A Paradigm Shift For National Security Policy: The Sixth Element of National Power

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EXECUTIVE SUMMARY

Title: A Paradigm Shift For National Security Policy: The Sixth Element of National Power

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Thesis: The United States' national security is increasingly dependent on advanced weapons and technologies but the administration lacks a comprehensive and coherent interagency policy that overcomes parochial agency perspectives to ensure that national security objectives are met

Background: The debate over the balance between a laissez-faire approach to arms and technology sales and stringent export controls has existed since the United States became an arms exporter in the late 1800's. One side of the argument is that strong arms and technology sales produce strong allies, increase domestic employment, support a robust research and development capability, and produce cheaper weapon systems. On the other hand, many believe that arms sales and technology transfers jeopardize our national security, shift jobs overseas and drain the United States domestic research and development capability. The reality is that each argument is to some extent valid. Furthermore, different agencies within the federal government often have opposing positions that have developed and become well entrenched since World War II.

The arms industry is becoming more global as shrinking defense budgets and dependence on advanced technologies increase. Information technologies are becoming the leading requirement for industry, militaries, and governments around the world. Factors such as technology diffusion, defense industry globalization, and the information revolution and the prevalence of dual-use technologies have had a global impact. Perhaps most significantly they have reduced the ability of the U.S. to unilaterally affect international affairs through arms and technology transfer policy. This has made many of the Cold War arguments regarding arms and technology policy irrelevant.

Recommendations: The administration must lead a paradigm shift that recognizes technology as a sixth determinant of national power equal and tightly linked to the other five determinants. The administration must take aggressive and innovative steps to create a domestic consensus on the role of technology and implement effective policy to balance competing national security interests.

To create a paradigm shift in national security policy the Clinton Administration must revise the National Security Strategy to detail the coordinated use of technology as a tool to enhance national power. The administration must also publish a Presidential Decision Directive that identifies the roles of the various departments in development and use of technology as a legitimate determinant of national power and redefine the scope and importance of the informational element of national power. This PDD must also direct a study to evaluate the establishment of a cabinet level executive agency that will monitor and coordinate the guidelines of the PDD.

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TABLE OF CONTENTS

LIST OF FIGURES

Part 1

THE CURRENT DEBATE

Introduction

Growing international economic interdependence, the increasing reliance of the military on advanced dual-use technologies, and global technology diffusion are dramatically changing the United States' position in the global arms and technology transfer market Unfortunately, the United States government has shown a lack of a comprehensive and coherent interagency policy that can adapt to the changing situation. The administration, the Department of State, Department of Commerce and the Department of Defense have shown little deviation from their traditional Cold War viewpoints regarding arms and technology transfer policy. As an example, an ongoing controversy over the transfer of sensitive encryption equipment from Hughes Electronics and Loral Space & Communications Ltd. to the Chinese government has once again brought the debate over the sales and transfer of advanced weapons and technologies to the front page of the nations newspapers.[1] The sale of these satellites were approved by the Commerce Department even though the State Department, somewhat uncharacteristically, recommended that the White House disapprove the transaction.[2] Agreeing with the Department of Defense, intelligence agencies and his advisers Secretary of State Warren Christopher recommended that satellites and associated technology remain on the "munitions list" under the combined control of the Department of State and Department of Defense. Five months later President Clinton transferred control of satellite exports to the purview of

[1] "House Probe Faults U.S.-China High Tech Deals", *Reuters News Service* 30 December 1998, downloaded from http://nt.excite.com/news/981230/18/politics-china.

[2] Jeff Gerth and David Sanger. "How China Won Rights to Launch Satellites for the U.S.", *New York Times* 17 May 1998, downloaded from New York Times on the Web, http://www.nytimes.com.

the Department of Commerce.[3] This change essentially gave presidential approval to the sale. Representative Chris Cox, who chairs the Congressional Committee that is investigating the sales, summarized the situation when he stated "I can tell you today that we have found that national security harm did occur."[4] This incident of apparent conflict between the White House, Department of Commerce, Department of State, and Department of Defense over the transfer of sensitive technologies is merely a glimpse of the much larger problem.

This paper will argue that traditional ad hoc regional arms and technology transfer policy, driven by parochial agency viewpoints will be increasingly ineffective as a foreign policy tool in modifying the behavior of other states and potentially dangerous to U.S. national security. Since the end of the Cold War, the debate over the proper development, use, and export of arms and advanced technologies has been growing. The stunning victory of coalition forces in the Persian Gulf War has highlighted the United States' technological superiority, technological dependence, and potential technological vulnerability. Regardless of potentially revolutionary changes in technology that affect all aspects of national security, the various departments of the United States government are well entrenched in their traditional positions on the sale and transfer of advanced weapons and technology. There are three basic arguments supporting or rejecting arms sales and transfers.

The first argument is made by proponents of arms sales and technology transfers that argue in favor of a liberal policy because it is beneficial to the competitiveness of the domestic economy. These proponents argue that strong exports boost the global economy and create jobs domestically which can generate a positive economic cycle of domestic growth. As stated by Robert Carlucci,

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[3] Jeff Gerth and David Sanger. "How China Won Rights to Launch Satellites for the U.S.", *New York Times* 17 May 1998, downloaded from New York Times on the Web, hap: / /www.nytimes.com.

[4] "House Probe Faults U.S-China High Tech Deals", *Reuters News Service* 30 December 1998, downloaded from http://nt.excite.com/news/981230/l8/politics-china.

Assistant Secretary of State for Political Military Affairs in 1997, "exports are essential to a strong economy."[5] Although the Department of Defense and the intelligence agencies generally argue that in many cases the potential loss of important defense technologies overseas outweigh these considerations, this argument represents a typical position of many administrations as well as the Departments of State and Commerce.

The second point of contention is related to issues of foreign policy. Foreign policy objectives have historically been a strong argument for lenient export controls favored by the Department of State and most administrations since the Vietnam War. The Department of State has long been a proponent of using technology and arms sales as tools to accomplish foreign policy objectives because sales and transfers are believed to strengthen military alliances and woo adversaries to the United States' political viewpoint. While a member of the Nixon White House, former National Security Adviser Henry Kissinger's personal records show that he secretly offered classified satellite imagery products to the Chinese as part of his détente initiative.[6] The State Department under the Reagan Administration was notorious for its favorable view of arms transfers as legitimate foreign policy tools and the current administration has a similar viewpoint.[7] When asked about pending legislation to ban another controversial sale of satellite equipment to the Chinese, State Department spokesman, James Rubin highlighted the Clinton Administration's view on the issue when he stated, "If this legislation passes it will threaten American global leadership in the communication and commercial satellite business".[8]

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[5] Janne Nolan, " United States," in *Cascade of Arms: Managing Conventional Arms Proliferation,* ed. Adrew J. Pierre (Washington. D.C.: Brookings Institution Press, 1997), 137.

[6] Michael Dobbs, "Kissinger Offers China Satellite Data in 1973, Papers Shod', *Washington Times,* 10 January 1999, Sec. A2.

[7] Nolan, 134

[8] Eric Schmidt, "House Votes to Ban Export of Satellite and Missile Technology to China," *New York Times.,* 21 May 1998, downloaded from New York Times on the Web http://www.nytimes.com.

The third focus of discussion concerns the health of the domestic defense industry. Historically, the Department of Commerce and many recent administrations have been in favor of exports of arms and technology as a means to stimulate the domestic defense industry to be more innovative and competitive in the global market. Additionally, they argue that exports of arms and technology allow the defense industry to maintain production lines, and retain the employment of critical engineers and scientists on critical production lines that domestic demand alone can no longer justify. However, the role of international arms sales and transfers in promoting the health of the domestic economy is certainly controversial. Many academics argue that the best thing for the U. S. Defense industry is to convert their production lines, through the development of dual use technologies, to civilian products for domestic and international consumption. Others maintain that the industry is best maintained by nationalizing the defense industry and strictly controlling exports.

The Department of Defense (DOD) is fundamentally in favor of tighter controls of exports because the economic and political benefits do not justify the danger to national security created by poorly controlled transfer of weapons and weapons technology. Nonetheless, DOD has on occasion supported a variety of arms and technology sales to allies to boost their ability to defend themselves. It has also supported some sales to maintain production lines to ensure a surge capability in critical domestic industries. However, the Defense Department's perspective may be shifting more toward more lenient policies as the defense industry and military procurement officials become increasingly concerned about competitiveness of the industry, reducing the costs of expensive weapon systems, an apparently irreversible reliance on foreign companies for components of critical systems and the shrinking domestic production base.

These arguments and the corresponding positions on either side have developed largely from historical precedent. These traditional perspectives have solidified as policy has developed since World

War II. Therefore, it is worthwhile to discuss the some of the historical context of the debate. The attitudes that are prevalent now have been shaped by the historical precedents of sales and transfers in the past.

Historical Background

Arms sales have been a national security issue since the Revolutionary War. During that period, the U.S had essentially no capacity to manufacture its own arms. The colonies did have some ship building capability but as for other weapons the country was entirely dependent upon imports. A valuable lesson was learned. The United States would need to build an indigenous arms manufacturing capability.

By the start of the Civil War, the United States had developed a robust arms production capacity. Fortunately for the Union, the preponderance of this capacity was in the northern states and the Union was able to eventually win the Civil War by fielding an overwhelming force created by sheer productive capacity. The Civil War is recognized by some historians as the first industrial age war. [9]Among the technological innovations that were either developed in the U.S. or first used by the U.S. in large scale combat were the rifled musket, the rifled field gun, the iron clad ship, steam powered commerce raiders, and rail transportation. The Civil War was the beginning of the United States' reliance on productive and technological superiority. Even with excess production capacity at the end of the war, the U.S. did not become a large-scale weapons exporter during the 1800's. Although it did export weapons in limited amounts, productive capacity in the United States was

[9] Paul Kennedy, *The Rise and Fall of the Great Powers: Economic Change and Military Conflict From 1500-2000,* (New York: Vintage Books, 1989), 180.

primarily occupied with fulfilling the country's Manifest Destiny.[10] Arms transfers did not become an important aspect of U.S. foreign policy until World War I.

At the start of World War I the United States was a sleeping economic and military power with manufacturing capabilities that were rapidly mobilized and quickly dwarfed those of its next competitor, Russia.[11] When the U.S. was finally drawn into the war, it was fifteen months before the U.S. could put ground forces ashore in Europe. However, its weapon manufacturing capability was felt in Europe almost immediately. America was able to build a destroyer in an astonishing three months and float new merchant vessels by the hundreds.[12] After the war, the United States became isolationist in its foreign and economic policy. Nonetheless, it began to participate widely in the international arms trade as an outlet for its wartime production lines. The U.S. became a significant exporter of tanks, aircraft, and armored cars. In 1930, for example, the U.S. was the number three exporter of tanks exporting a total of 574 tanks and controlling 14.7 percent of the world market.[13] It was also the top exporter of combat aircraft with 3,218 exported and 22.8 percent of market share.[14] The total number of weapons exported was relatively low because of an emphasis on the quality rather than quantity of weapons.[15] With sizeable shares of the market in the most advanced weapons systems arms sales were viewed, like any other commodity, as simply another facet of legitimate world trade. This cynical attitude among arms exporters generated a growing backlash of negative public

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[10] Sherman Gee, *Technology Transfer, Innovation, and International Competitiveness,* (New York John Wiley and Sons, 1991), 29.

[11] Kennedy, 270

[12] Kennedy, 271

[13] Edward J. Laurance, *The International Arms Trade.* (New York Lexington Books, 1992), 63.

[14] Laurance, 63.

[15] Robert B. Harkavy, The Arms Trade and International Systems. (Cambridge, Mass.:Balinger Publishing Company, 1975), 45.

opinion. As a result of this public outcry the period is often referred to as the Merchant of Death Era.[16] Not until 1938 was the arms trade recognized as a significant foreign policy tool.

As the world became embroiled in World War II, the United States' initial contribution to the war effort in Europe was through the Lend-Lease Act. President Roosevelt envisioned the U.S. as the "arsenal of democracy."[17] Specifically, the Lend-Lease Act gave the President the authority to lend, lease, barter or sell under any terms he deemed appropriate any defense article to "the government of any country whose defense the President deems vital to the defense of the United States."[18] The program provided an immense volume of weapons to the allies, at essentially no cost and changed the scope and intent of U.S. arms sales and transfers.[19] The Lend-Lease Act was the beginning of the extensive use of arms transfers for the sole purpose of attaining national security policy objectives.

When World War II ended the United States had clearly established itself as a world power. As such, it quickly assumed responsibility for rebuilding Europe and Japan while fighting to contain communism in the Cold War.[20] In support of these objectives the U.S. began the Military Assistance Program (MAP) in 1949. Figure 1 shows MAP grants as a percentage of total U.S. arms deliveries and depicts the predominance of MAP as the preferred mode of arms and technology transfer into the 1960's. This program granted weapons systems, primarily surplus World War II equipment, to NATO members and Asian Allies.[21] MAP became a useful complement to NSC-68 as a foreign policy tool to augment the containment strategy by building the defenses of our allies against communist encroachment. Although this was a period of rapid technological advances, high technology weapons

[16] Laurance, 83.

[17] Henry Kissinger, *Diplomacy,* (New York: Simon & Schuster, 1994), 388.

[18] Kissinger, 388.

[19] Henry Kissinger, *Diplomacy.* (New York: Simon & Schuster), 389, 753

[20] Kennedy, 367.

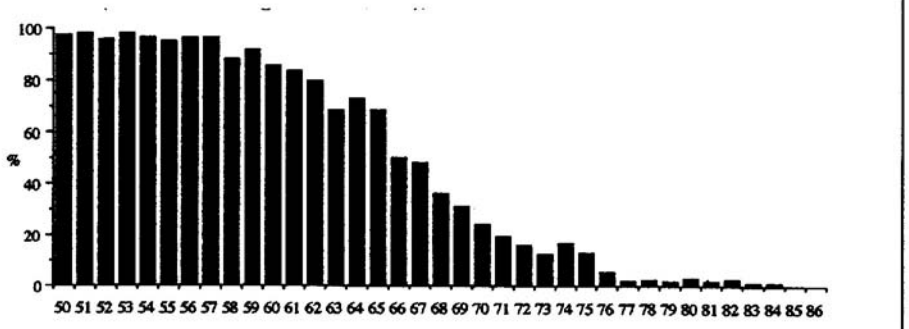

Figure 1. MAP Grants as a Percentage of Total U.S. Arms Deliveries
Source: Edward Laurance, The International Arms Trade, (New York: Lexington Books, 1992), 92.

systems were reserved for use in the defense of Europe in a potential conventional conflict with the USSR; while surplus World War II equipment was considered adequate for the developing countries to fight the proxy wars of the Cold War Era.[22] Despite the volume of weapons transferred this was a period of tight export controls. Along with Military Assistance Program, the Export Control Act of 1949 was implemented and gave the president unprecedented power to control American commerce in the name of national security.[23] The Export Control Act institutionalized the predominance of political and security objectives over economic objectives in the arms and technology trade.

1966-1980 Expanding Arms Trade

Lend-Lease and MAP created significant changes in the arms market. However, the miraculous reconstruction of the European and Japanese economies created subtle changes in the

[21] Keith Krause, *Arms and the State: Patterns of Military Production and Trade.* (New York Cambridge University Press, 1992), 99.

[22] Laurance, 100.

[23] Michael Mastanduno, "The Untied States Defiant", in *Defense and Independence in a Global Economy* ed. Raymond Vernon and Ethan B. Kapstein. (Washington, D.C.: Congressional Quarterly, 1992), 94.

political and large changes in the economic landscape of the 1970s. Additionally, some third world countries were now able to independently affect the global arms market.

A significant change in the market was the influx of new independent competitors. In the 1960's the Marshall Plan was showing positive affects. The European countries and Japan were rebounding economically which increased their ability to compete in the international arms market. In 1959 China and the Soviet Union had a political and ideological split. These political and economic changes created conditions which allowed China and France to become major independent arms exporters.[24] This period also coincided with the rise of OPEC and an influx of oil revenues into the Middle East. Petroleum revenues and political turmoil in the area created by the Arab-Israeli conflict combined to touch off a Middle East arms race which was a factor in the beginning of a steep increase in the amount of weapon entering the market from third world countries.[25] The dramatic increase in third world production during this period is shown in figure 2. The flooding of the market with these new suppliers caused a reduction in the influence of ideology and an increase in the importance of technological and financial competitiveness in the market place.

[24] Laurance, 99.

[25] Laurance, 101.

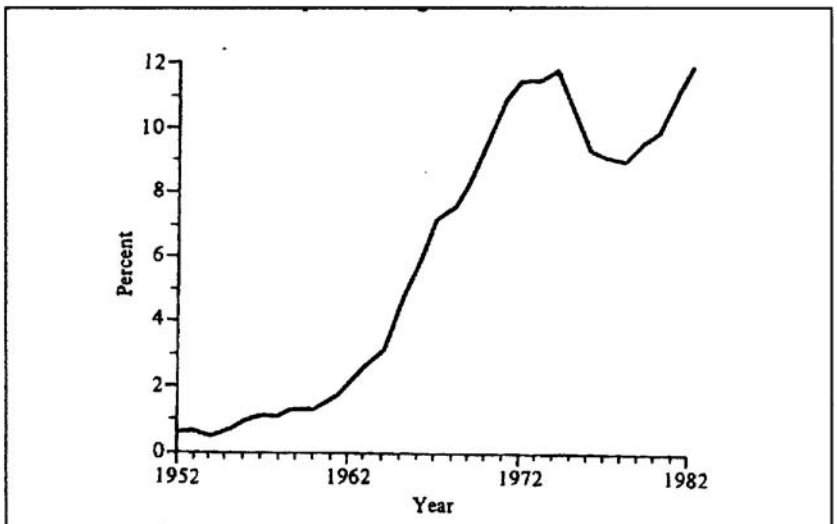

Figure 2. Third World Weapon Production as a Share of Total Weapon Imports, 1952-82

Source: Edward Laurance, The International Arms Trade. (New York: Lexington Books, 1992), 101.

An exponential rise in the cost of weapons systems also began in this period. From 1918 to 1960 there was no change, when adjusted, for inflation in any major category of weapons.[26] However, after 1960 the rising use of electronic components was the catalyst for price increases as the cost of research and development rose to as much as fifty percent of total procurement costs. Consequently, since 1960 the cost per ton of tanks has increased two to three times.[27] This increasing technical sophistication had the effect of concentrating production capability of the most advanced systems in the developed countries. Nonetheless, some third world countries managed to expand their domestic capabilities to produce fairly advanced weapons. The increased market competitiveness forced the developed countries to increase exports of weapons and technology to third world countries to maintain market share and offset the research and development costs of advanced weapons. Paradoxically, this practice increased the third world's opportunities to copy and produce these weapons.

[26] Laurance, 100.

[27] Laurance, 101.

Increasing competitiveness during this period generated growing pressure on the United States government from the defense industry to reduce export controls. Through the late 1960's the Kennedy and Johnson Administrations struggled with ways to reduce the trade barriers imposed by the Export Control Act of 1949. Both administrations, in concert with the Department of State, sought to liberalize controls not only to aid the defense industry but also to allow more flexibility to use arms and arms technology as political bargaining chips. Congress and DOD, however, preferred to maintain tight controls and initially prevailed in the legislative battle. However, struggle between the Department of State, the Department of Commerce and the Department of Defense over the best arms control policy became more strenuous. In 1969 the Johnson Administration was finally able to get the Export Administration Act enacted to increase cooperation between government and business on export controls.[28] The Export Administration Act resulted in the reduction of some barriers to trade and lead to a greater involvement of agencies other than the Defense Department in the determination of weapon and technology export controls.

1980-1991 "Arms Bazaar"

The period from 1980 to the fall of the Soviet Union in 1991 experienced a slight decline in the demand for advanced weapons systems in the Third World. MAP as a mode of arms transfer, depicted in figure 1, had dropped off and was being replaced by other arrangements for the transfer of arms and technology. One mode of payment that replaced MAP grants was the collaborative agreement. Collaborative agreements are arrangements in which companies or governments agree to share research and development or production costs of a weapon system by dividing aspects of the process among several companies. These agreements essentially reduce the price of a weapon system

[28] Michael Mastanduno, "The United States Defiant", in *Defense and Independence in a Global Economy* ed. Raymond Vernon and Ethan B. Kapstein. (Washington, D.C.: Congressional Quarterly, 1992), 100.

to recipient countries by reducing costs. These arrangements may be consortiums, mergers, partnerships, or offset agreements. Although these arrangements had been used since World War II, they had previously been reserved for limited and tightly controlled transfers between the U.S. and NATO countries to help rapidly build their equipment inventories.[29] During this period collaborative agreements became the rule rather than an exception. Consequently, the decade saw a shift from the controlled world of bilateral negotiations between countries to an "arms bazaar" where commercial arms companies and consortiums began to deal directly with the governments of recipient countries.[30] Also during this period dual-use technologies began to occupy a significant portion of the arms market.[31] While the availability of technologically sophisticated arms continued to grow, civilian business was experiencing an information revolution which drove a rapidly expanding and technologically changing market in computer, data storage, and data transmission systems. As a result, the demand for dual-use civilian technologies grew in proportion to the demand for advanced weapons systems. Through the 1970s, the United States had generated the preponderance of high technology research, development and production of dual use technologies were not a large concern.[32] However, during the 1980s the United States' domination of the market in dual use technologies began to decline. By this time, Japan and West Germany were very successful competitors in the world arms market largely on the strength of their ability to exploit dual-use technologies.[33]

The decade of the eighties saw a sharp decline of bipolar politics as a major force in the arms and technology market. The waning bipolar system combined with the increase of arms producing countries created several new market characteristics which have continued in today's arms market.

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[29] Laurance 151.

[30] Laurance, 127.

[31] Laurance, 155.

[32] Laurance, 155.

[33] Laurance, 155.

These characteristics are likely to not only persist but become more acute and perhaps more dangerous in the future. The first and perhaps most critical characteristic is that recipient states acquired enough capability to deter, directly threaten, and influence the behavior of the major states in the system. The conflict with Iraq was an example. Iraq was a country that had no significant domestic production capability in the 1960s. However, in a short period of time it was able to acquire enough military power to influence the actions of major states. Through the 1970's and 1980's Iraq purchased significant conventional forces and a formidable non-conventional (WMD) capability. A second change in the market was that major suppliers could no longer contain the outbreak of conflict simply by using arms transfers or the cessation of arms transfers as an instrument of policy. Regardless of attempts to embargo or unilaterally control arms trade the number of suppliers was large enough and sufficiently independent of political ties that arms were readily available from multiple independent suppliers. The Falklands War illustrates this point No threats by the U.S. to cut off military cooperation with Argentina was sufficient to affect their actions because they believed had acquired sufficient capability to act unilaterally. Similarly, the ability of major suppliers to control the conduct of a conflict through the bilateral transfer of arms was reduced. Another lasting characteristic is that arms transfers can no longer secure the political alignment of recipient countries. As the bipolar system declined arms transfers were no longer a viable tool to secure a third world country's allegiance as so often occurred, for example, in post-colonial Africa during the height of the Cold War. A final lasting characteristic of the period was the exportation of arms and technology simply for financial gain. Much like the inter-war years this practice was again acceptable. As the arms market became more competitive ideological fervor declined and arms once again became more of a commodity than a foreign policy tool.

In summary, the development of arms and technology transfer policy through the Cold War Era has brought the U.S. back to a political and economic environment similar to the inter-war period in which the negative consequences of the arms trade are much less susceptible to unilateral or bilateral control.[34] The qualitative arms race generated by increased technology diffusion and globalization of the industry has created an environment in which many suppliers are equally capable of supplying the high technology equipment that developing countries require to accomplish their regional political or military objectives. It is became much more difficult for developed countries to control arms sales through unilateral or bilateral action. This was particularly true when the controlling influence of the bipolar system diminished (1980-1991) and was eventually eliminated (after 1991). The nature of the modern arms and technology market has diffused the United States' ability to impact other states' policies through the sale of arms and technology and cast doubt on arguments that arms and technology transfer is an essential foreign policy tool. With this in mind, it is necessary to review how recent administrations developed policy to the changing arms market.

The Policy Nixon to Clinton

The Nixon administration, confronted with a significant shift in the arms market, chose to fully engage in arms and technology transfer as a foreign policy tool.[35] Prior to 1970, arms sales and transfers had been exclusively under the control of the Department of Defense, however, President Nixon involved the State Department, the National Security Council and other agencies in the process. As Nixon's National Security Adviser, Henry Kissinger was known to "hand out weapons like hostess gifts" noted one State Department official and he personally opened arms relationships with Iran and

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[34] For a lengthy discussion of these characteristics see Laurance, 152-169.

[35] Janne E. Nolan, "United States" in *Cascade of Arms: Managing Conventional Weapons Proliferation*, ed. Andrew J. Pierre, (Washington, D.C.:Brookings Institution Press, 1997), 84.

Saudi Arabia. [36] The Nixon Administration's policies produced a 65 percent increase in the value of arms sales agreements over previous administrations.[37] Accordingly, Nixon's policy and the results of the Vietnam War generated a growing public outcry against foreign arms deals.

In response to growing public concern with arms sale policy, the Carter Administration attempted to dramatically reverse the policies of the Nixon era and tightly control arms sales. President Carter was the only president in the post-Vietnam era to attempt unilateral and multilateral conventional arms control. He instituted qualitative and quantitative unilateral controls as well as limits on annual dollar amounts of arms sales and conducted conventional arms transfers limitation talks with the Soviets.[38] He envisioned arms control "as an exceptional policy implement" to be used only in very specific and unique circumstances.[39] Regardless of intentions his efforts failed. In fact, due to declining domestic military spending, overall exports climbed during the Carter Administration.[40] President Carter's policy failure did not go unnoticed by the Reagan Administration.

President Reagan quickly changed any idea that arms sales were *not* a routine foreign policy tool. The Reagan Administration viewed arms transfers as an indispensable instrument of American foreign policy.[41] This resulted not only in some very conspicuous arms deals but also in the tightening of controls over a long list of critical technologies. The Department of Defense saw a resurgence of its control over arms and technology transfer issues and used its influence to invoke the review authority over export license applications granted it in a 1974 amendment to the Export

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[36] Keith Krause, *Arms and the State: Patterns of Military Production and Trade,* (New York Cambridge University Press, 1992), 102

[37] Nolan, 134.

[38] Bernard A. Schreiver, "Jimmy Carter's Arms Transfer Policy: It Won't Work" in *U.S. Aims Sales Abroad A Policy of Restraint?* ed. Robert Pranger. AEI Defense Review vol 2 no. 5 (1978), 13.

[39] Schreiver, 11.

[40] Nolan, 136.

[41] Keith Krause, *Arms and the State: Patterns of Military Production and Trade,* (New York Cambridge University Press, 1992), 105.

Administration Act.[42] Frankly, the Bush presidency essentially continued Reagan administration policies.[43] like his predecessor, President Bush and his staff actively pursued arms sales and transfers as a foreign policy tool.

The driving factor behind arms transfer policy in all of these administrations had been political considerations. Recent administrations have explicitly acknowledged their pursuit of political objectives in arms export policy. The Carter Administration for example had ten goals for approving arms transfers of which eight were politically objectives.[44] The Reagan Administration had six goals of which five were political objectives. Arms transfer data shows that the geographic focus of arms and technology transfers directly correlate to changes in American foreign policy objectives. Congressional justifications for arms sales also frequently relied on political motives.[45] Politically driven objectives and policies not withstanding; total arms sales actually increased in the Carter Administration and showed an overall decrease in the Reagan administration. The fact that the Carter Administration significantly reduced the defense budget whereas the Reagan administration significantly increased defense spending highlights two intriguing points. The first is that the real driving force behind arms transfers has become the relative health of the domestic defense budget.[46] If domestic spending is increasing (the Reagan Administration) then arms exports will tend to show an overall decrease. Conversely, as defense budgets decline (Carter administration) exports will increase. The second point is that an increase in arms transactions that were counter to public policy indicates increases in politically independent transactions directly between commercial entities and purchasing states. The

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[42] Michael Mastanduno, 'The United States Defiant," in *Defense and Independence in a Global Economy,* ed. Raymond Vernon and Ethan B. Kapstein. (Washington, D.C.: Congressional Quarterly, 1992), 104.

[43] Krause, 111.

[44] Krause, 111.

[45] Krause, 112.

[46] Janne E. Nolan, "United States," in C*ascade of Arms: Managing Conventional Weapons Proliferation,* ed. Andrew J. Pierre (Washington, D.C.:Brookings Institution Press, 1997), 138.

post-Vietnam administrations provided the Clinton Administration with many examples of the results of conventional arms trade policy on both sides of the central arguments.

The Clinton Administration

President Clinton campaigned on a promise to modify export controls and began his term in the White House with the intention of fulfilling that promise.[47] In September of 1993 President Clinton wrote a letter to Edward McCracken, the chief executive officer of Silicon Graphics, in which he stated, "One reason I ran for president was to tailor export controls to the realities of a post cold war world." Shortly after that letter was sent, the President took steps to relax export controls on a variety of dual use technology items such as encryption technology and powerful personal computers.[48] In 1994 the Clinton administration, in hopes of increasing U.S. global competitiveness, removed essentially all export controls on telecommunication equipment and computers. This came shortly after the dissolution of the Coordinating Committee on Multilateral Export Controls (COCOM).[49] This policy change was a precursor of how the Clinton White House's policy would evolve.

Two years after assuming the presidency President Clinton put his intentions on paper and on 17 February 1995, he published Presidential Decision Directive 34 (PDD 34), The Clinton Administration Policy on Conventional Arms Transfer. It was unremarkable and contained few significant changes over previous administration's policies.[50] Nonetheless, consistent with his focus

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[47] Micahel T. Klare, 'The Subterranean Arms Trade," in *Cascade of Arms Managing Conventional Weapons Proliferation,* ed. Andrew J. Pierre (Washington, D.C.: Brookings Institution Press, 1997), 58.

[48] Jeff Gerth, "China Buying U.S. Computers, Rinsing Fears", *New York Times*, 10 June 1997, New York Times on the Web http: / /www.nytimes.com.

[49] Thomas L Freidman, "U.S. Ending Curbs on High-Tech Gear to Cold War Foes," New *York Times,* 31 March 1998, downloaded from NY Times on the Web, http: / /www.nytimes.com.

[50] Nolan, 131.

on domestic economic issues and previous actions of weakening export controls, the Clinton policy favored a slightly more economic perspective of arms and technology transfers. Moreover, the administration took the unusual step of specifically stating that the U.S. military would provide training to countries that receive arms exports approved by the administration. A government report concluded "Clinton policy publicly elevates the significance of domestic economic considerations in the arms transfer decision-making process to a higher degree than has been the case in previous admirustrations."[51]

Not surprisingly, the Clinton Administration was quickly confronted with the same problems prior administration's had encountered with balancing the drawbacks and benefits of arms sales and technology transfers. The administration was aware that to meet the conflicting demands of a military that was increasingly dependent on expensive advanced technologies; a need to maintain or increase the United States' competitiveness in international technology markets; and a requirement to shape a complex post Cold War through economic and diplomatic efforts; significant changes would be required. Indeed, as a National Security Council official explained, "these issues were harder to get a hold on than weapons of mass destruction. There were more angles to them, relating to economic, political and security policy, and involved more actors"[52] Unfortunately, as his predecessors had discovered, in many cases the issues were "just to hard" to create a comprehensive policy.[53] President Clinton, known for the now famous phrase, "It's the economy stupid," found that the domestic economic impact of arms and technology transfer policy was only a part of tightly woven and complex tapestry of domestic and international security issues.

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[51] Andrew J. Pierre, "International Regime for Arms Sales," *Cascade of Arms: Managing Conventional Weapons Proliferation,* eel Andrew J. Pierre (Washington, D.C.: Brookings Institution Press, 1997), 415.

[52] Pierre, 415.

[53] Miehael Moodie, : Beyond Proliferation: The Challenge of Technology Diffusion" in *Weapons Proliferation in the 1990's.* ed. Brad Roberts (Cambridge, Mass.: MIT Press, 1995) 72.

Part 2

THE INTERNATIONAL ECONOMICS OF NATIONAL SECURITY

The international economics of national security policy has been and continues to be a focus for great debate. Unfortunately, the United States is in period of history in which the political and economic environment is as complicated as it has ever been. Economic interdependence and a related issue, globalization are forcing contemporary policy makers to make decisions that have long term affects on the national security of the country. When the United States was last in a similar situation, during the inter-war period, many would argue that the policy choices were short sighted and lead to the depression and eventually war. Since that time the world has become more intertwined politically and economically making the choices even more difficult.

Economic Interdependence

Intuitively most Americans sense that the world is becoming increasingly interdependent. Although there are a multitude of reasons for growing economic interdependence there are three factors that directly affect arms transfers. The first is the impact of the Marshall Plan on the economic and military development of the world during the Cold War. The second reason, partially a result of the effectiveness of the first, is the fall of the Soviet Union. The third is the influence of advanced information technologies on the global economy.

Since the Marshall Plan was first publicly discussed in a speech in 1947 the United States has taken on the ambitious objective of restoring the postwar world economy based upon its own model

of open and free markets.[54] No country has worked so diligently to encourage other countries economic success.[55] Further, the Marshal Plan called for global economic recovery based solely on the United States' resources. Combined with the Bretton Woods system, the International Monetary Fund and the World Bank, the Marshall Plan was so successful that our allies and friends used it as a model of economic development throughout the non-communist world. Some of our allies, such as Germany and Japan are now our closest competitors. However, an important characteristic of free and open markets is an inherent interdependence that comes when companies vie globally for more cost effective sources of materials, labor, and components regardless of national origin. The result of this inherent interdependence has been an increase in international trade every year since the end of World War II.[56] Accordingly, imports and exports, as a share of gross domestic product (GDP), have increased in virtually every country over the same period.[57] The exponential increase in the availability and power of advanced information technologies expedited the already established trend of companies spreading their business across the globe in search of new markets and lower production costs. As one example, in 1970 U.S. companies 95 percent of domestic high technology requirements in 1986 that percentage had dwindled to only 82 percent.[58] The designed interdependence stimulated by the Marshall Plan in the 1950s was dramatically increased by the events of 1991.

Arguably, the greatest impact on the global economy in recent history has been the fall of the Soviet Union.[59] As the Soviet Union began to unravel, ideological barriers to trade fell. John Makin,

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[54] Kissinger, 445.

[55] Glenn R Pascall & Robert D. Lamson, *Beyond Guns & Butter Recapturing America's Economic Momentum After a Military Decade.* (Washington D.C.: Brassey's (US), Inc., 1991), 35.

[56] Jeffrey Sachs, "International Economics: Unlocking the Mysteries of Globalization," *Foreign Policy* , Spring 1998.

[57] Jeffrey Sachs, "International Economics: Unlocking the Mysteries of Globalization," *Foreign Policy* , Spring 1998.

[58] Raymond Vernon & Ethan Kapstein, "National Needs, Global Resources" in *Defense and Independence in a Global Economy,* ed. Raymond Vernon and Ethan B. Kapstein, (Washington, D.C.: Congressional Quarterly, 1992), 13.

[59] Ian Anthony, 'The Conventional Arms Trade," in *Cascade of Arms: Managing Conventional Weapons Proliferation,* ed. Andrew J. Pierre (Washington, D.C.: Brookings Institution Press, 1997), 410.

director of Fiscal Policy Studies at the American Enterprise Institute noted, "The most significant event of 1988 in the world's major capitals was that economic strength had become more important than military strength."[60] The absence of Soviet influence allowed the emergence of numerous new independent competitors in the global market Czechoslovakia and Ukraine are examples of two of the strong and relatively mature economies released from Soviet domination to compete on the open market. Developed countries were able to reorient some of their resources from defense expenditures to commercial expansion. Another aspect of the reduced influence of superpower competition was an increase in concern with regional competitors. The countries of the world are now seeking new economic and security arrangements through a spreading web of treaties and agreements.[61] The North American Free Trade Agreement (NAFTA) and the European Union are examples. Hungary, Poland and Czechoslovakia have made sufficient progress in economic, political, and defense reforms to formally join NATO. Accordingly, other former Soviet Union and Warsaw Pact countries are involved in the Partnership for Peace Program as they to seek to make the necessary reforms to gain admission to NATO. African countries are also forming regional economic and defense organizations like the Organization of African Unity (OAU). These developing regional cooperation initiatives increase economic interdependence and tighten political and military ties.

Advanced technologies have given individual investors, companies and governments unprecedented access to world financial markets. In the last fifteen years the increase in the flow of international capital has exceeded the growth of international trade and global production.[62] There is perhaps no more appropriate example of growing economic interdependence than the recent and ongoing financial crisis in Asia (know by some as the "Asian contagion" or "Asian Flu"). The exact

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[60] Glenn R. Pascall & Robert D. Lamson, *Beyond Guns and Butter. Recapturing America's Economic Momentum After a Military Decade.* Washington, D.C.: Brassey's (US) Inc., 1991) 106.

[6l] Jeffrey Sachs, "International Economics: Unlocking the Mysteries of Globalization," *Foreign Policy* , Spring 1998.

causes of the economic crisis that struck Russia, Brazil, Indonesia and South Korea are not fully understood and are certainly to complicated to be discussed in detail in this paper. Some have blamed the fickleness of international monetary markets and others blame the general global economic structure. Nicholas Kristoff and Sheryl WuDunn succinctly summarized that situation in a recent article.

> *... causes seem so many and so intertwined that it is difficult to fit them together in any neat equation. Moreover, for all the talk in recent months about grand solutions to crises, there is a growing sense that no good answer may be out there, and that one price of economic development has perhaps been a loss of control over the markets that nurtured the development.* [63]

The crisis does point out, quite painfully in some cases, that the world is highly interdependent and becoming more so. As an example, the impact this recent economic crisis has had in the "booming" American economy is strongly felt in the economically conservative heartland. Mary Jo Paoni, who plans to retire in April of 1999 despite her pension funds loss of $27 million on Indonesian stocks when that economy plummeted, says, “We're worried" she said exclaiming "good God, look what's on TV now!" Mrs. Paoni is referring to a news story describing how the crisis in the global economy has caused a drop in the price of a bushel of corn that surrounds her home from $5.00 per bushel to $2.12 per bushel; as a result tractor sales are down and the John Deere factory is laying off more employees.

> *“ I sit here in this kitchen and say I don't have anything to do with Asia, but I do," she said. “ There's always some tentacles out there. Asia will definitely have an effect on Iowa and Illinois.”*[64]

Economic interdependence has created a highly competitive global market economy in which the U.S. has become increasingly dependent on foreign sources for key manufacturing facilities and advanced technologies. One example is semiconductors. Member of the Japanese Diet and co-author

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[62] Jeffrey Sachs, "International Economics: Unlocking the Mysteries of Globalization," *Foreign Policy* , Spring 1998.

[63] Nicholas D. Kristoff & W. Sheryl WuDunn, 'The World's Ills May Be Obvious, but Their Cure Is Not", New York Time, 14 March 1999, downloaded from New York Times on The Web http://www.nytimes.com/library/world/global

[64] Nicholas D. Kristoff & W. Sheryl WuDunn, 'The World's Ills May Be Obvious, but Their Cure Is Not", *New York Times*, 14 March 1999, downloaded from New York Times on The Web http://www.nytimes.com/library/world/global

of *The Japan that Couldn't Say No,* Shintaro Ishihara's claim that Japan could bring the U.S. to it's knees in six months by withholding semiconductors may be slightly overstated, however, it makes a valuable point about economic interdependence.[65]

Globalization of the Defense Industry

A direct result of increasing global economic interdependence is the globalization of the defense industry. Decreasing domestic demand and increasing reliance on global sources of raw materials and important sub-components has forced the defense industry of the U.S. and other developed countries to seek international collaborations and agreements to remain competitive. In addition, as technology has become more important to the maintenance of military superiority, the defense industry has made greater use of dual-use technologies to mitigate the research and development expenses of "cutting edge" technology. Further, the exploitation of dual-use technologies has exacerbated the related problem of technology diffusion by distributing the capability to produce critical military technologies imbedded in the production of commercial products.

Globalization of the arms industry has been the "quiet revolution" of the 1980's and 1990's. Globalization has been a factor in the arms trade since the inter-war period but it has appreciably accelerated since the 1980s.[66] Figure 3 shows the incidence of inter-firm linkages during the period 1961-1993 and the dramatic increase in collaborative agreements particularly as the bipolar system declined and disappeared. Mergers, joint ventures, consortiums, and "family of weapons" agreements have increased dramatically and will likely continue to increase due to technology diffusion and consistently decreasing domestic defense budgets in the developed countries. These types of arrangements assist the industry in sharing costs, sharing risks, and achieving economies of scale in a

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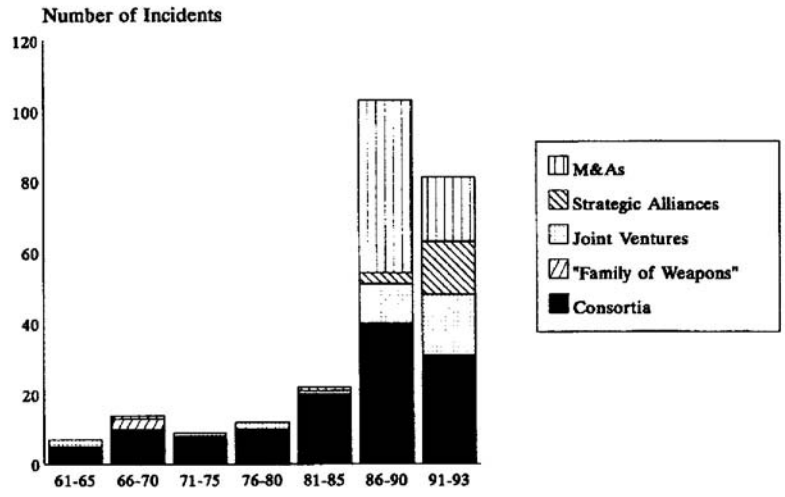
[65] Jacques Gansler, *Defense Conversion: Transforming the Arsenal of Democracy.* (Cambridge, Massachusetts: MIT Press, 1995), 43.

[66] Richard Bitzinger, *The Globalization of Arms Production: Defense Markets in Transition.* (*Washington,* D.C.: Defense Budget Project, 1993)i.

Figure 3. Inter-Firm Linkages Within the Global Defense Industry, 1961-1993
Number of Incidents According to Period of Initiation



Source: Richard Bitzinger, The Globalization of Arms Production: Defense Markets in Transition. (Washington, D.C. : Defense Budget Product, 1993), 11.

declining market. Although these collaborative linkages improve profit margins for industry, they raise concerns among defense officials and policy makers because they potentially weaken the industrial base of the supplier country, dilute the effects of arms control initiatives, and jeopardize the security of the technology upon which advanced weapons systems depend.

The rapid increase of globalization in the American defense industry is not difficult to understand from a commercial point of view. The most important issue for any company is net profit Figure 4 shows what is perhaps the strongest force for globalization which is the rapid decline of defense expenditures as the Cold War drew to a close. As domestic demand has continued to decrease the U.S. defense industry, like the defense industries in Europe and Japan has add to produce more of it's products overseas to reduce costs and sell more of it's products overseas to increase sales. The impact of decreasing defense budgets are exasperated by the exponential increase in the costs of weapon systems. A basic understanding of economics indicates that if unit costs increase and demand is down then the total number of units purchased goes down. Accordingly, the U.S. defense industry

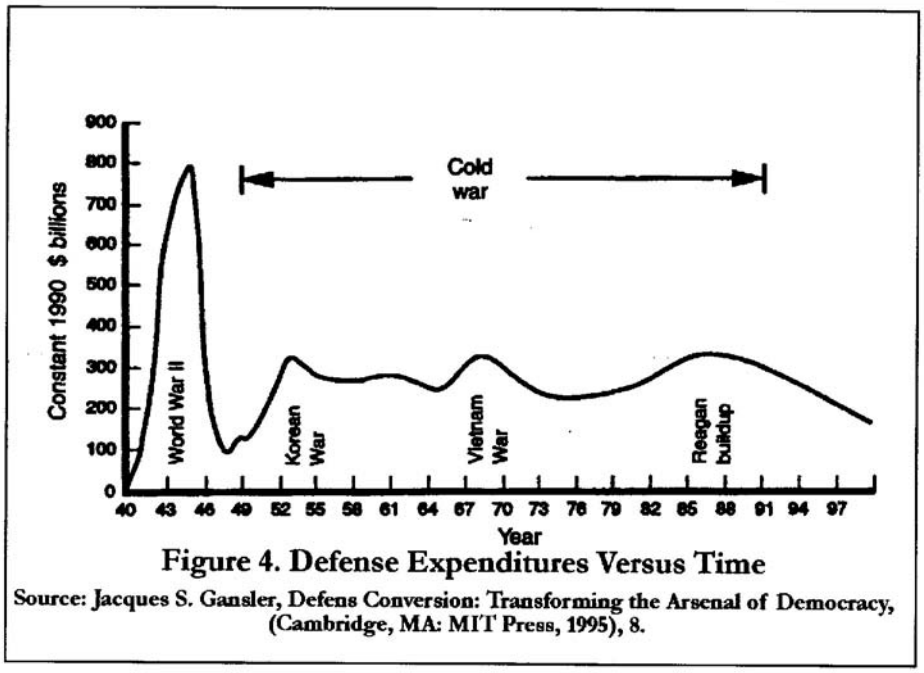


Figure 4. Defense Expenditures Versus Time

Source: Jacques S. Gansler, Defens Conversion: Transforming the Arsenal of Democracy, (Cambridge, MA: MIT Press, 1995), 8.

suffers lower net profits for defense industry. An example of the price increases are the spiraling costs of aircraft between 1970 and 1985 shown in Figure 5. The number of aircraft purchased has declined by 74 percent but total cost has increased by 450 percent.

Year	Total number of aircraft	Cost
1970	**3,500**	**$4 Billion**
1975	**1,700**	**$4 Billion**
1980	**1,000**	**$6 Billion**
1985	**919**	**$18 Billion**

Figure 5. Costs of Total Aircraft Produced by Year 1970-1985.

Ethan B. Kapstein, "Advanced Industrialized Countries" in *Cascade of Arms: Managing Conventional Weapons Proliferation.* (Washington, D.C.: Brookings Institution Press, 1997), 28.

The cost to U.S. national security of globalization is not only the loss of critical technology production but also the potential loss of a credible industrial base. International collaborative agreements potentially degrade the industrial base by transferring technical skills and production capability offshore. In many cases these agreements transfer research and development, component manufacture, and in some cases, final assembly to other countries and once these skills and technologies are transferred the losing country has little control over how they are used. Historically, recipient countries that benefited from collaborative agreements often developed into competitors of the original supplier country. Consequently, the result of arms transfer policy in Europe and Japan after World War II is the development of these countries into our primary arms and technology competitors. Additionally, the loss of engineers, factory space, and productive capacity potentially reduces the supplying country's ability to rapidly mobilize production in an emergency. However, some academics believe that collaborative agreements are beneficial to the domestic arms industry. They argue that potential risks of engineering and production capabilities moving offshore are offset by the tendency of collaborative agreements to enhance the defense industry's ability to stay active

even though domestic demand is low. The Department of Defense has even encouraged collaborative agreements in certain circumstances to maintain the skills and technology on a particular production line even if there was little or no domestic demand for the items being produced.[67] As John Singley, Deputy Assistant Secretary of the Army for Research and Technology described the problem, "if your procurement monies go away" and industry goes off shore or completely out of the business "how are you going to maintain your engineering capability? Just having a bunch of scientists and not having anyone who understands production engineering or manufacturing processes or how to translate research into an item that gets into the field..." reduces the United States' ability to surge production of components and weapons systems in the event of a national emergency.[68] Although not the result of a national emergency, a good example of the loss of production capabilities involves the Tomahawk Cruise Missile. The Japanese Ministry of International Trade and Industry (MITI), under pressure from anti-nuclear forces in the Japanese government forced Dexcel, the American subsidiary of Kyocera to withhold ceramics technology from the Tomahawk Missile program.[69] As the economies of the world become more intertwined globalization will continue to have profound affects on arms control, regional security, and the defense industrial base.

One type of collaborative agreement is the offset which, as mentioned previously, has significantly increased as a mode of arms and technology transfer since 1970. A 1994 Government Accounting Office study of offset agreements cited an interesting example. Turkey used $3.2 billion in Foreign Military Financing Program (FMF) funds and $1 billion of its own national funds to purchase

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[67] Laurance, 168.

[68] William H. Gregory, *The Price of Peace: The Future of the Defense Industry & High Technology in the Post Cold War World.* (New York: Lexington Books, 1993), 33.

[69] Gansler, 44.

a particular weapon system.[70] Turkey requested and was granted permission to produce and assemble parts of the weapon system. The assembled parts were valued at $363.5 million. Follow on co--production was valued at $396.5 million. This essentially gave Turkey a $760 million dollar discount off of the cash cost of the weapons. Subsequently, Egypt, also using FMF grants, purchased the same weapon system. At the U.S. government's initiative and request, Egypt allowed Turkey to assemble and deliver the weapon system rather than get it directly from the United States. The result for U.S. industry was production of the weapon system was moved offshore.[71] Offset agreements augment a nation's inability to afford the high price of modern weapon systems and promotes U.S. foreign policy, however, form a foreign policy perspective the U.S. was able to please key friends and allies in the Middle East.

Another aspect of globalization and often a direct result of collaborative agreements is technology diffusion. This too is a complex issue that impacts economic, foreign policy and defense issues and tends to create diametrically opposed positions among policy makers. Some argue that technology diffusion is essential for economic prosperity. Others argue that it is a serious threat to national security. Figure 6 shows that the preponderance of collaborative agreements are in the most technologically dependent industries. Collaborative agreements are not the only cause of technology diffusion. Direct sales and transfers that are not carefully monitored by the supplying government as well as dual-use technologies also encourage technology diffusion.

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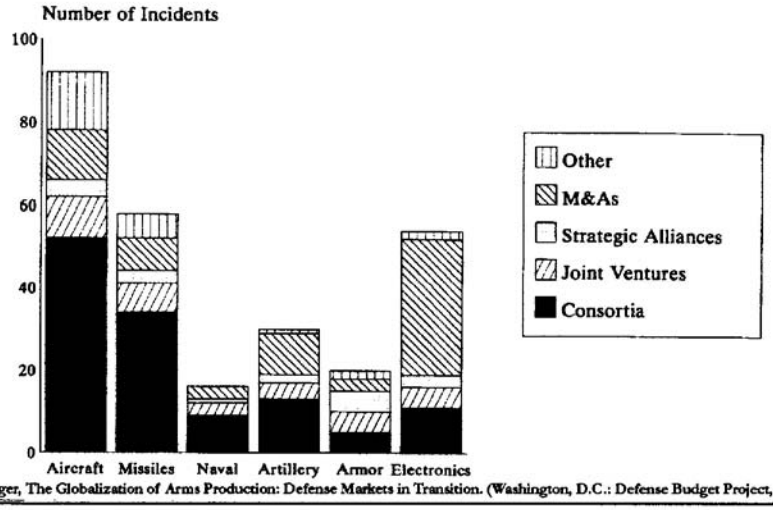
[70] United States General Accounting Office, *Military Export's: Concerns Over Offsets Generated With US. Foreign Military Financing Program Funds* (Washington, D.C.: GPO, 1994), GAO/NSIAD-94-127, 7.

[71] United States General Accounting Office, *Military Exports: Concerns Over Offsets Generated With U.S. Foreign Military Financing Program Fund* (Washington, D.C.: GPO, 1994), GAO/NSIAD-94-127, 7.

Figure 6. Collaborative Agreements by Industry Sector, 1961- 1993 Number of Incidents



Richard Bitzinger, The Globalization of Arms Production: Defense Markets in Transition. (Washington, D.C.: Defense Budget Project, 1993)12.

Collaborative agreements tend to encourage technology diffusion by giving participating countries the ability to produce components or complete systems of advanced weapons and dual-use commercial technologies. The proliferation of producers effectively dilutes the strength of unilateral and bilateral arms control agreements. Technology diffusion increases the opportunities for sanctioned or non-signatory countries (Libya and Iraq are examples) to circumvent controls via third countries or companies that have not agreed to comply with applicable arms control regimes. This proliferation of suppliers also fuels the domestic argument that if we refuse to transfer weapons or technology to a country someone else will and, the argument continues, the U.S. further loses control of the proliferation of the technology. Therefore, the only way to counter the proliferation effects of diffusion is to engage large numbers of countries in broad multilateral agreements to support arms control regimes.[72] Unfortunately this type of consensus is very difficult to achieve in periods of war and more difficult in times of relative peace.

[72] Laurance, 169.

A superb example of technology diffusion in militarily significant commercial systems is the proliferation of satellite technology. This technology proliferated primarily through commercial transactions and government sponsored transfer of dual-use technology. The average American that watched the Persian Gulf war on CNN would be surprised to learn that critical parameters and performance figures for major components of military and civil space systems are identical. That same American may also be surprised to know that the United States and its western allies no longer hold a monopoly on space technology. In fact, the only real remaining baffler to the development of space technologies, the high cost of such programs, is now mitigated by cooperative and cost sharing initiatives between many countries? Several countries have developed satellite technologies that are comparable in capability and absolutely critical to the U.S. military.

Indeed, the U.S. military now purchases civilian satellite access to augment overtasked military satellites. The Gulf War conclusively proved the military utility of civilian satellite systems. During the war, the United States Defense Mapping Agency purchased $5.7 million worth of imagery from French built SPOT satellites and Air Force officers used commercial LANDSAT images for terrain analysis, invasion planning, and map making.[74] If the Iraqi forces had similar access to the technology available the war may have gone somewhat differently.

As the commander of U.S. Space Command noted,

> *During Desert Storm, the allied coalition was able to covertly reposition forces immediately before the ground combat phase began only because the Iraqis did not have an aerial surveillance capability. The move allowed General Schwarzkopf to completely surprise the Iraqi ground forces and minimize allied*

[73] Steve Berner, "Proliferation of Satellite Imaging Capabilities: Developments and Implications," in *Fighting Proliferation: New Concerns for the Nineties.*, ed. Henry Sokolski, (Maxwell Air Force Base, Alabama Air University Press, 1996), 158.

[74] Berner, 120.

casualties. We could not have managed this against an adversary equipped with reconnaissance satellites.[75]

Civilian satellites are so advanced that with the capabilities available in 1995; an adversary that had access to all civilians satellites would have a 50 percent probability of detecting an, such as a major troop movement, event than occurred over a 24 hour period. Moreover, an adversary would have a 100 percent probability of detecting an event that occurred over 2 1/2 days.[76] With stereo capability and geodetic accuracy of fifteen to 100 meters these commercial systems are usable for non-time critical missions such as ballistic missile targets sets.[77] Currently eight countries have deployed civilian satellites that are available for commercial tasking and are capable of better than 100-meter resolution. Some of these platforms have synthetic aperture radar (SAR) which gives them the ability to acquire images 24-hours a day through all weather conditions.

Since 1995 these capabilities have significantly improved in part due to a recent relaxation of U.S. policy on satellite technology which resulted in the launch of commercial satellites with resolutions of one to three meters. The only differences remaining between civilian and military satellites specifications are in the type of power supply and the orbit.[78] Appendix A contains examples of satellite imagery currently available for purchase via the internet. This imagery, with resolutions as fine as two meters from the Russian SPJN-2 satellite, is suitable for targeting stationary targets.

Another example of diffusion of militarily relevant technology is the growing proliferation of cruise missile technology. The 1994 Defense Science Board Study on Cruise Missile Defense stated that "the United States is not in good shape to defend against low flying cruise missiles with a low

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[75] Berner, 125.

[76] Berner, 124.

[77] Berner, 96

[78] Berner, 129.

radar cross-section (RCS)."[79] Seventy or more countries have anti ship cruise missiles (ASCM) in their inventories. The United States has transferred the Harpoon ASCM to twenty-three countries and at least one of these countries, Taiwan, has reverse engineered the missile and is now selling it as the Taiwan manufactured HF-2.[80] Fortunately, the majority of these ASCM systems are not low RCS, however, they are a serious threat because they fly very low and relatively fast making them difficult to detect far enough from the ship to effectively counter the missile. Further, with commercially available technology, they are easily converted to a longer range, highly precise, overland capability similar to the Tomahawk land attack cruise missile (LACM). Although cruise missiles are expensive (approximately $800,000.00 per missile) their accuracy and high probability of destroying large, valuable targets makes them cost effective. These systems will become cheaper and harder to detect as their ability to fly lower, faster, and more accurately is increased with the rapid exploitation of commercially available global positioning satellite (GPS) technologies.

GPS receivers and advanced mapping software that can be combined to create a basic GPS navigation system are commercially available and can be found in some passenger cars. Government GPS satellites transmit a coarse/acquisition (C/A code) that is accurate to 30 meters and was designed to be available to all users.[81] However, the accuracy of the C/A code created a potential threat to security interests so the Department of Defense introduced the SA (selective availability) feature which degrades the C/A code to 100 meter accuracy. Although the SA feature intentionally degrades the GPS signal to reduce its accuracy it is easily corrected by a differential GPS system (DGPS).[82] DGPS systems produce a ground based signal that is as much as ten times more accurate than the C/A code.

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[79] Dennis Ghormley and K Scott McMahon, " Proliferation of Land Attack Cruise Missiles: Prospects and Policy Implications," in *Fighting Proliferation: New Concerns for the Nineties.*, ed. Henry Sokolski, Maxwell Air Force Base, Alabama: Air University Press, 1996), 131.

[80] Ghormley and McMahon, 134.

81 Ghormley and McMahon, 140.

[82] Scott Pace and others, *The Global Positioning System: Assessing National Policies.* (Santa Monica, CA: RAND, 1995), 77.

The commercial demand for GPS and the emergence of DGPS is likely to force the Department of Defense to abandon SA completely.[83] GPS and the availability of commercial mapping software indicates that the ability to produce highly accurate land attack cruise missile technology is likely to rapidly proliferate.[84]

Dual-use technologies

The examples of satellite and GPS technologies show that dual-use technology is an important part of essential commercial industries as well as the defense establishments around the globe. Most Americans are familiar with the most dangerous aspect of dual-use technology which is the application to weapons of mass destruction. A good example of the dual-use linkage between civilian requirements and weapons of mass destruction is the technology associated with the satellite launch vehicle (SLV). The SLV is essentially a rocket designed to lift satellites safely and accurately into orbit. Without this technology a country must rely on other countries to launch satellites. The Chinese developed its initial satellite launch capability from technology provided by Soviet scientists in 1955. Since then they have provided this technology to a number of countries to include Pakistan, Iran, Syria, Saudi Arabia, South Korea and Israel. India and Japan have developed their significant SLV capabilities from U.S. technology. These technology transactions were originally intended to be for commercial use, however, SLV technology is easily converted to ballistic missile technology and several of these countries have developed ICBM launch capability including India and Pakistan that recently launched their 6rst nuclear warhead capable missiles.[85]

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[83]Ghormley and McMahon, 141.

[84] Ghormley and McMahon, 149.

[85] Thomas C. Mahnken and Janne E. Nolan, "Space Launch Technology and Missile Proliferation," in *Space Power Interests* ed. Peter Hayes. (Boulder, Colorado: Westview Press, 1996), 25.

The examples discussed above rely heavily on technologies that are critical to growing commercial industries and equally important to essential military capabilities. These dual-use technologies are seen by some as the key to the United States' economic and military superiority in the 21st Century. Others feel just as strongly that because of diffusion, globalization, and concerns about the competitiveness of the American defense industry these technologies represent the end of the United States' historic technological edge and are a vulnerability in the United States' security posture.

Proponents of greater exploitation of dual-use technologies argue that eventual conversion to civilian production through the exploitation of dual-use technologies is necessary for the U.S. defense industry to survive the steadily declining defense budgets of the post Cold War Era. Although the U.S. defense industry is certainly using dual-technologies to diversify production it is far from converting to civilian production. Rather than convert to civilian production under government direction, the defense industry is pursuing three strategies to counter declining domestic demand and remain competitive. First there has been a tendency towards mergers and acquisitions both domestically and internationally. This has allowed the defense firms that remain to diversify and improve competitiveness. Second, U.S. firms have engaged in teaming and co-production arrangements to domestically develop and produce next generation weapons. Finally, the U.S. defense industry has become much more export oriented. General Dynamics' exports have increased from 17 percent of sales in the 1980's to 50 percent in the 1990's. Similarly, Martin Marietta expected exports to increase from 8 percent of sales in 1991 to 20 percent in 1994.[86] Indications are that U.S. industry is increasing its efforts aimed at direct penetration of international markets independent of government brokered transactions. The Clinton Administration is allowing, and in some cases encouraging these efforts for

[86] Kapstein, 80.

which it has received strong criticism.[87] The marketing and protection of dual-use technologies has been a sensitive issue for government policy makers for many years, however, the United States' closest competitor's have developed a significantly different approach.

In many European countries and certainly in Japan the government has always played a much larger role in research and development than the U.S. Government In most cases, these governments are focused first on stimulating civilian competitiveness and applicability of technology to defense industries is secondary. The majority of defense contractors in Europe and Japan are civilian industries with a small percentage of their total resources dedicated to the defense industry. According to a senior official in the Japanese Defense Agency's Technical Research and Development Institute (TRDI).

> *There is no black versus white, military versus civilian technology. All technology is gray. It becomes a military or civilian in application. Today 81% of Japan's R &D efforts are focused on the commercial side.*[88]

European companies are also much more diversified, export oriented, and expressly aimed at the exploitation of dual-use technology.[89]

The implications of the changing dynamics in the international economy are significant for the United States' future competitiveness, tenuous technological superiority, and national security. The U.S. has historically opposed the type of governmental involvement in civilian industry that has helped its competitors become so competitive in civilian and defense technologies. The international competitiveness of the domestic defense industry and the United States' continued technological superiority will rely on dual-use technologies. Although technology has historically been important to

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[87] Aaron L. Freidberg, "The End of Autonomy," in *Defense & Independence in a Global Economy,* ed. Raymond Vernon and Ethan B. Kapstein. (Washington, D.C.: Congressional Quarterly, 1992), 86.

[88] Richard J. Samuels, "Reinventing Security Japan Since Meiji," in *Defense & Independence in a Global Economy,* ed. Raymond Vernon & Ethan B. Kapstein (Washinton, D.C.: Congressional Quarterly,1992), 56.

[89] Kapstein, 83.

the nation's security, technology has become so critical the nation's security interests will require a reevaluation of traditional trade policies. To efficiently exploit critical technologies American companies will have to make more cooperative arrangements with international firms and increasing reliance on foreign sources of supply and technical expertise will play a progressively critical role in commercial and defense related research and development and production.

Part 3

THE CHANGING NATURE OF TECHNOLOGY IN THE DEPARTMENT OF DEFENSE

Since the end of the Cold War the United States Armed Forces have experienced an ongoing process of reevaluating the organizational, doctrinal, and technological future of the four services. This process of review and change is not only the natural result of the defeat of Soviet Union but also a response to technological change. Technological change has always driven changes in national security policy. However, the United States and many other nations now understand that more than at anytime in the past the economic, social, and defense posture, in short the national security, of their nations are dependent on their technological capability.[90] Technology has become the motive force for the development of new weapon systems, doctrine, and defense organization. The outcome of the Persian Gulf War forced the world to acknowledge the importance of advanced technology and strive to counter America's perceived mastery of it. Advanced technology in conventional weapon systems has become the deterrent of the post Cold War Era and the Department of Defense's vision of the impact of technology is embodied in Joint Vision 2010. This document, published by the Chairman of the Joint Chiefs of Staff, is the concept for the Department of Defense's utilization of current and emerging technologies to meet the threats of 2010 and beyond.

A key characteristic of Joint Vision 2010 is the concept of full spectrum dominance. Full spectrum refers to all aspects of air, land, sea, space dimensions as well as the electromagnetic spectrum in a given battlespace. Dominance of the entire battlespace will rely on advanced command and control, advanced sensors, advanced precision weapons, an advanced ability to move men and

[90] Moodie, 74.

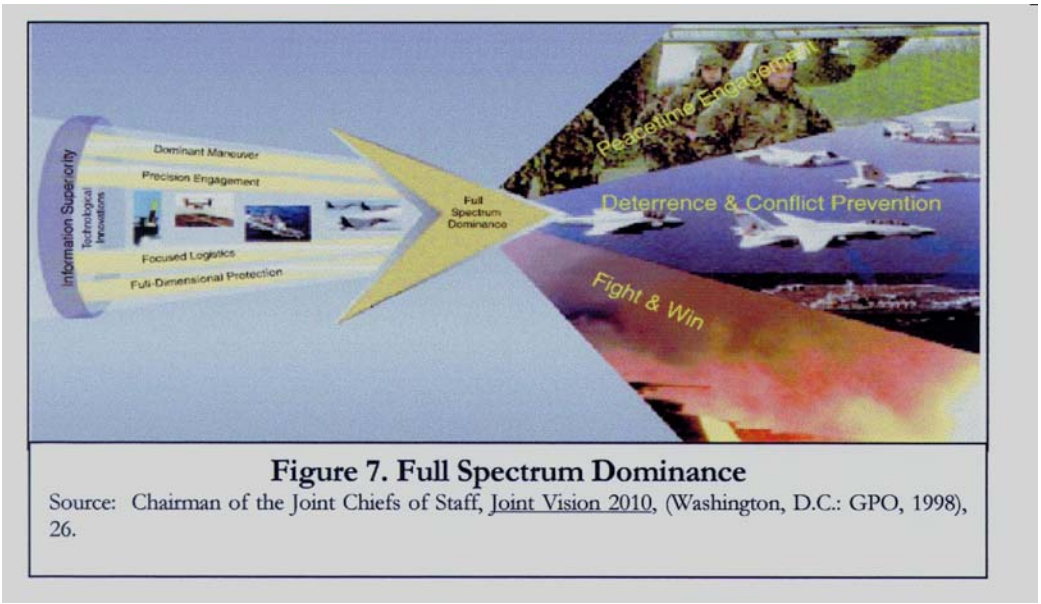

Figure 7. Full Spectrum Dominance

Source: Chairman of the Joint Chiefs of Staff, Joint Vision 2010, (Washington, D.C.: GPO, 1998), 26.

machines quickly throughout the battlespace. Full spectrum dominance will be augmented by advanced logistics systems capable of "just in time" supply. As shown in figure 7 information superiority and technological innovation will facilitate the synergistic effects of the operational concepts of dominant maneuver, focused logistics, precision engagement, and full dimensional protection to dominate the enemy in any combat environment Information superiority, defined as "The capability to collect, process, and disseminate an uninterrupted flow of information while exploiting or denying an adversary's ability to do the same." is critical to attaining the system integration necessary to maximize the potential effects of the four operational concepts.[91] Information superiority is the foundation of what many refer to as the revolution in military affairs and essential to the ability to integrate all of the systems on the battlefield.[92]

The precision engagement capability of such Gulf War "heroes" as the Patriot missile, the Ml-Al Main Battle Tank, precision guided munitions ("smart" bombs) and others are evolutionary

[91] Chairman of the Joint Chiefs of Staff, Joint Vision 2010.

developments of weapons that have evolved through years of refinement. The revolutionary aspect of military operations in the Gulf War was the integration of these weapons with national level intelligence systems, theatre intelligence, surveillance systems, and rapid command and control inputs. Being able to seamlessly integrate all of these systems while prohibiting the enemy from doing the same was the true success story of the Gulf War. The technological challenge of information superiority is the revolutionary ability to integrate the more advanced systems required to support Joint Vision 2010 in near real time. The system integration that was accomplished in the Gulf War and was not possible without data processing, storage and distribution technologies developed initially for use in civilian industry and applied to military requirements. Edward Woolen, Vice President of Marketing Research for Raytheon Corporation summarized the criticality of system integration.

> *It takes a 1st generation equivalent of 386 CPU to run an AMRAAM missile. That chip has long been released to the world. Patriot is a particularly low-tech weapon system.. .In fact it is probably two or three generations old. What makes it into a weapon is the ability to put all of these bits and pieces together in a useful way.*

System integration was critical and only the surveillance, targeting, and data transmission capabilities of satellite based information and advanced computer systems could provide the fusion of information that was critical to integrate relatively low-tech equipment into a system of systems capable of dominating the battlefield.[94] The systems available now are many times more capable than those in the Gulf War. The systems required to fulfill the expectations of Joint Vision 2010 will have to be faster, more accurate, and have higher transmission and storage capacities than are currently available.

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[92] For a thorough discussion of the Revolution in Military Affairs see John Arquila and David Ronfeldt, eds. *In Athena's Camp: Preparing for Conflict in the Information Age.* (Washington, D.C.: Rand, 1997).

[93] Edward Woolen, "Exports and Defence Jobs! Industrial Base in the Industrialized States: An American Approach," in *Arms and Technology Transfers: Security and Economic Considerations Among Exporting and Importing States,* ed. Sverre Lodgaard and Robert Pfaltzgraff, Jr. (New York: United Nations, 1995), 210.

[94] Moodie, 79.

Specific technologies that are critical to the ability to integrate systems include computers, high-speed digital communications, and advanced data security systems. Since declining defense budgets have reduced the Defense Department's influence in the national research and development effort; these information technologies were developed and continuously improved primarily by commercial entities.[95] During the 1950s, 1960s and 1970s defense research appeared to be a consistent engine of economic growth generating the technological "spin-offs," such as commercial air transportation, Teflon, and the microwave. However, the recent trend has been the use of commercial "spin-offs" in information technologies being used for military purposes. Eighty percent of computer research in the 1950s was funded by the Department of Defense. In 1960, 50 percent of all U.S. research and development was DOD funded. That had dropped to 33 percent in 1990.[96] Reduction in the perceived threat has created a situation in which the defense budget has declined steadily since the end of the Reagan Administration (refer to figure 4). The impact of this decline has been the reversal of the historic relationship between civilian and defense research and development. In many critical areas, civilian research now leads defense research efforts.

Joint Vision 2010 is a conceptual framework that is becoming a procurement blueprint for the military forces of the future.[97] Because of dwindling budgets and the lengthy procurement process the capabilities required to realize the operational concepts envisioned in Joint Vision 2010 are in the development and procurement cycle now. These acquisitions include precision munitions such as the Joint Air to Surface Stand-off Missile, additional satellite systems for improved imagery and communications, systems to support full spectrum protection such as the Theatre Missile Defense system, and others. Appendix B shows some of the advanced technology systems being funded for

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[95] Moodie, 81.

[96] Moodie, 74.

[97] James R Blaker, "Understanding the Revolution in Military Affairs," ROA *National Security Report,* May 1997: 260.

fiscal year 2000. Concurrently, the research and development of emerging technologies needed to achieve the operational concepts of Joint Vision 2010 is underway. A sample of some of the projects that the Defense Advanced Research Agency is funding are shown in Appendix C.

Unfortunately, the Department of Defense is attempting to procure rapidly changing technology for the 21st Century with a Cold War Era procurement system. The military has been justifiably focused on cost cutting and protection of the industrial base than purchasing the best technologies available.[98] However; these policies may no longer be prudent for a technology dependent military using advanced weapons that are built around systems in which major technological improvements are now measured in months rather than years.[99] Although improvements have been made, a procurement process that sometimes takes twenty years to field a major system is not going to meet the technological demands of Joint Vision 2010.[100]

The difficulty in solving the technology dilemma the Department of Defense faces is that possible solutions will potentially increase technology diffusion, industry globalization, and may adversely affect the economic health of the shrinking domestic defense industry as well as jeopardize the security of the technology that is so vital. A solution that many have recommended is a major revision of extremely stringent military specifications and purchase more commercial off the shelf technology (COTS). Although this may be disturbing for the defense industry which is sensitive to the loss of any business to commercial competition, it would have a positive impact on the procurement of rapidly changing information technologies. One example of the cost-reducing impact

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[98] Joseph F. Pilat and Paul C. White 'Technology and Strategy in a Changing World," in *U.S Security in an Uncertain Era* ed. Brad Roberts (Cambridge, Massachusetts: MIT Press$_5$ 1993), 79.

[99] David C. Gompert, ed. *Strategic Assessment 1998: Engaging Power for Peace* National Defense University (Washington, D.C.: National Defense University, Institute for National Strategic Studies, 1998), downloaded from National Defense University, http: / /www.ndu.edu/inss/sa98ch15.html.

[100] Pilat and White, 81.

of modifying military specifications and procurement procedures the purchase of semiconductors. Semiconductors produced for the commercial sector more than meet military demands. Chips currently hard mounted on automotive engine blocks exceed temperature requirements by ten degrees are cheaper, and are three years more advanced in processing speed.[101] However, five of the top ten semi-conductor firms in the U.S. have refused government business because of arcane accounting procedures, specifications, and standards.[102] Fortunately the Defense Department has made some progress toward improving procurement procedures.

The Department of Defense has shown that it is capable of streamlining the procurement process. A positive example was the procurement of the Trimble Trimpack portable GPS receiver. The Trimpack (known by DOD as SLGR, Small Lightweight GPS Receiver) was bought off the shelf. During procurement, the DOD bought sufficient numbers to drop the price by $1000.00 a unit. However, during the search for an improved replacement for SLGR the movement toward a better procurement process was stalled by changes to specifications which made it difficult for Trimble to make a competitive bid. When Trimble couldn't adjust to the specification changes the bidding process was also opened to the traditional defense contractors.[103]

Joint Vision 2010 is a concept that has become an outline for research, development and procurement of weapon systems. It is highly dependent on advanced information technologies and weapon systems integrated into a system of systems capable of near real time analysis of information. This information will be used to direct rapid, precise fire and maneuver to dominate the battlespace. However, the unwieldy procurement process and technology diffusion may hinder the procurement of the innovative technologies required to produce these capabilities. Conversely, liberalization of the

[101] Gransler, 38.

[102] Gransler, 38.

procurement process may encourage further technology diffusion thus making these technologies so readily available that they become military irrelevant.

[103] Gregory, 131-134.

Part 4

CONCLUSION

The Problem Refined

> *Diverse, robust, leading-edge industrial producers are more critical to our U.S. national security at the current time than to most other nations or to ourselves at earlier periods of our history. Our basic security posture is built on the assumption that America will maintain a lead in a rather broad range of advanced industrial technologies. If we lost this lead, we would end up having to support the full weight of an arsenal economy, [which] would become, vis-a-vis Japan, not so different from the arsenal economy of the Soviet Union vis-a-vis ours."*[104]

Although the development of policy that effectively controls arms and technology transfer has been a challenge since World War I, the exponential growth of dual—use technologies and the growing interdependence of the civilian and defense sectors have magnified the problems developing policy that effectively policy. No single solution or combination of ad hoc fixes will effectively balance the potential benefits of arms and technology transfers with the many threats to national security that they pose. Virtually any single solution for one issue comes with a price in some other aspect.

Nonetheless, rather than make a comprehensive revision of policy that addresses the issues through a domestic consensus behind comprehensive policy the agencies and policy makers of the U.S. government remain tied to parochial Cold War arguments and allow only reactionary incremental changes in policy. Historical fact and contemporary trends show that rapid proliferation of advanced conventional weapons and dual-use technologies have significantly reduced the United States' ability to

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[104] Glenn K Pascall and Robert D. Lamson, *Beyond Guns and Butter Recapturing America's Economic Momentum after a Militaryy Decade*. (Washington, D.C.: Brassey's (Us, Inc., 1992), 138.

manipulate other nations through unilateral or bilateral arms transfer policy. Historic patterns of regionally dependent arms and technology transfer policy derived primarily from prejudiced agency specific perspectives are becoming progressively less effective and potentially detrimental to U.S. national security. A paradigm shift in the government's perception and utilization of the elements of national power to develop a strategically sound arms and technology transfer policy is required.

Proponents of more arms and technology transfer feel that policies increasing transfers would benefit defense industry by allowing them to exploit the benefits of overseas sales and production. As the domestic defense budget continues to decline exports are thought to be key to maintenance of a viable surge capacity. However, the defense industry has shown that it is fully capable of competing in the global market often quite independently of government policy.

Proponents also argue that dual-use technologies make arms sales and transfers more valuable as foreign policy tools because they are increasingly linked to critical commercial technologies. This linkage makes dual-use technologies appear to be very lucrative tools for the Department of State and Department of Commerce to use to achieve their policy objectives. Unfortunately, economic interdependence, technology diffusion, and changes in global political alignments have significantly diluted the power of weapons and technology as tools to secure political loyalty or affect the outcome of international disputes.

A third argument in favor of more liberal transfer policies has been the general benefit to the domestic economy. Clearly dual-use technology has become a key factor in the growth of the American economy. However, as the defense budget declines defense spending and the defense

industry has become a smaller portion of the GDP thus reducing its ability to stimulate or retard the economy.[105]

Opponents of arms and technology transfer argue that economic and political benefits should not outweigh the security issues of providing technologies that are important to advanced weapons systems to foreign owned companies or subsidiaries of American owned companies overseas. They also argue that in most cases foreign policy objectives are not sufficient to transfer critical arms or technologies overseas where the United States could lose control over the proliferation of the technology or tip a military balance creating a regional conflict. As an indicator of the ill effects of technology transfer and globalization, many would site the newspaper headlines reporting Department of Defense personnel scrambling to expedite supplies of critical components from global sources for deployed weapons systems during the Gulf War.[106]

Advocates of tighter control over arms sales argue that the best way to support the domestic defense industry is through support of domestic innovation through government funded research and development programs and improved procurement procedures. They argue that domestic innovation and superior quality are the keys to success in the 21st Century.[107]

The examples in this paper and those available daily in the media show that national security is best served by a balanced policy which encourages appropriate sales and transfer policy and enforces export controls that protect qualitative superiority in critical technologies. The path the Department of Defense has laid for itself in Joint Vision 2010 makes these issues more critical. DOD has committed itself to reliance on the most advanced technologies available to maintain technological

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[105] Pascall, 34.

[106] Gansler, 44.

[107] Gansler, 45.

superiority over potential adversaries. Essential business information technologies and defense information technologies are fusing and, although the operating environments may be different, the functions are the same.[108] Development of these information technologies will inevitably speed the trend toward more technology diffusion and globalization because these technologies are of little use if U.S. allies and business partners can not have access to the same information systems. There is certainly no "black and white" policy solution that effectively balances these issues. However, it is clear that a more unified technological-industrial policy is required. As the Defense Science Board noted in 1987.

> *The U.S. is partially and irreversibly dependent on foreign sources for critical weapons systems components. For the past 40 years, Americans have assumed… a one way street; We had the superior technology; our allies were expected to rely on our advanced systems for equipping their forces. Because of the evolution of the world economy, that is no longer true.* [109]

The price for continuing with no coherent policy is high and the potential damage to national security is significant. Not taking advantage of the benefits of economic interdependence may be just as damaging as ignoring the dangers of uncontrolled exports of arms. The nation's historical lessons regarding arms and technology transfer policy can provide some insight into what is and is not effective, however, sustaining the historical status quo of interagency rivalry and short sighted regional policies is not sufficient. Significant changes are required to build a comprehensive technology policy that will take the country strongly into the 21st Century. The choices are challenging but they must be dealt with through innovative and coherent policy. The current administration must reevaluate the international and domestic situation and develop a sound technology policy built upon consensus among the various agencies.

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[108] Moodie, 77.

[109] Glenn R. Pascall & Robert D. Lamson, Beyond Guns and Butters Recapturing America's Economic Momentum After a Military Decade. (Washington D.C. Brassey's (US), Inc.) 1991, 56.

Recommendations

The issues are amazingly complex and it is critical that the development and execution of any comprehensive policy incorporate at a minimum the Departments of Defense, State, and Commerce. A coherent and consistent policy is required that takes into account domestic industrial base, defense technology requirements, and foreign policy initiatives in a unified interagency policy process.. Recent attempts at multilateral and unilateral controls have not been very effective and a number of international agreements have met with little or no success. For example, the Missile Technology Control Regime and the Wassenaar Agreement have had only a slowing effect on the proliferation of advanced technology systems as evidenced by recent examples of proliferation in Iraq, Pakistan, India, and North Korea. Due to the realities of global economics and policy disagreements between agencies, domestic initiatives to control the transfer of arms and technology have had little impact. What is required is prudent and aggressive direction from the executive branch that unifies the various agencies under one farsighted and inclusive policy. As the House Committee on Science, Space and Technology, Technology Policy Task Force concluded

> *America does not have a formal polity for stimulating and guiding technology development. We do have numerous laws as well as many ingrained patterns and practices that govern the way that we envision, develop, and utilize technology. These guidelines and influences viewed collectively form and "ad hoc" national policy for technology.*[110]

President Clinton began his Presidency strongly in favor of revising arms control and export policy. Revision of export controls and reductions in arms sales were important parts of his platform. However, the administration has been stymied by the complexity of the issues and possibly, poor

[110] Gregory, 10.

political judgement.[111] The result has been a potentially dangerous mix of traditional politically driven policy consistent with previous administrations and a relaxation of critical technology export regulations and arms control policy designed to support domestic economic policy.[112] The Clinton Administration claims tight control over arms sales while the American share of the global market increased 23 percent in l996.[113] Before the U.S. trades its technological superiority away; jeopardizes the U.S. industrial base, misses a lucrative trade opportunity or inadvertently tips the scales of a regional power struggle; the administration must take steps to unite the various agencies of the government in a consensus on a pragmatic and extensive technology policy. This policy must acknowledge technology as a pivotal element of national power.

A paradigm shift in national security policy is required that forces the entire government to recognize that the use and misuse of technology directly affects national security. The federal government must institutionalize an understanding of technology as a sixth determinant of national power equal in significance and inextricably linked to the political, economic, military, psychological, and informational determinants.[114]

The first step in generating the paradigm shift is publishing a revised National Security Strategy National Security Strategy that specifically addresses technology policy. Most importantly the new National Security Strategy must outline the administration's new technological/industrial policy and how it will be used to enhance national power and protect national security interests. The current

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[111]John Lancaster, "Clinton's Salesmanship Boosts American Firms But Draws Criticism," *Washington Post*, 4 April 1997, Sec A-16. Downloaded from http: //infomanage.com/nonproliferation/weaponsales/gulf.html.

[112]Janne B. Nolan "United States", in *Cascade of Arms* ed. Andrew Pierre.

[113] Philip Shenon, "U.S. Increases Its Lead in World Market for Weapons", *New York Times,* 16 August 1997, Sec. 1-3:1.

[114] David Jablonsky, "National Power," Parameters, (Spring, 1997): 19.

strategy requires appropriate refinements to the dual-use and munitions licensing process.[115] The new strategy must go beyond refinements discuss a thorough analysis and revision of the policies of all agencies to meet the needs of a technology dependent national security establishment..

The second step is publishing a new Presidential Decision Directive (PDD). This Presidential Decision Directive should provide detailed and comprehensive guidelines for the development, procurement, sale, and transfer of advanced conventional arms and dual-use technology. It should use any applicable sections of previous decision directives such as Protecting America's Critical Infrastructure, PDD 63; The Clinton Administration Policy on the Control of Arms Exports, PDD 34; and National Space Policy, May 11, 1978, PDD-NSC 37 but not be restricted by their limited scope. As a way to build consensus in support of the policy the PDD should be drafted with input from the organizations that will be involved in its execution. At a minimum the administration should collect input from the Department of Defense, Department of State, and Department of Commerce as well as independent agencies such as the Arms Control and Disarmament Agency and the Trade Promotion Coordination Committee should be involved. The objective of the PDD would be to not only define the use of technology as a determinant of national power but also specify the role of each of the departments and cabinet level agencies in managing technology and executing the policy. At a minimum it should provide guidelines for comprehensive arms and technology export policy that is adapted to the current and future economic and political environment. To create an environment of cooperation and maintain consensus between the various agencies the PDD should follow the example of Presidential Decision Directive 56, The Clinton Administration Policy on Managing Complex Contingencies and direct the formation of an interagency working group. Such a group would be a standing technology policy working group that could be modeled on the Clinton

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[115] *A National Security Strategy* for a *New Century,* (Washington, D.C.; GPO, 1997) downloaded from http://www.whitehouse.gov/WH/EOP/NSC/Strategy/

Administration's Interagency Conversion Committee.[116] The working group should be headed by the National Security Adviser or his designee and be augmented by an external advisory board that would be made up of members of industry, academia, and relevant non-governmental agencies. The two groups would coordinate to establish guidelines regarding the establishment and enforcement of export controls, stimulation of domestic innovation, development of critical products and processes, foreign technologies to be accessed, and technologies to be protected. It would also establish measures of effectiveness that evaluate the performance of the U.S. government, allies, sanctioned countries, and industry in complying with established guidelines.[117] Perhaps most importantly it should continuously reevaluate the roles of the agencies involved in the approval of arms and technology transfers to ensure they maintain compliance with the national security strategy in their areas of responsibility.

Technology is an acknowledged vital determinant of national power in the future. The United States' economic, political, social, and military future depend on a continued technological superiority over our competitors. As Pascall and Lamson succinctly stated, “U.S. national security is based on a strategy of deterrence, which in turn relies on qualitative superiority."[118] This applies more now than it ever has in the past and the time is here to revamp national security policy to protect and cultivate technological superiority as a critical element of national power.

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[116] Gansler, 238.

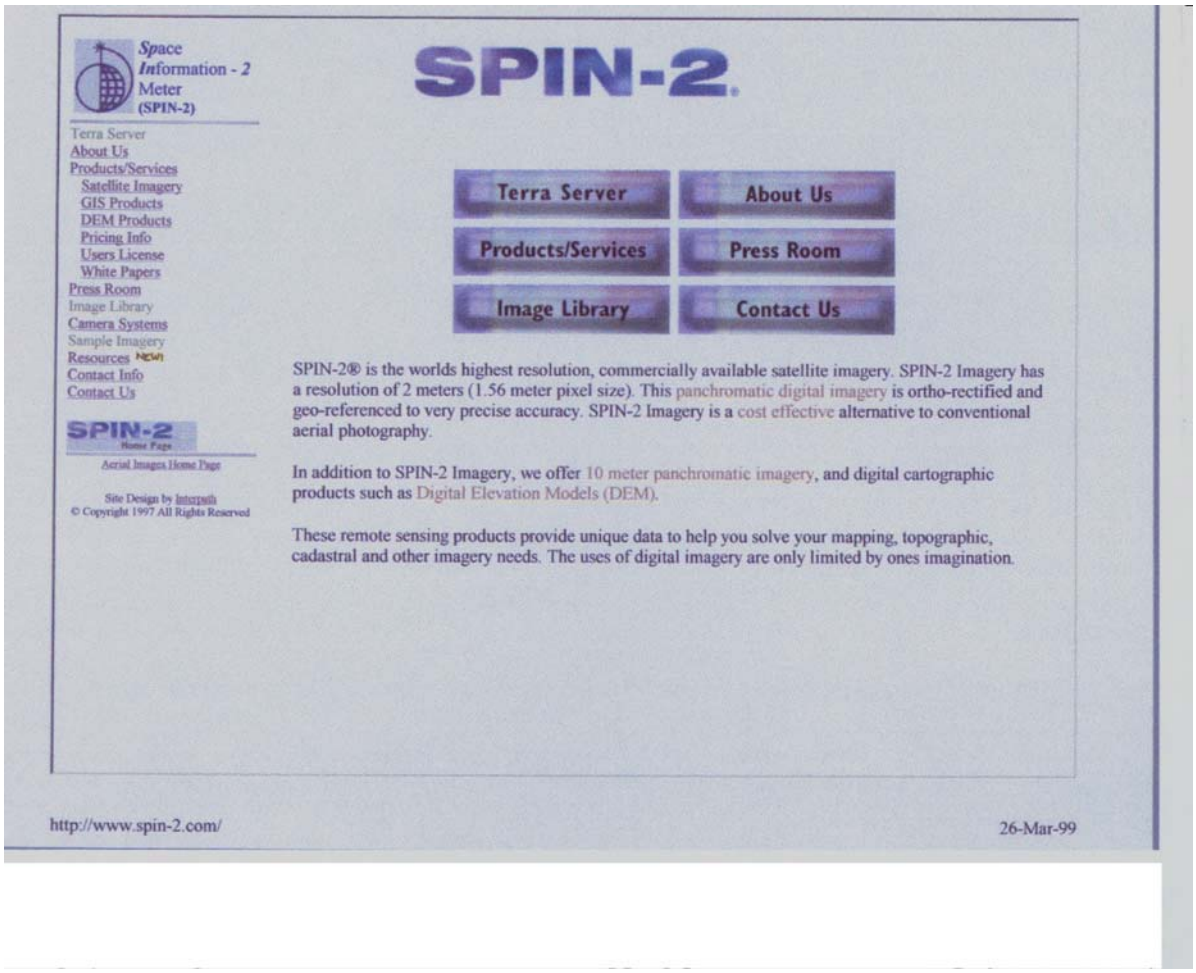
[117] Gansler, 238.

[118] Pascall and Lamson, 57.

Appendix A: Example of Commercially Available Satellite Imaging

This is a web page provides access for anyone with a credit card to purchase satellite imagery. This particular image is of surplus B-52 aircraft at Davis-Monthan Air Force Base in Tucson Arizona. The resolution is sufficient that with little or no training, special equipment, money a person could assess the type of aircraft and basic condition of the aircraft. This type of information could provide vital information to a conventional or unconventional (terrorists or guerillas) adversary.

Appendix A: Example of Commercially Available Satellite Imaging



This is the home page for SPIN-2. Note that from this site a person can purchase not only imagery but Digital Elevation Models and GIS mapping products based on imagery taken with two meter resolution.

Appendix B. Department of Defense FY 2000 Budget, Program Acquisition Costs

DEPARTMENT OF DEFENSE
FY 2000 BUDGET
PROGRAM ACQUISITION COSTS
(Dollars in Millions)

	AIRCRAFT	FY 1998	FY 1999	FY 2000	Page No.
Army					
AH-64D	Longbow Apache	505.6	630.7	773.5	1
RAH-66	Comanche Helicopter	262.6	364.8	427.1	2
UH-60	Blackhawk Helicopter	282.7	273.5	102.8	3
Navy					
AV-8B	Harrier	334.2	389.0	346.4	4
CH-60	Helicopter	59.4	176.1	325.6	5
EA-6B	Prowler	117.0	160.2	248.0	6
E-2C	Hawkeye	375.8	460.9	411.6	7
F/A-18E/F	Hornet	2,424.4	3,178.2	3,066.3	8
T-45TS	Goshawk	295.8	316.1	357.9	9
SH-60R	Helicopter	82.0	226.4	348.8	10
Air Force					
B-2	Stealth Bomber	650.4	424.7	374.6	11
C-17	Airlift Aircraft	2,367.4	3,192.2	3,561.9	12
CAP	Civil Air Patrol	2.9	3.0	2.5	13
E-8C	Joint Surveillance Target Attack Radar System (Joint STARS)	433.3	663.3	483.0	14
F-16	Falcon Multi-Mission Fighter	210.4	206.6	440.8	15
F-22	Advanced Tactical Fighter (ATF)	2,084.0	2,365.7	3,074.3	16
ABL	Airborne Laser	153.5	257.3	308.6	17
DoD-wide/Joint					
JPATS	Joint Primary Aircraft Training System	125.2	150.4	166.8	18
JSF	Joint Strike Fighter	913.4	923.3	476.9	19
V-22	Osprey	1,185.6	1,060.2	1,168.7	20
C-130J	Airlift Aircraft	544.6	493.5	42.9	21
	MISSILES				
Army					
ATACMS	Army Tactical Missile System	173.5	182.4	199.9	22
BAT	Brilliant Anti-Armor Submunition	142.4	182.9	249.8	23
JAVELIN	AAWS-M	145.7	348.6	411.1	24
LONGBOW	Longbow Hellfire Missile	231.2	345.1	294.3	25
MLRS	Multiple Launch Rocket System	176.2	152.1	192.7	26

The BAT submunition is an example of the precision engagement concept of JV 2010

DEPARTMENT OF DEFENSE
FY 2000 BUDGET
PROGRAM ACQUISITION COSTS
(Dollars in Millions)

	MISSILES	FY 1998	FY 1999	FY 2000	Page No.
Army Contd.					
AVENGER	Missile System	0	34.9	33.8	27
Navy					
RAM	Rolling Airframe Missile	56.4	50.7	53.6	28
STANDARD	Missile (Air Defense)	177.7	223.7	213.1	29
TOMAHAWK	Cruise Missile	129.4	201.9	198.1	30
TRIDENT II	Submarine Launched Ballistic Missile	306.0	374.4	537.0	31
Marine Corps					
JAVELIN	AAWS-M	58.2	82.9	92.9	32
DoD-wide/Joint					
AMRAAM	Advanced Medium Range Air-to-Air Missile	202.4	187.3	207.3	33
JASSM	Joint Air-to-Surface Standoff Missile	167.2	130.9	168.4	34
JSOW	Joint Standoff Weapon	178.3	231.2	275.9	35
AIM-9X	Sidewinder	106.3	117.2	142.3	36
	VESSELS				
Navy					
DDG-51	AEGIS Destroyer	3,621.6	2,899.4	2,928.0	37
NSSN	New Attack Submarine	2,975.1	2,353.9	1,105.7	38
SSN-21	Seawolf Attack Submarine	222.3	57.8	66.4	39
LPD-17	San Antonio Class Amphibious Trans.	230.8	638.2	1,523.1	40
ADC(X)	Auxilliary Dry Cargo Ship	-	-	453.1	41
	TRACKED COMBAT VEHICLES				
Army					
M1A2	Abrams Tank Upgrade	622.2	702.2	658.3	42
M2A3	Bradley Base Sustainment	302.4	440.7	348.8	43
Crusader	Artillery Systems	301.2	313.6	343.9	44
	SPACE PROGRAMS				
Army					
DSCS	Defense Satellite Communications System (Ground Systems)	101.9	126.3	89.3	45

JASSM is another example of a new system that will provide the precision engagement capability.

DEPARTMENT OF DEFENSE
FY 2000 BUDGET
PROGRAM ACQUISITION COSTS
(Dollars in Millions)

		FY 1998	FY 1999	FY 2000	Page No.
SPACE PROGRAMS					
Air Force					
DSP	Defense Support Program	103.4	100.5	119.1	46
MLV	Medium Launch Vehicles	197.5	182.4	66.1	47
MILSTAR	Satellite Communications	609.7	546.5	361.3	48
NAVSTAR GPS	NAVSTAR Global Positioning System	259.4	188.0	269.8	49
Titan	Heavy Launch Vehicles	515.7	661.0	476.7	50
EELV	Evolved Expendable Launch Vehicle	23.3	259.1	395.6	51
SBIRS-H	Space Based Infrared System-High	337.9	539.4	328.7	52
SBIRS-L	Space Based Infrared System-Low	213.5	192.2	229.0	53
OTHER PROGRAMS					
Army					
FHTV	Family of Heavy Tactical Vehicles	112.3	196.4	190.4	54
FMTV	Family of Medium Tactical Vehicles	204.5	335.4	427.9	55
HMMWV	High Mobility Multipurpose Wheeled Vehicle	120.9	64.2	99.3	56
SADARM	Sense and Destroy Armor Munition	75.8	63.1	73.9	57
WAM	Hornet (Wide Area Munition)	36.1	32.6	23.7	58
Air Force					
SFW	Sensor Fuzed Weapon	164.4	132.6	73.1	59
WCMD	Wind Corrected Munitions Dispenser	29.4	21.1	48.9	60
DoD-wide/Joint					
TMD	Theater Millile Defense Defense	3,047.1	2,833.5	2,962.4	62
NMD	National Missile Defense	936.2	1,092.9	1,286.6	63
JDAM	Joint Direct Attack Munition	100.8	107.0	174.4	64
UAV	Unmanned Aerial Vehicles	652.3	779.6	648.1	65

Defense Adv Research Projects Agcy
FY 2000/2001 RDT&E PROGRAM

EXHIBIT R-1

APPROPRIATION: 0400D Research Development Test & Eval, Defwide

Date: FEB 1999

Line No	Program Element Number	Item	Act	Thousands of Dollars FY 1998	FY 1999	FY 2000	FY 2001	S E C
2	0601101E	Defense Research Sciences	1	66,706	64,429	64,293	68,792	U
	Basic Research			**66,706**	**64,429**	**64,293**	**68,792**	
7	0602110E	Next Generation Internet	2	39,313	49,504	40,000		U
12	0602301E	Computing Systems and Communications Technology	2	296,646	323,959	322,874	331,023	U
13	0602302E	Extensible Information Systems	2			70,000	70,000	U
14	0602383E	Biological Warfare Defense	2	58,452	84,754	145,850	151,000	U
16	0602702E	Tactical Technology	2	140,997	169,759	137,626	123,937	U
17	0602708E	Integrated Command and Control Technology	2	43,994	39,607	31,296	32,000	U
18	0602712E	Materials and Electronics Technology	2	213,386	278,286	235,321	219,063	U
	Applied Research			**792,788**	**945,869**	**982,967**	**927,023**	
32	0603285E	Advanced Aerospace Systems	3			19,664	19,000	U
41	0603739E	Advanced Electronics Technologies	3	272,020	265,442	246,023	233,198	U
42	0603746E	Maritime Technology	3	32,750				U
43	0603747E	Electric Vehicles	3	15,000	9,000			U
48	0603760E	Command, Control and Communications Systems	3	147,525	177,492	222,888	213,380	U
49	0603761E	Communication and Simulation Technology	3	70,165	52,258			U
50	0603762E	Sensor and Guidance Technology	3	160,881	209,971	232,319	211,893	U
51	0603763E	Marine Technology	3	19,597	23,659	22,538	21,964	U
52	0603764E	Land Warfare Technology	3	79,319	88,613	97,825	101,376	U
53	0603765E	Classified DARPA Programs	3	124,194	50,040	77,780	49,600	U
54	0603800E	Joint Strike Fighter (JSF) - Dem/ Val	3	21,134				U

Defense Adv Research Projects Agcy
FY 2000/2001 RDT&E PROGRAM

EXHIBIT R-1

APPROPRIATION: 0400D Research Development Test & Eval, Defwide

Date: FEB 1999

Line No	Program Element Number	Item	Act	Thousands of Dollars FY 1998	FY 1999	FY 2000	FY 2001	S E C
55	0603805E	Dual Use Applications Programs	3	115,784				U
	Advanced Technology Development			**1,058,369**	**876,475**	**919,037**	**850,411**	
102	0605114E	BLACK LIGHT	6	4,522	4,985	5,000	5,000	U
114	0605502E	Small Business Innovative Research	6	45,869				U
121	0605898E	Management Headquarters (Research and Development)	6	35,633	38,498	31,387	32,632	U
	RDT&E Management Support			**86,024**	**43,483**	**36,387**	**37,632**	
123	0909999E	Financing for Cancelled Account Adjustments	6	146				U
	RDT&E Management Support			**146**				
	Total Defense Adv Research Projects Agcy			**2,004,033**	**1,930,256**	**2,002,684**	**1,883,858**	

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