equipments should be reduced. The Congress also requested that DoD provide it an assessment of the impact of the transfer of critical technologies will have and have had on the military capabilities of controlled countries.

G. THE ALLEN REPORT

Throughout the decade of the 1980s, export control was both implemented as a part of U.S. national security policy, and debated as an impediment to research, trade and commercial equality for U.S. corporations. The debate reached an intensity level of such proportion that it precipitated an analysis undertaken by the National Academy of Sciences. The product of that effort, commonly called the Allen Report,[6] after the panel chairman, General (Dr.) Lew Allen, this report reaffirmed the existence of both sides of the equation. There are compelling reasons to implement a system of national security controls. There exists an equally compelling set of reasons to allow information, technologies and techniques to flow freely, without the impediment of government evaluation and decision mechanism.

Many of the major conclusions of the Allen report are congruent with those stated some eleven years prior by the Bucy panel. It affirms the linkage between free world security interests and the use of advanced technologies in major military systems. This places substantial emphasis on both the maintenance of a vigorous technology base and on barriers to the outward flow of such technologies. However, the scope of U.S. export controls, as they existed in the mid 1980s may weaken the growth of U.S. exports and undermines the effectiveness of the control program. Further, the most important elements

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[6] "Balancing the National Interest: U.S. Security Export Controls and Global Economic Competition," 1987, National Research Council, Dr. Lew Allen, Chairman.

of an effective control program embrace their international dimensions. Thus, a system of controls implemented as a cooperative effort among several nations is the most effective system which has been discovered to date to implement the control of advanced technologies with the least adverse impact. The need for a multinational approach reflects the widespread availability in which Japan has played such a major role over the last several decades.

H. THE OMNIBUS ACT ON INTERNATIONAL TRADE AND COMPETITIVENESS OF 1988

The Trade Act is the most recent expression by the Congress of the shift in priorities from a national security dominated policy view to one that is more attuned to trade balances and regulatory burdens placed on U.S. industry. The overall concern with national security is still paramount, but clearly it is tempered by a recognition of the high level of technological sophistication available to principal adversaries from Third World countries, the difficulty of maintaining an effective control system in light of this availability, and a certain disillusionment with those administering the national security side of the export control equation.

In the past, export control policy has assumed that the Soviet Union was the major target of such controls along with its client states that could act as vehicles for transferring acquired Western goods and technologies to them. The PRC was considered less of a military threat with a developing political shift that could result in further mitigation of this threat. Exports are controlled to the smaller allied states (i.e., Albania, Cuba, North Korea, Viet Nam) more for political reasons than their direct military threat to the United States and its allies. The retreat from liberalization by the PRC and the Soviet overtures to reduce arms has changed the balance and, if it is to be believed, reduced the threat to United States' interests.

On the technical side, the cornerstone of export control has been the control of technology and the means to produce significant military and military support equipment. Where before control of technology was a given, but nonspecific and all encompassing, now the specific concerns are clearly enunciated and specified in some detail. The same is true for the means to produce. The major change has been the decreasing control of dual use (primarily commercial) products, in large part due to the growth of industrial capabilities in the non-aligned free world. This growth has made sophisticated equipment, more advanced than indigenous Soviet products, freely available as commodities on the world market. This free availability of advanced products, despite the lack of comparable

advancement by the Soviet Bloc, has made justification of reexport controls very difficult, and the need to provide equal access to Soviet markets by Western manufacturers of comparable products has made regulations based solely on demonstrated Soviet Bloc capabilities burdensome to the industries of the concerned states.

The Act asserted the exceptional importance of remaining competitive in the international marketplace as a matter of economic well being. Thus, an overall goal of this Act was to limit the power of the U.S. Government to impose export control for national security reasons. Specifically, controls for national security can be imposed only to the minimum extent required to protect militarily critical technologies, and then, only if those technologies are not available in adequate quantity and quality from unrestricted sources.

The Trade Act, although dealing with many other significant trade issues, provided some significant changes to the Export Administration Act. The Trade Act: (1) further liberalized the licensing of controlled products and technologies to the PRC; (2) removed all licensing requirements on exports to COCOM members and other cooperating countries except for supercomputers, nuclear goods and technologies, and eavesdropping equipment; (3) removed the reexport licensing requirements when the controlled U.S. content of components in other lower performance equipment is less than 25 percent of the value of the final product; and (4) removed from control all medical instruments and equipment and those goods and technologies which required only notification to COCOM. The Trade Act also presumed Secretary of Defense approval of export control decisions by the Secretary of Commerce unless he appealed those decisions to the President within 20 days. It reinforced the Secretary of Commerce's role in the review of the control list, the formulating of U.S. COCOM proposals, assessing the actual foreign availability of controlled goods and technologies, and unilateral removal of licensing requirements for those items for which he determines that foreign availability existed. DoD's responsibility for developing the MCTL remained untouched, but its incorporation into the control lists was still subject to agreement by the Secretary of Commerce.

IV. U.S. CRITICAL TECHNOLOGY CONTROL MECHANISMS

A. INTRODUCTION

The acquisition of national security sensitive goods and technology by the Soviet Union and other countries whose actions or policies run counter to the national security interests of the United States, has led to the significant enhancement of Soviet Bloc military-industrial capabilities. The Export Administration Act of 1979, as amended in 1985 and 1988, addresses this threat by emphasizing the control of critical technologies. While stressing that *it is important for the national interest of the United States that both the private sector and the Federal Government place a high priority on exports*, Congress observed that this interest must be *consistent with the economic, security, and foreign policy objectives of the United States*. Accordingly, the Congress declared it to be the policy of the United States to use export controls to the extent necessary *to restrict the export of goods and technology which would make a significant contribution to the military potential of any other country or combination of countries which would prove detrimental to the national security of the United States*. Further, the Act stipulated that the *export controls imposed under this section should cover and (to the maximum extent consistent with the purposes of this Act) be limited to militarily critical goods and technologies*. The Act provided the necessary initiative for the first step, which was to produce a list of technologies that need protection.

The Act directed that *the Secretary of Defense and other appropriate departments shall identify goods and technology for inclusion on the control list* [§(5)(c)(2)].[7]

In summary, the export control activities sought to limit the availability of more capable and often lower cost Western technologies. It did so to deny adversary countries the means to develop, produce, and manage advanced military systems or devote additional resources to military systems.

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7 *Militarily Critical Technologies List*, Office of the Under Secretary of Defense for Acquisition, October 1989, U.S. Government Printing Office, Washington, D.C., pp. iii-v.

B. THE MILITARILY CRITICAL TECHNOLOGIES LIST (MCTL)

The Export Administration Act in Section 5(d)(3) states that

> The Secretary of Defense shall bear primary responsibility for developing a list of militarily critical technologies. In developing such list, primary emphasis shall be given to--
>
> (A) Arrays of design and manufacturing know-how,
>
> (B) Keystone manufacturing, inspection, and test equipment,
>
> (C) Goods accompanied by sophisticated operation, application, or maintenance know-how, and
>
> (D) Keystone equipment which would reveal or give insight into the design and manufacture of United States military systems,
>
> which are not possessed by, or available in fact from sources outside the United States to controlled countries, and which, if exported, would permit a significant advance in a military system of any such country.
>
> EAA of 1979 §(5)(d)(2)
> as amended in 1985 and 1988

These terms are defined in more detail later in this chapter.

The Militarily Critical Technologies List (MCTL) has been developed to respond to this requirement and in fulfillment of the responsibilities of the Secretary of Defense as outlined in Section 5(d) of the Export Administration Act of 1979. The MCTL constitutes the key element in stimulating United States actions designed to achieve protection of critical technologies and products, and removing restrictions on technologies and products which are not critical.

The MCTL does not *per se* provide the basis for determinations on technology transfer cases. The reviewer must refer to the specifics of the proposal under consideration to determine if the critical aspects of technology identified in the MCTL are relevant to the case, and, if relevant, whether foreign availability exists. Also to be considered is the degree to which the terms of release or transfer provide protection for critical technologies identified in the MCTL. Even in cases where critical technology transfer is determined to be involved, the reviewer may consider whether safeguards or protective measures for technology transfer may be devised. These considerations are especially important in the case of transfers to Allied countries when the U.S. has established cooperative agreements. The MCTL thus provides a point of departure for consideration of proposed export cases, but not a comprehensive basis for their resolution.

In developing the MCTL, the various Technical Working Groups undertake detailed investigations of each technology, to include: research; product development; and status of U.S., Soviet, COCOM and other national capabilities; assessment of the military uses of the technology and its contribution to the superiority of U.S. military capabilities. This analytical process produces practical distinctions between militarily useful technologies, which are not placed in the MCTL, and militarily critical technologies, which are. The MCTL also identifies the probable directions and progress in new technology areas that may supplant currently critical technologies.

Because of the pace of technological change, the MCTL is subject to continuing review and revision. As directed by the Omnibus Trade and Competitiveness Act of 1988, the Secretary of Defense has established:

> ... a procedure for reviewing the goods and technologies on the list of militarily critical technologies on an ongoing basis for the purpose of removing from the list of militarily critical technologies any goods or technologies that are no longer militarily critical
>
> and adding to the list
>
> ... any good or technology that the Secretary of Defense determines is militarily critical

To support and maintain the currency of the MCTL, work is carried on across a broad spectrum, and on a continuing basis, to update and improve the coverage and description of the critical technologies and related goods included in the list.

Militarily critical technologies included on the MCTL must meet strict criteria. Technology included is that not available to the controlled countries and which meets at least one of the following criteria:

- Used in U.S. military system(s), either deployed or scheduled for near term deployment *and* is critical to the performance of such system(s) in that its absence would severely degrade the performance of at least one primary mission parameter.
- Represents an intelligence community projection of Warsaw Pact acquisition targets. In most instances the technology would be the same as identified by the first criterion but it is conceivable that the technology not critical to the performance of the U.S. systems may still be of considerable importance to those under development in Warsaw Pact countries.
- Although not currently embedded in a U.S. system, is a leading edge technology with high potential for having an impact for advanced military applications.

The format of the 1989 version of the MCTL provides for a brief description of the critical technology involved, a statement of the rationale for its inclusion in the list, and the specific critical elements of that technology which include: "Arrays of Know-How," "Keystone Manufacturing, Inspection and Test Equipment," "Keystone Materials," "Goods Accompanied by Sophisticated Know-How," and "Items of Intrinsic Military Utility." These terms are defined as follows:

- **Arrays of Know-How.** Limited to the know-how and related technical information (including design and manufacturing know-how) which are not in the public domain and which are required to achieve a significant development, production, or utilization purpose. Such know-how includes services, processes, procedures, specifications, design data and criteria, and testing techniques.
- **Keystone Manufacturing, Inspection and Test Equipment.** Equipment specifically necessary for the effective application of significant arrays of technical information and know-how.
- **Keystone Materials.** Materials specifically necessary for the effective application of significant arrays of technical information and know-how.
- **Goods Accompanied by Sophisticated Know-How.** Goods the use of which requires the provision (disclosure) of significant arrays of technical information and know-how (including operation, application, or maintenance know-how), and keystone equipment and materials, for which embedded know-how is inherently derivable by reverse engineering, or is revealed by use of the goods.
- **Items of Intrinsic Military Utility.** Items other than those identified as "Keystone Manufacturing, Inspection and Test Equipment," "Keystone Materials," and "Goods Accompanied by Sophisticated Know-How" whose transfer to potential adversaries shall be controlled for the following reasons:
  - -- The end product in question could significantly enhance the recipient's military or warmaking capability either because of its technology content or because of the quantity sold.
  - -- The product could be analyzed to reveal U.S. system characteristics and thereby contribute to the development of countermeasures to equivalent U.S. equipment.

It should be noted that reference to an item under "Arrays of Know-How" in the MCTL does not presuppose a potential recommendation for end-item control, except where the relevant end item is identified as "Keystone Manufacturing, Inspection and Test Equipment," "Keystone Materials," "Goods Accompanied by Sophisticated Know-How,"

or "Items of Intrinsic Military Utility." In most cases, the primary concern is with arrangement for the development, production, and utilization of such items. Technical information describing basic research, a stage which precedes development, is not included. It should also be noted that "Items of Intrinsic Military Utility" encompasses the items of "Keystone Equipment" specified in the law.

C. IMPLEMENTATION AND USE OF THE MCTL

The MCTL provides a detailed and structured technical statement of development, production, and utilization technologies which the Department of Defense assesses as being crucial to given military capabilities and of significant value to potential adversaries. While it does not replace existing export control lists, it supports development of export control policy, technology release guidelines, and specific proposals or controls to be implemented by COCOM or by using such U.S. mechanisms as the Control List (CL) [originally referred to as the Commodity Control List (CCL)] and the International Traffic in Arms Regulation (ITAR). As an example, the Technical Working Groups are responsible for the initial preparation of COCOM technical proposals and these efforts have resulted in appreciable streamlining of the export control lists. For items which are *already* on the export control lists, the MCTL supports Defense license reviews of items proposed for export. Other uses of the MCTL are in connection with the review of DoD publications and policies where the MCTL is used as an additional reference document.

The Export Administration Act further provides that

> ... the Secretary (DOC) and the Secretary of Defense shall integrate items on the list of militarily critical technologies into the control list ... with all deliberate speed. ... a good or technology shall be included on the control list only if ... controlled countries do not possess that good or technology, or a functionally equivalent good or technology, and the good or technology or functionally equivalent good or technology is not available in fact to a controlled country from sources outside the United States in sufficient quantity and of comparable quality ... §(5)(d)(4)

The ongoing review and updating of the MCTL mandated by the law is vital to this process.

The MCTL is specifically designed to facilitate its use in conjunction with regulatory documents promulgated by the Department of Commerce, Department of State, Department of Energy, and the multinational COCOM. To this end, each of the items enumerated under "Keystone Manufacturing, Inspection and Test Equipment," "Keystone Materials," "Goods Accompanied by Sophisticated Know-How" and "Items of Intrinsic

Military Utility" is followed by numbers assigned to the commodities on the relevant control lists.

D. THE U.S. TECHNOLOGY CONTROL PROCESS

Critical technologies control is a complex intra- and intergovernmental process, involving academia and industry, undertaken by the United States and its COCOM allies to minimize the transfer of militarily critical Western technologies to the USSR, Warsaw Pact, and other controlled countries while promoting technological cooperation among the Allies. The process includes the identification of critical technologies, international negotiations leading to a common acceptance of technologies to be controlled, formulation of effective policies, development of procedures to implement them, and the licensing of products and technologies based on these policies and procedures.

In the U.S., the process begins with the identification of technologies and products deemed to be militarily critical by the Department of Defense. These are carefully reviewed by interagency groups, which consider whether they meet the COCOM strategic criteria for inclusion in COCOM's international strategic embargo system. If it is concluded that the strategic criteria are met, then a U.S. control proposal is prepared and submitted to COCOM. Other COCOM members submit their proposals as well. Proposals are also submitted to decontrol products and technologies determined to be no longer militarily critical. The process continues with negotiation of multilateral controls in COCOM and subsequent implementation of these controls by member nations. In the United States this may entail modifying U.S. laws and regulations and export case review and licensing procedures.

U.S. initiatives in the critical technologies control process stem from changes to the MCTL, and from inputs by other departments and agencies. These are the inter-departmental Technical Task Groups (TTGs), established by the Department of State (DOS); the Technical Working Groups (TWGs), organized by the Institute for Defense Analyses (IDA) on behalf of the DOD; and the Technical Advisory Committees (TACs), organized by the Department of Commerce (DOC). The U.S. Government oversees activities concerning export control through the Economic Defense Advisory Committee (EDAC), which has membership from a number of other government agencies and organizations and is chaired by a representative of the DOS.

The process begins with the construction of the MCTL by the TWGs. The TWGs, administered by IDA, have knowledgeable technical persons from DOD, other departments

such as Energy and Commerce, other government agencies, industry, and academia as members. Each TWG (currently there are 12) is responsible for accomplishing the necessary analyses and actions required to update the portions of the MCTL for which they are responsible. They identify technologies of a militarily critical nature in their areas of responsibility and ensure that timely recommendations are made to bring such technologies under export control. To accomplish this, the TWGs prepare and forward to the TTGs technical proposals that implement their portion of the MCTL. The technical parameters in the proposals must be fully substantiated by the relevant MCTL items and associated Foreign Technology Assessments (FTAs). The TWGs also participate in the identification of control levels for West-to-West control of technology and products.

The 12 interdepartmental Technical Task Groups (TTGs) meet periodically and recommend technologies and products for control or decontrol in COCOM. TTG membership consists of governmental personnel, with a chairperson designated by the Department of State. The TTGs review the recommendations of the TWGs and technical papers submitted by other government agencies, make determinations on various items under negotiation or discussion, including determining the characteristics of items of equipment, estimating the reasonableness of bringing items under control, and assisting in determining potential control candidates. The TTGs forward requirements to intelligence agencies for information needed to make informed decisions, arrange for governmental and contractor technical advance and consultation, coordinate positions with other task groups when appropriate, and prepare and submit proposed revisions to the International Industrial List (IIL), International Munitions List (IML), the International Atomic Energy List (IAEL), and related U.S. export control documents.

Technical Advisory Committees have been established under the provisions of the EAA to provide the Department of Commerce and other government agencies with advice and assistance regarding wide-ranging aspects of controls affecting U.S-produced articles, materials, and supplies (including technical data and information) subject to export control. These government-sponsored advisory groups consist of members from industry and government. Their recommendations are considered during the revision of the MCTL by the TWGs and during preparation of U.S. COCOM proposals by the TTGs. Members may participate in COCOM negotiations when invited.

Within the United States there is also a series of control lists. The Control List (CL), maintained by the Department of Commerce, is a part of the Export Administration Regulations (EAR § 799.1) and represents the implementation of the Export Administration Act. In content it corresponds to the IIL, and it is modified after changes in the IIL are

negotiated in COCOM. One difference between the IIL and CL is the CL contains items which are unilaterally controlled by the United States. This may occur for national security, nuclear non-proliferation, or foreign policy reasons.

Another control list in the United States is the U.S. Munitions List, which identifies arms, ammunition, and implements of war contained in the International Traffic in Arms Regulations (ITAR). This list also is published as part of the Export Administration Regulations (Supplement 2 to EAR § 770), but is maintained by the Department of State, Office of Munitions Control. It refers specifically to military, rather than dual-use, equipment and technology. It is the primary vehicle used to control items listed on the IML.

The Nuclear Referral List, maintained by the Nuclear Regulatory Commission, is part of the Export Administration Regulations. It controls nuclear-related materials and technology and is published as Supplement 3 to EAR § 770. It relates to the IAEL.

Together, these control lists contain the products and technologies that the United States believes are important to protect from potential adversaries. They are under continual review in order to maintain an appropriate balance between national security and economic benefits.

E. EXPORT ADMINISTRATION REGULATIONS (EAR)

The Export Administration Regulations are issued by the DOC pursuant to provisions of the Export Administration Act (EAA). A major part of the EAR is Part 799.1, the U.S. Control List (CL). The CL reflects implementation by the Secretary of Commerce of the policy guidelines in the EAA.

The EAR define the conditions under which a commodity may be exported using a General License and those instances in which a Validated Export License is required. A General License is a general authorization permitting the export of certain commodities and technical data without the necessity of applying for a separate license document for each shipment. A Validated Export License, rather than a General License, is required if the commodity or technology to be exported is in one of the following categories:

- A *strategic* commodity bound for any destination (or, in a few cases, one bound only for a destination, such as communist countries, to which exports are restricted for national security reasons). A strategic commodity is defined as one believed to be capable of contributing significantly to the design, manufacture, or utilization of military hardware.

- A *short-supply* commodity to any destination. A short-supply commodity is one in short supply in the United States and wanted abroad and which, if permitted to be exported without restriction, could result in an excessive drain on U.S. supplies and have a serious inflationary impact on the U.S. economy.
- Any other commodity bound for a destination for which there are serious foreign policy concerns.
- *Unpublished technical data* to certain destinations. The term unpublished technical data refers to technical information, generally related to the design, production, or use of a product, that is not available to the public. Such data is not described in detail in books, magazines, or pamphlets, nor it is taught in colleges or universities. It is know-how that would not be released by the holders without a significant charge.

F. INTERNATIONAL TRAFFIC IN ARMS REGULATIONS (ITAR)

The ITAR is the basic set of regulations for control of U.S. exports of munitions and implements of war. The U.S. Department of State has an Office of Munitions Control (OMC) which is responsible for maintaining the USML, which is also contained in Supplement No. 2 to Part 770 of the EAR. The USML identifies the arms, ammunition, and implements of war by category that are addressed in the ITAR. Due to U.S. laws and regulations certain items identified in the MCTL as dual use items and controlled in COCOM on the IIL are also included in the USML, which is incorporated in the ITAR. Conversely, some items controlled in COCOM on the IML are listed in the CL and are licensed by DOC.

The ITAR is updated and republished on a periodic basis as required. Current changes to the ITAR and other information of use to exporters are published in the form of munitions bulletins. Applicable portions of these bulletins are incorporated into the ITAR revisions.

G. NUCLEAR ENERGY REGULATIONS

The NRC maintains a list of equipment and material that are under NRC licensing authority and are included in Supplement 3 to Part 770 of the EAR and in the CFR Title 10, Chapter I, Part 110. Additional regulations authorized by the Secretary of Energy based on the Atomic Energy Act of 1954, which established requirements applicable to unclassified activities in foreign atomic energy programs, are specified in CFR Title 10, Chapter III, Part 810. NRC controls the export of special nuclear materials and facilities as prescribed by the Atomic Energy Act. The NRC Rules and Regulations are published as Title 10,

Chapter I, Part 110 of the CFR dated May 31, 1984. Part 110 is titled "Export and Import of Nuclear Facilities and Materials." This Department of Energy regulation prohibits all persons within or under the jurisdiction of the U.S. from directly or indirectly engaging in the production of any special nuclear material (including the supplying of equipment, materials, or technical data) outside the U.S. Certain activities outside the U.S. involving the production of special nuclear materials, reprocessing, isotope separation, the production of heavy water, and the fabrication of nuclear fuel containing plutonium require a specific authorization by the Secretary of Energy.

H. SUMMARY

The technology control mechanisms resident in the United States Government involve a variety of agencies and activities, and support different policy goals through multiple processes. They are, themselves, products of policy evolution. As such they do not serve all interests equally, and are subject to frequent criticism, debate, and dialogue. Most important, they constitute a part of the changing processes of government and are subject to periodic change. When these weaknesses are recognized, steps are identified and implemented which allow these tools to better support the goals and policy officials of the government.

V. THE ENVIRONMENT OF THE COMING DECADE

A. MAJOR TRENDS

The technical parameters for technology control in the future are not clear. This section will review some of the major trends which will significantly affect technology control in the years ahead. Some of these are just beginning, and are poorly understood. Others are well established and continue to deserve mention because of the magnitude or growth of their impact.

Multicentering, the development of technology centers in many world regions, is an evolution of immense proportions which is not easily understood. The phenomena is inescapably linked to international education, multinational corporations, the ongoing search for raw materials across the world, and the drive, particularly among newly industrialized countries, to acquire advanced technologies as a vehicle to address their social needs or economic deficiencies. The continued, indeed magnified, progress of this major trend generates two expectations. The demand for technologies of all kinds will be so great that a control process of some nature will be a vital portion of the policy framework needed if the control of militarily critical technologies are to be a part of the strategy of any nation against potential adversaries. Second, because technologies will tend to breed much faster and in many more locations, technologies of unusual military promise will emerge from unlikely sources across many international boundaries. Therefore, technology intelligence/ technology monitoring will have increased importance. Further, the potential benefits of cooperative research, development and evaluation of new technologies will have a higher promise than ever realized in the past.

The evolution of the European Economic Community has been a matter of slow progress in the face of many barriers: cultural, economic and political. Nevertheless, progress has been made and will, in 1992, culminate many efforts in the formal emergence of the greater economic and trade union of the member nations. The EEC promises to be a larger voice and more powerful industrial and economic block than ever realized in history. Common standards of trade, currency, European passports applicable to member states and other matters will enhance the ease with which technologies can be shared within the community. Industrial firms have for some time already worked to position themselves

advantageously in anticipation of major changes. Whether the 1992 date holds an immediate revolution or a more gradual series of adjustments, the overall effect on technology and technology controls will be profound. This is particularly apparent in a practical sense when one realizes that Ireland, a member of the European Economic Community, is not a member of COCOM. For nations like Japan and the U.S., our continued functioning in COCOM is likely to change substantially as the greater unity of the EEC takes form.

By far the most explosive international development of concern to technology transfer is the opening of the Warsaw Pact nations of Eastern Europe. The political and military ramifications of this dramatic series of events are not the focus of this paper. However, the state of technology evolution found in these nations is such that a high priority will be placed on acquisition and employment of Western technologies for a wide range of uses. Moreover, the industrial firms of most Western nations are anxious to sell such technologies and establish themselves in the large and promising markets of the region. Thus, the political reality is that technology control will be made more complex and difficult by the opening of Eastern Europe. The military implications have yet to be fully assessed by the United States. While a reversal of current liberalizing trends may not be likely, the remarkable rate of change suggests that a careful examination of outcomes, in the event that a reversal did occur, should be a consideration in the development of technology security policy.

As Eastern Europe becomes more accessible, the United States is becoming progressively more aware of technological advances achieved in Eastern Europe which have not been routinely duplicated in the West. Thus, even for military applications, certain refined materials and industrial processes are owned and controlled by nations of Eastern Europe. Czechoslovakia stands out as a nation particularly successful in developing the types of technologies of interest to those who monitor world technological advances from an MCTL perspective. We anticipate, therefore, that two important subtrends will emerge. First, as relations with the Eastern Bloc countries improve, more technology will move from the West into the Eastern European nations, making those particular elements more vulnerable to passage to proscribed nations. Second, new technologies will evolve in Eastern Europe which will be of military significance and interest to the nations of the free world. The desire of Western governments to acquire these technologies will provide leverage and items for sale by the developers.

An additional impact which will be of particular interest is the ongoing effort to improve administrative procedures involved in export control. The COCOM processes and

most national means to enforce technology control are often time-consuming and painstakingly detailed. In the past, one of the primary criticisms of the U.S. technology control processes was the apparent inability to keep up with either the evolution of technical matters or the demands of the commercial community for case decisions. Both of these remarks have sound basis in fact and both encapsulate one of the weakest portions of the technology control process. It is slow. We recognize that administrative mechanisms which are technically detailed require extensive deliberations and careful analysis by very highly qualified members of the scientific community. Further, while the processes are imperfect, they have experienced an evolution in response to criticism and are dramatically better than they were a few years ago. Additional sharpening and focus for the export control mechanisms can be anticipated in the future, simply because it remains in the best interests of the member nations to cause this to happen. Export control mechanisms are unlikely to be perfect, but it is possible for them to become usable at a reasonable level of suboptimization.

B. THE EUROPEAN COMMUNITY OF 1992

The European Economic Community was established by the 1957 Treaty of Rome. The goal was a common market, but there remained a maze of border controls, government subsidies of national industries, closed national systems of procurement, national regulation of industrial standards, copyrights, transportation, banking, insurance, health requirements for the entry of goods, and so forth. The goal of full economic unity proclaimed in early 1970 was never met. Years of attempting to preserve the fragmented, protected and highly regulated national economies had led to competitive weakness and high unemployment in Europe. In the meantime, Canada, Japan, and the U.S. had surged technologically and succeeded in generating millions of new jobs.

In March 1985 the EEC, consisting of the following 12 countries: Belgium, Denmark, Federal Republic of Germany, France, Greece, Italy, Netherlands, Ireland, Portugal, Spain, Luxembourg, and the United Kingdom, decided that it should constitute a single market by 1992. The Single European Act signed in 1986, which amends the Treaty of Rome, endorses the commitment to a unified market, allowing for decisions in most areas to be taken by a qualified majority, but the European Council remains the top decisionmaking body within the EEC. The European Commission as the prime regulatory agency under the Council has issued 279 implementing directives which must be in place by 1992. Agreement has been reached on 107 of them.

The project has continued to progress and defy the odds against it. "1992" was born for sound economic reasons and these same forces continue to be its engine. Entrepreneurs and corporations have continued to work with politicians and diplomats to transcend considerations of local and national interests. They have forced it to work. In anticipation, businessmen are now engaged in formidable maneuvering in the form of mergers, joint ventures, buyouts and takeover bids aimed at obtaining either the best position through transnational alliances in Europe or the best position in their country against the expected onslaught of competition from abroad. Over time the European Commission will assume a greater regulatory role on issues relating to business transactions, the commercial environment, government subsidies, and so forth. Administration will continue to be under the scrutiny of the Council of Ministers.

Establishing a well-functioning single internal market by 1992 will hardly be a smooth process. But whether it is achieved then, or at some later date, a host of problems await resolution. Issues range from the elimination of border controls to the standardization of electrical plugs. Some major problems may be more readily solved, than mundane problems such as adopting a standard electrical plug. Standardization in this area alone would cost European countries $80 billion. For now the EC has prudently decided to keep three different kinds of plugs.

The current transformation is aimed at making the penetration of external markets, through trade and investment, easier for the industries of European countries, many of which depend on exports for their growth and have capital available for placement abroad. It is also aimed at minimizing the penetration of the EC by competitive forces. Major points of discussion (in addition to the Common Agricultural Policy, which absorbs 70 percent of the EC's budget, and favors European farmers over foreign farm imports to the EC) are found in most commercial sectors. In financial services, foreign banks and insurance companies will be allowed to set up branches in the EC if reciprocity is granted by their country to European banks and companies. The EC has moved toward a lax definition of post-1992 reciprocity and banks and insurance companies already operating in EC countries before 1992 will be treated as European. Many officials believe that the unified market will require a centralized monetary system, with a single currency, the ECU, which exists already, but plays only a minor role in transactions. Creating a central bank and a common currency will be difficult.

Mergers in the automobile industry present especially delicate political problems. Major European auto makers sometimes constitute their country's largest industry, their single largest employer, and a source of national pride. The transition to a truly free market

in the automobile industry will not be instantaneous. Some nations, such as France and Italy, have import quotas on Japanese cars, while Germany does not. The Europeans want to keep car imports down as long as the Japanese market is closed to their cars, and they might impose a quota on cars produced in the U.S. with predominantly Japanese capital or a high content of Japanese parts. Regulations will require that 80 percent of parts for European cars be produced within the EC. Such a regulation may not be feasible in the light of multinational product sourcing. The latest model of Volvo 780, considered a product of Sweden, not an EC member, is an example. The car is engineered in Sweden, designed and assembled in Italy with a French engine, West German electronics, Irish tires, Japanese transmission, and a South Korean electrical harness. The air conditioning and fuel emission controls are American and the glass, Canadian. In turn, the Canadian glass firm might be American owned.

Thus far, two most troublesome sectors are border controls and indirect taxation. No steps have been taken to address unifying direct taxes. The unification of indirect taxes has hit a number of snags. One concerns the value-added tax. Countries with low rates or very limited coverage for the tax, such as England, fear that raising the rate and increasing coverage would be inflationary. On the other hand, France, which gets 40 percent of its public revenue from taxes on consumption, resists lower rates because of the loss of government income.

Access of foreign companies to key sectors of public procurement is likely to remain restricted even though American companies established in Europe qualify as European companies. Plans for a Community-wide television broadcasting network have been stymied. Little progress has been made in matters of copyright and patents. Opening up procurement in the four traditionally protected "national" areas--energy, telecommunications, transportation, and water--is only beginning.

However, in an area which does indicate "political cooperation," leaders of the 12-nation EC, the European Council, met in Paris November 18th to consider financial aid and training measures to encourage the changes surging through Eastern Europe. Of consequence was that the President of France and the Prime Ministers of Ireland and Spain were mandated to carry out three measures:

1. Consider the creation of a banking facility for the development and modernization of Eastern Europe,
2. Study the possibility of a European foundation to train management people from Eastern Europe, and

3. Open existing EC programs involving education and training to Eastern Europeans.

In light of the rapidly changing events in the East Bloc nations, the EC's capacity to unite will be shaped by actions in the other countries of the world. Of interest is the fact that West Berlin is considered part of the EC. East Germany now enjoys free trade with the EC via West Germany, which should prove interesting because East Germany is tied economically with other East Bloc nations. Perhaps this could be the beginning of Gorbachev's "common European house." With the relaxing of the Soviet trip on the East Bloc nations, which is symbolized by the breaching of the Berlin wall, the efforts of the EC could not be more timely. The economic welfare of the people of Europe, East and West, looks very promising which in turn is politically promising for a peaceful world. The advent of computers and instantaneous worldwide telecommunications will certainly aid the process. There is reason to be optimistic.

The European Community (EC) is currently making efforts to establish primarily economic unity among the 12 cooperating nations by 1992. There is, however, a great difference between economic unity and political unity, and a unified West European economy will require a strong intra-European political consensus. So far, the current plan for 1992 represents an extraordinary broad consensus, supported by Socialist, Conservative, and Christian Democratic governments. Even some West European Communist parties support the idea of European unity. Upon examining the significance of the EC in 1992 one detects that the cooperative efforts of the 12 European nations includes barriers against some Japanese trade practices, especially in regard to automobiles.

C. U.S.-JAPANESE BILATERAL EFFORTS

With respect to advanced technology matters involving the U.S. and Japan, there is reason for optimism. The successful promulgation of a number of cooperative efforts which involve or are closely related to militarily critical technologies bears witness to a positive attitude and a strong future. Japanese and American counterparts have worked well and productively together on many aviation-related developments. The coproduction of a number of military aircraft have made both nations dramatically aware of the competitive parameters inherent in aircraft development and manufacture. Japanese participation with the Boeing Company over many years has led to increased awareness of product improvements and good cost control methods and technology transfer techniques. There appears now to be a new threshold of product development based on the 767 aircraft. Derivatives and follow-ons will assure greater competitive advantage in the markets of the

future in terms of efficiency, reliability and cost per seat mile. A series of military aircraft agreements extend for many years. Of these, the FSX evolution, although subject to protracted debate, made both parties more aware of the requirements and objectives of the other nation. It was helpful to bring into focus the need to accurately value each technology and production practice developed within the context of a joint program. Negotiation in the face of broad technical uncertainty is, in itself, an art which deserves greater attention from the academic and industrial communities.

Beginning many years ago, the Japanese space programs acquired techniques and capabilities from the U.S. as a part of a comprehensive program to acquire the technical capability to enter the commercial space market. With full U.S. cooperation, hard work, competence and determination the Japanese have been able to harness what others have done with respect to satellite development, launch, and control. The H-II launch vehicle is an excellent example of the capabilities which will make Japan commercially competitive in commercial space activities in the near future. Early cooperative arrangements with Ford Aerospace and other American firms provided initial capability in communications satellites which could then be expanded and modified so that Japan can have space-oriented activities uniquely suited to Japanese capabilities and needs.

The role of international corporate activity in the Japan-U.S. relationship has not been measured precisely and varies widely among individual corporations and, nationally, in response to government financial and policy initiatives. Future establishment of more joint ventures, cooperative R&D agreements, mergers and international acquisitions can be expected and would be consistent with expectations in other world markets. This activity will be a primary vehicle for drawing upon technology from more than one nation. To date, joint ventures have been constructed between the United States and Japan to take advantage of centers of technology and education as well as social and industrial infrastructure. As examples, the Science and Technology Agency's Frontier Research Program is hosting a dozen U.S. scientists; by the end of this century 100,000 students are expected to be studying in Japan.[8]

As we enter the decade of the 1990s, the roles and actions of the United States and Japan will be shaped by the changing forces and factors which have been outlined above, and by a clearer understanding of the roles of technology in meeting broad social and political goals. While postulating technological change is easy, it is important to recognize

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8 "Japan's Science and Technology Aim Toward Globalization," Wil Lepkowski, *Chemical and Engineering News*, May 8, 1989, p. 7-14.

those instances in which technology controls and limits have, for many years, served broad multinational interests. Some will continue into the future. For example, many of the technologies used to build nuclear weapons date from the 1940s. Although old, these technologies have been successfully withheld from most proscribed nations--i.e., the nations which do not have nuclear weaponry. This has been accomplished through a variety of means. Political pressure, carefully guarded production methods, and the nuclear nonproliferation treaty have all helped restrain the flow of nuclear weapons know-how. As a treaty signatory to the Nuclear Nonproliferation Treaty, Japan has very clear policies with respect to nuclear weaponry, while simultaneously pursuing vigorous nuclear research and nuclear power programs.

Chemical weaponry is a different matter. Because some chemical arms can be made using industrial processes which look like segments of other common chemical manufacturing processes, the singular traits which usefully distinguish nuclear weaponry are not present to define limits for chemical arms. Concerned nations, including Japan and the United States, can, through a process of education, international negotiation, and alert monitoring, make a contribution toward limiting the spread of chemical arms. While advanced technologies will have a role in such programs, the particular technologies are only now emerging as arms reductions and controls are seriously negotiated.

The Missile Technology Control Regime (MTCR) announced in 1987 was specifically intended to monitor and control selected technologies needed to produce an airborne missile which can carry 500 kg a distance of 300 km. Missile elements which embrace specific technologies are divided into two categories based on sensitivity. Category I includes the most sensitive such as guidance systems. Category II contains less sensitive matters such as rocket fuels technology. To a reasonable degree, the nations which participate in the MTCR--France, Canada, the U.K., Japan, the United States, Germany, and Italy--have succeeded in making production of such missiles a more difficult action. Therefore, the MTCR can be regarded as at least restraining, even though it depends upon the national means available in each country for enforcement.

Treaties limiting conventional arms are the subject of ongoing negotiations between the United States and the Soviet Union. Although the recent changes in the political climate make fruitful discussion more likely, real barriers to agreement remain. One of these is the discussion of inspection criteria. While inspection of industrial facilities provides increased assurance of treaty compliance, such inspections could yield an exceptional byproduct of technology observation when inspectors view factories in operation. This revisits the crucial dilemma for protection of technology. There are compelling reasons to be able to

walk through the other signatory's arms production facilities; there are equally compelling reasons to be concerned about what technologies are placed in jeopardy as a result of so exposing one's own industrial facilities. Drawing substantive conclusions from this discussion would be premature. However, it is safe to assert that both technology protection and developing new "national technical means" will play strong, if not yet clearly understood, roles in the negotiation of conventional arms control treaties.

The United States will continue to have concerns about maintaining military capability through high quality, technologically advanced systems. This "technological edge" will be required in order to compensate for smaller numbers of defense forces and equipment relative to that of potential adversaries. The security needs for the United States and its allies may decline in the coming years, but will not disappear, and there will be great pressure to provide for national security in the most cost effective manner. To optimize this process, the United States should make the best possible use of available technology and minimize its need to continually modify its systems to counter developments by potential adversaries. Therefore, a compelling need for control of advanced military technologies will continue to exist.

Over the next decade, it is expected that dual use technologies will become progressively more important. Commercial dual use technologies are often more advanced than those in current fielded military systems and are driven by commercial demand. They continue to develop rapidly. The key to a successful policy over the next decade will be a narrowing of the range of products and technologies covered by controls, and an increase in the specificity of those controls which remain. Technology controls should be effective and should achieve the desired security objectives, but should do so with a minimal impact on commercial industry. Thus, a rational, more streamlined procedure will be helpful to cooperative efforts in this area. It is clear from the remarkable progress of Japanese technical development that, without the active support of Japan, efforts to control proliferation of critical technologies will simply be ineffective.

Japan and the United States share many pragmatic goals relating both to national security and to economic development. In the decade of the 1990s, the potential exists for the two countries to meet their common goals through cooperative development programs which reinforce each other's strengths and promote continued growth. A more detailed examination of Japan's technological development and participation will be provided in the next chapter.

VI. THE U.S.-JAPAN CONTEXT

A. EVOLUTION OF THE JAPANESE INDUSTRIAL BASE

The evolution of the Japanese industrial base has been dramatic over the past forty years. Many changes in technology and the world economy have accompanied this growth. During the 1970s, Japan faced rising oil prices and adjustments in exchange rates which slowed its growth through the 1980s, but in the past few years a shift from heavy industries into higher value-added industries has fostered new growth. Japan has dynamic research programs in every important high technology area, including semiconductors, superconductivity, artificial intelligence, and biotechnology.

Japan has gradually shifted its emphasis from heavy manufacturing to a knowledge-intensive industrial base. The importance of Japanese contributions in these advanced technologies is reflected economically but also is seen in the degree to which others are seeking technical information from Japan. New programs have sprung up in the United States to better access available information; for example, the National Science Foundation (NSF) in Washington this year connected by computer to Tokyo's National Center for Science Information system (NCSIS). This will allow on-line access to scientific databases. The Department of Commerce runs a Japanese Technical Literature program from its Office of Commercial Affairs. Japan, which had already achieved a high level of performance in the manufacturing industries, has now also achieved a leadership role in the knowledge industries on which future world technological developments will depend.

B. JAPAN'S CONCEPT OF THREAT AND EXPORT CONTROL

The fact that Japan possesses an export control system will continue to affect the harmony of the relationships it enjoys with the United States, the Soviet Union, and the PRC. Each of these countries views Japan's export control system from a different perspective. The United States sees Japan's system as absolutely essential to the maintenance of Western technological superiority and a key element in preserving Western security. The Soviet Union, on the other hand, views Japan's export control system as an obstacle to attaining parity, if not superiority, over the West in advanced military systems

and, to a lesser extent, competitive capability in the marketplace. China sees the system primarily as a nuisance and a hindrance to its ongoing modernization programs.

Japan appears to differ from the United States in its assessment of the extent to which dual-use technologies constitute a threat to security. It has, however, strong programs for control of military technologies. Japan controls missile-related technology through its own lists and also participates actively in the Missile Technology Control Regime (MCTR). Japan also actively supports restrictions on COCOM's nuclear-related items and is a signatory of the Non-proliferation Treaty, as well as a participant in other groups which restrict nuclear-related technology. Arms are controlled through the Export Trade Control Order and corresponds to the COCOM list. Japan also has a series of arms controls guidelines which state that arms cannot be sold abroad.

The United States uses export control as a means of implementing foreign policy, an approach which in general Japan does not support. For many countries, economic factors are the critical feature of their trade policies, and they choose not to incorporate foreign policy matters into the development of their trade policies. Each country must come to its own conclusion in resolving these matters, and it is important to be able to view this issue from several perspectives. The United States does not wish to support, either implicitly or explicitly, foreign activities which it considers detrimental to its interests. When the United States suspended trade with the Soviet Union, Japan instituted a temporary suspension also. However, in general the Japanese system does not provide for export control based on foreign policy considerations.

The Soviet Union does not represent a significant portion of Japan's trade, either export or import, and Japan has not evidenced a strong desire to expand its activity. The country has not pushed aggressively for changes which would benefit such trade. On the other hand, Japan, along with other COCOM members, has not considered the threat from the Warsaw Pact to be the same as viewed by the United States. In the past, the United States has taken much of the responsibility for the defense of Japan. However, as Japan continues to take more responsibility for its own military security, these issues may receive more recognition.

C. EVOLUTION OF JAPANESE EXPORT CONTROLS[9]

Japan, a COCOM member since 1952, has adhered to all the established COCOM rules and has agreed in principle that it is important to prohibit certain high technologies to the Communist Bloc. However, it took the 1987 Toshiba Machine case to create a new awareness inside and outside of Japan that both Japanese and Western security can be directly related to Japanese trade policies and the enforcement of its export control rules.

Japan, primarily in response to U.S. criticism, quickly amended its basic law governing trade and established new mechanisms designed to strengthen the enforcement of its strategic trade control policy. Specifically, Japan:

1. Increased the sanctions and penalties for violations of its revised Foreign Exchange and Foreign Trade Control Law;
2. Expanded MITI's export licensing procedures to allow better scrutiny of applications and to increase on-site pre-licensing inspection;
3. Established a number of interagency fora to facilitate better cooperation and more effective working relationships among ministries and agencies involved in export control;
4. Agreed to the establishment of a joint U.S.-Japan Council to facilitate bilateral cooperation in COCOM and export control related activities;
5. Expanded and upgraded its presence on the COCOM permanent staff;
6. Forced Japanese companies to establish or improve their internal export control compliance programs to help preclude another Toshiba-like case; and
7. Acknowledged in the amended Foreign Exchange and Foreign Trade Control Law that its export control system has important bearing on Japan's national security.

Japan has moved from being primarily an importer of technology in the 1950s and 1960s to one of the world's major exporters of high technology products in the 1980s. It achieved this new status through a combination of coordinated technology acquisition, product improvement, aggressive marketing activities, and a relatively small defense component to the national R&D budget. While the United States and Western European countries were devoting a large amount of government R&D funding to defense-related technologies, Japan was focusing on commercial applications. By 1980, the complexion

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9 Richard P. Cassidy, Japan's Export Control System and Its Importance to National Security," 31 May 1989.

of dual-use high technology markets had dramatically shifted from being primarily defense driven to consumer oriented. The characteristics of international competition and fast-paced new technological developments resulted in large-scale availability of dual-use high technology commodities, many of which were being restricted and controlled by COCOM or unilaterally by the United States.

During the détente years of 1972 to 1980, the number of items on the COCOM embargo lists was significantly reduced, and Japanese and many Western companies achieved significant earnings in high technology deals with the Soviet Bloc. For the most part, national security concerns regarding exports were secondary. During this period, most COCOM members believed a weak embargo policy was in their best national economic interests.

In evolving from that period, Japan has made many adjustments. Currently, there are a total of 183 different commodity categories (217 if sub-divisions are included) on Japan's restricted list. The major categories of restricted items that obviously fall more in the realm on national security concerns include: munitions, nuclear-related materials, missile technology, chemicals applicable to poison gas production, and associated high technology data. The vast majority of restricted commodities/technologies on Japan's control list fall into the category of strategic dual-use commodities. COCOM members have determined these commodities and/or their technologies to be critical for the national security and well-being of the free world.

Within the Government of Japan, the main participants in the export control process are the Ministry of International Trade and Industry (MITI), the Ministry of Foreign Affairs (MOFA), the Ministry of Finance (MOF) in which the Customs and Tariff Bureau is the key player, the National Police Agency (NPA), the Ministry of Justice (MOJ), and the Japan Defense Agency (JDA). Prior to 1987, MITI clearly had the lead in export control policy formulation and administrative supervision. However, the reaction from the United States over Japan's, and specifically MITI's, handling of the Toshiba Machine case severely shook the Nakasone Government. MITI now shares some export control policy authority with MOFA.

Japanese customs law requires all exports to have an export declaration and a permit for export from Customs. The Foreign Exchange Law further stipulates that an export license must be obtained from MITI for all shipments of controlled products. Japan has two types of export licenses: the individual validated license (IVL) and the recently initiated "comprehensive" export license. Most of Japan's license applications are in the categories

of computers, integrated circuits, recording equipment, electrical measuring equipment, semiconductors, machine tools and numerical control equipment.

Japan adheres closely to COCOM-issued restrictions and maintains what has been described as a moderately effective export control system. The system was characterized as moderately effective because the organization focuses more on preventing the "accidental diverter" than the "dedicated diverter." Japan's recent strengthening of its export control mechanisms clearly emphasized increasing the administrative aspects of control over the enforcement side. The homogeneity of the Japanese people coupled with their ingrained loyalty to group, employer, and to country are considered by most Japanese as the most effective deterrents to illegal export activities.

National security does not rely on weapon systems alone. The vigor of the Japanese economy and the health of the bilateral U.S.-Japan alliance are also national security considerations. Maintaining effective strategic trade controls requires sustained multinational coordinated efforts on the part of Japan, the United States and other COCOM nations. Western security, in part, depends on maintaining the technological lead over potential adversaries. This lead can be sustained only by supporting a vigorous domestic technological base and by impeding the flow of specific technologies useful to the Soviet, Warsaw Pact, and Chinese militaries.

D. EVOLUTION OF JAPANESE MILITARY CAPABILITIES AND RESPONSIBILITIES

For most of the last thirty years, Japan has been a constitutionally limited nation whose military agenda has been one of modest self-defense capability and moderate defense budgets. Indigenous production of armaments was not a major element in the country's industrial mix, and exports of equipment having defense application were insignificant. Starting in the early 1980s, however, the picture began to alter with Japan agreeing to expand its defensive responsibilities.

Beginning in 1983 successive governments commenced a re-equipment program to enable these new responsibilities to be discharged. Major electronics projects, including a $640 million integrated digital defense communications network, were approved. Among new electronics programs are the modernization of the Japanese Air Self Defense Force's Base Air Defense Ground Environment (BADGE) and an air defense communications system based on a U.S. communications satellite and digital microwave links.

Japan's capability in electronics, communications, and associated fields has many strengths which are applicable to military equipment. In mature integrated circuit technologies such as silicon, Japan is internationally dominant, having six out of the top ten companies ranked by worldwide sales volume. This includes companies ranked one, two, and three. In certain areas of "new wave" electronic technology such as fiber optics, high definition television, and gallium arsenide circuitry, Japan leads the world. In future technologies such as superconductivity the signs are that Japan is in advance of the world in its commercialization plans. The country is still working to produce world-class software, and is mounting major efforts to master fifth generation computing and artificial intelligence.

While none of the above technologies are specifically aimed at military applications, most can be. High definition television, for example, can be used to improve command, control, communications, and intelligence display systems and other defense communication equipment. Existing electronic hardware made in Japan also has dual purpose capability. In this connection it has been reported that off-the-shelf commercial radio sets have been used for tactical communications in El Salvador. Again, the same types of microwave links can be used for civilian telecommunication networks and in Japan's integrated digital defense network. At the same time, Japan is backing military-specific research and development in areas such as communications and electronic warfare. All this adds up to a potentially formidable technical capability in defense production. Allied to this are production and international marketing skills already proven in areas such as consumer electronics, professional mobile communications, and telecommunications.

The assumption may be made that the Japanese technology is as advanced as that of the United States based on licensing agreements that it has with U.S. firms which gives them access to the most advanced technology. During the 30-year period between 1950 and 1980, U.S. industry licensed some 32,000 technology agreements to Japan at a cumulative cost to U.S. industry of more than $800 billion. These licenses were sold to the Japanese at a price of less than $9 billion. Japan not only has the most advanced telecommunications technology but, because of the massive trade imbalance, it is able to finance a considerable portion of the products it produces and sells to foreign nations, especially East Bloc nations short of hard currency.

Because of the surplus accounts in trade and accumulated funds, the Japanese can obtain the latest foreign technology by purchasing controlling interest in overseas companies. This has resulted in broad access to many new technologies in the United States at less than development cost.

Japanese programs have included measures to build modern industrial infrastructure within which to employ advanced technology systems. This is consistent with policies for industrial development and represents excellent long-term planning. A good illustration is found in the aerospace industry. For many generations of commercial aircraft acquisition, the Japanese have participated in some form in the production of the aircraft which they purchase for domestic and international use by flag carriers. The specified participation arrangements have varied from subcontractor or license arrangements, to codevelopment and coproduction. Over time, this participation has yielded strong bonds between Japanese venture partners and U.S. manufacturers such as the Boeing Company.

A Japanese venture group was formed for teaming with the Boeing 7X7 project. This was to have provided broad Japanese sharing in management, financing, and technical development of a new transport aircraft. Although this project was discontinued, the even newer Being 777 development has been announced, and a Boeing official has been quoted as stating that there is a very good change that the Japanese will play a role in the aircraft's development.[10]

Military procurement practice has a parallel evolution. The JSDF is a modern, well equipped and well trained force of land, sea, and air participants. Many of their end item weapon systems are of U.S. origin and licensed to Japan. For example, the F-15, C-130, P-3, Nike and Hawk families of missiles, and other weapons were acquired through coproduction and licensing arrangements. While such practices appear to increase weapon system cost by a factor of about 0.5, the increased expenditure also buys industrial capability and technical know-how. For the Japanese, this has been well worth the effort, because such programs evolve into vital industrial and national security capability. While sometimes viewed as competitive with U.S. industries, Japanese producers are also positively regarded because of their contributions to increase to the total free world defense industrial base. As such, in a crisis of major proportions they could support production of major weapon systems which are vital to the United States. Thus, technology movement in militarily-related systems has results which are simultaneously cooperative and competitive.

It is clear that the Japanese approach has resulted in the fielding of credible major weapon systems. Coupled with sufficient training and exercises, the net result is a quality military force, the third largest in the world. This has made possible a significant expansion in missions for Japanese forces. The most timely of these was the acceptance by

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10 "Boeing Selects Design for 777 Candidate," *Aviation Week and Space Technology*, Vol. 131, No. 25, December 18, 1989, p. 107.

the JSDF of patrol and security responsibility for Sea Lines of Communication (SLOC) to a distance of 1000 NM from the Japanese main islands. This maritime effort has been coupled with strong air defense and ground forces initiatives. This has had a considerable impact in sharing defense burdens in the North Pacific.

The Japanese military, in a manner similar to its U.S. counterpart, reflects the result of commitment to high quality, advanced technology systems. Such systems are obviously useful in increasing the effectiveness of uniformed personnel and compensating for fielding fewer systems and units than potential adversaries.

E. SUMMARY

Much of the impressive development experienced by both the U.S. and Japan has been possible because of the broad harmony of the Pacific Rim powers and complementary strategic capabilities. This environment has assisted in maintaining the stability in the region which is essential for continued growth in productivity and economic markets.

Good and sufficient reasons will continue to exist which mandate the existence of export control policies. However, through an ongoing international dialogue, all parties have come to understand more clearly the costs and implications of such policies. Barring an unusual combination of bad management and bad luck, this better understanding, coupled with ongoing technical evolution, will permit us to depend further on international export control as the most effective tool of such a policy. Further, there should be a narrowing and deepening of those technologies selected for control. Finally, if the current climate in Eastern Europe continues to flourish, the concerns over the military threat and the number of proscribed destinations will be correspondingly reduced. Then the challenge of export control will become smaller and more manageable within the structure of the governments of nations around the world.

Technology growth, a strong trait in both Japan and the United States, should be a part of the infrastructure which creates additional wealth, productive capacity, and leads to further leadership roles for both nations.

VII. THE FUTURE

A. LEARNING FROM THE PAST

The continued liberalization of relationships with East European nations and the USSR through the glasnost and perestroika policies initiated by Gorbachev will have profound effects on future technology transfer/export control policies of COCOM and other nations.

Western democracies have provided substantial packages of advanced technologies, know-how, manufacturing materials, facilities and other capability to the USSR and its predecessors for a very long time. A significant cycle of modernization initiatives was undertaken by Czar Peter I (Peter the Great). These efforts constitute an early, classic case of technology transfer. Naval training, broad force modernization, and a host of non-military industrial and agricultural measures were taken to move the Russian state toward an industrial society and build the international credibility necessary for Russia to assume broader international roles. Although the Czar's programs enjoyed considerable success, many efforts to introduce new technologies were absorbed into the societal fabric of the Russian people, and their total effectiveness is far from clear. In a strictly military sense, the evolution of the Russian fleet continued until the Russo-Japanese War when the great fleet steamed more than half way around the world to be beaten in battle by a force of smaller, agile, and very ably manned Japanese adversaries at the Battle of Tsushima Strait. The evolution of Soviet naval forces, it can be argued, still wrestles with the same parameters which led to their defeat in this historic battle.

Agriculture and agricultural technology provide opportunity for a second broad study which has considerable political and and strategic significance. Until approximately World War I, Russia was a successful agricultural nation, exporting large quantities of foodstuffs. This was true even though the industry was locked into a traditional system of indentured servant fiefs which many Russians regarded as extraordinary in its rigidity and inability to harness modern technological methods. A series of Communist rulers has periodically brokered transfusions of Western agricultural methods. In spite of such technologies and the cyclic application of collectivization and liberalization, the Soviet

Union has yet to achieve the self-sufficiency/surplus foodstuffs status it knew as a relatively backward monarchy.

Other examples can be taken from the experiences in World War II. The Soviet Union enjoyed broad benefits from its status as an allied power opposed to the Axis alliance. As post-war victors in that struggle, they harnessed substantial "state-of-the-art" technical know-how from the Germans, to include captive German personnel engaged in multiple advanced technology endeavors. Despite these "leaps toward the future," today the Soviet Union is chronically behind the Western nations in pushing forward across broad spectrum application and evolution of advanced technologies.

Today, following a period of relatively frigid relationships, the Soviets appear to be on the verge of yet another infusion of such Western technical capability. In this instance it is taking place in a world in which power is becoming multicentered, and technologies evolve at increasing rates of speed. Our primary challenge is to place the evolution of political dialogue and technological advancement into a historical context. We must determine what the Soviet initiatives mean in terms of the total future prospects for the United States, other technologically advanced nations of Europe and Asia, and other nations, particularly those of Eastern Europe.

The existing menu of export control mechanisms and parameters may be ill-suited to meet the political needs of the imminent and probably irreversible policy changes. Therefore it is entirely appropriate that the United States and its allies begin to craft new standards for export control which align with realistic and achievable goals of self interest across the spectrum of military and non-military national strengths. It does not serve any nation well to to continue to try to apply export restriction when the embargoed goods are easily entering the Soviet Union, and doing so to the detriment of American economic interests.

We develop clearer insight into achieving national goals by looking carefully at what past infusions of advanced technology have done for the Russians and their Soviet descendants. It is not clear that we should restrict technology (except for very specific military capabilities) or that the cost of such restrictions does not outweigh the benefits. It is clear that we do not yet comprehend enough about the variables and their context to always make effective and politically feasible policy decisions.

B. A POSSIBLE NEW POLICY AND TECHNICAL FRAMEWORK

In establishing a technical framework in which to consider export control decisions, two policy questions should be addressed. First, are the arms control actions and initiatives undertaken by Gorbachev:

- A serious attempt at arms limitations and reduction of threat to the U.S. and its interests and allies, at least in the long run?, or
- A serious attempt at arms limitations and reduction of threat to the U.S. and its interests and allies that, at least in the long run, will fail for internal reasons with a return to the heightened tensions and threats of the early eighties?, or
- A subterfuge to buy time for the Soviet Union to rebuild its industrial infrastructure for supporting its military and political objectives, and to satisfy some of the demands of its civil population?

The second question is conditioned by the first:

To the extent that Gorbachev's attempts are serious and well intended, is it in the best interests of the U.S. to have Gorbachev (or his like-minded successors) succeed in these overtures, and how far should the U.S. go in testing these intentions?

The first question addresses the validity of the statements and actions of Gorbachev and his current supporters. This paper hopefully assumes such validity, but conditions its recommended framework on the possibility that it may fail, and limits its recommendations such that an outright deception would not result in irretrievable loss. The second question deals with what the U.S. response should be. Specifically, is the United States prepared to take actions to make the Gorbachev program a success, or are the political and military risks sufficiently great that we should simply be spectators and let the Soviet Union play out its current changing policies? This paper takes the view that active, conditioned and verified support is the better approach. In fact, the second question is the more important, since if it were answered in the affirmative, then we should undertake risks conditioned on the answer to the first.

Following this approach, the next step is to determine what the Soviet Union will seek from the West to support its stated goals. It is expected that the Soviets will continue to place the highest priority on obtaining technology and the means to produce because it permits them to maximize their value added by use of existing plants and manpower. This minimizes their need for foreign exchange, which is always in short supply. As a result, it is expected that the Soviets will have three goals in the support they will seek from the West. First, the upgrading of their agricultural and industrial infrastructure to increase

indigenous productivity; second, increasing the availability of consumer and commercial products to satisfy pent up demands and make political and economic changes more acceptable; and third, the upgrading and acquiring of new (high technology) industries producing products competitive on open world markets to generate foreign exchange to pay for internal growth.

Upgrading the infrastructure and acquiring advanced technology are of national security concern because they may result in increased military capability. If the United States is to support their changes, then the industrial equipment and production facilities that the United States might provide would have to be current state of the art, if not advanced, because outmoded or older equipment and facilities are no longer available. Further, in the past, the Soviet Union has never been willing to accept other than the most modern and new equipment in what it buys, if for no other reason than as a face-saving device. Finally, the competition among our COCOM allies and the other industrial free world nations for an opening Eastern European and Soviet market will result in the offering of advanced and cost-effective technologies and facilities.

Within the near future, the Soviets will be entering into a number of transactions with Western suppliers for various technologies, production facilities, and products. The United States should establish, at least conceptually, a list of industries and types of transfers in increasing national security significance that it would be prepared to consider as guidance to its case officers and to industry. This list should consider the legitimate Soviet needs for transitioning and building a strong civil economy. In particular, elements of such transactions, computers, communications, control systems, etc., may be controlled, but if they are dedicated to non-strategic applications their transfer must be approved as part of such a transfer in order to have a viable transaction. An exemplary list in order of increasing national security concern might be as follows:

1. Support of agriculture and its infrastructure, including production of farm machinery, trucks, chemicals and fertilizers, and the road system to move products to market;
2. Support of the internal ground transportation system, road, rail and barge, and the necessary control systems to efficiently move freight;
3. Support of non-critical industries, facilities, tooling, control systems and processes, for internal and external consumption, where "criticality" is defined by the MCTL;

4. Support of communications upgrades to improve the infrastructure of the country in order to foster economic growth and for safety and educational concerns.

5. Support of upgrades to the existing air navigation and control system to foster increasing air travel over and between Siberia and other areas not previously served in large measure by other than Soviet commercial airlines.

If we want the USSR and its allies to develop and stabilize with the community of nations, we must accept some minimum national security risk and provide economic aid in areas such as those enumerated above. The question is not, "Will improved air traffic control radars and improved communications systems support better air defense and provide a better military capability?" That answer must always be yes, since all nations depend on joint use of ATC radars and communication for both civil and military purposes. Rather, the question is, "Do the economic advantages for the recipient country and the rest of the world outweigh the national security risks?" If that answer is affirmative, then the technology transfer decision process is much easier to implement.

We may have arrived at a historic point in the evolution of export control similar to Mr. Winston Churchill's famous "End of the Beginning." Certainly export control is well entrenched in the policy arena, has suffered through the growing pains of debate, inopportune application, attempts at harmonization in the international community, and many reexaminations. Now the world, led in many areas by the United States and Japan, faces exponentially blossoming technologies, historic political shifts, and unusual opportunities. An exciting world lies ahead. We look forward to accepting the challenges it offers.