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HIGH-TECH WEAPONS,
DUAL-USE TECHNOLOGY
AND STRATEGIC ALLIANCE

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I. Introduction

The Issue

Technology has become one of the major issues in U.S.-Japan relations. As Japan acquires greater competitiveness in world-class technologies, the U.S. has started to worry about the implications this will have for its future economy. Additionally, Japan's increasing technological strength has started to affect its security relationship with the U.S. This is become some of the advanced technologies in which Japan has gained an edge are dual use in nature; that is, they are useful for military as well as commercial purposes. The most significant problem emerging from the dual-use nature of Japanese technology is U.S. dependency on Japanese suppliers for military components. This means an increasing vulnerability of the U.S. security position, as more components used in U.S.-made weapons are produced in Japan. Hereinafter, this problem will be referred to as the "dependency problem."

It is worrisome that this problem is causing rising tension between the U.S. and Japan. On the U.S. side, there are those who are overly concerned about the vulnerability of U.S. weapons systems and advocate technonationalism through protectionist measures. On the Japanese side, as Shintaro Ishihara argues in The Japan That Can Say No, Japan could change the world's military balance by favoring the USSR over the U.S. in its semiconductor supply endeavors. This argument, however, may well be based on overconfidence concerning Japan's technological prowess.[1]

These overreactions are potentially dangerous for the future of U.S.-Japan relations. For this reason, a fuller analysis of the dependency problem should be

undertaken, and appropriate actions initiated by both the U.S. and Japan. If overreactions continue on both sides of the Pacific and if resultant friction emerges, a very complex issue could arise between the two nations in view of both the economic and security implications for their bilateral relationship.

Trend of Dependency

Although the dependency problem certainly has important implications for U.S.-Japan relations, it is difficult to determine the exact degree to which U.S. high-tech weapons incorporate Japanese electronic components in their systems. This is because the Department of Defense keeps statistics only for prime contractors, not for subcontractors or parts suppliers. There are, however, two methods of inferring the degree of dependency.

The first is to check the actual contents of existing weapons, either by breaking up or tracing sources of supplies. With the HARM missile, the Mark 48 torpedo and the Verdin Communication Device, for instance, a three-year tracing survey by the Navy and the Department of Commerce found, after checking 14,000 subcontractors, that about 20% of the components are made abroad.[2] This kind of survey, of course, cannot clarify the full extent of the dependency problem, but it provides a clue to determining it.

The second method is to estimate from trends in nonmilitary markets, where more data are available. If it is shown that the majority of dual-use components for commercial applications in the U.S. are supplied by foreign companies, there is a strong possibility that military markets rely on these dual-use components as well. A typical

example of this is semiconductor materials. Domestically produced semiconductor materials, such as silicon wafers, sputter targets and ceramic packages, account for only 5% of the total supply in the U.S., suggesting that the military sector is similarly dependent on foreign products.[3]

As seen in the Gulf War, the main U.S. high-tech weapons actually in use now are those that were made in the late 1970s and early 1980s, when the Japanese electronics industry was not so competitive. In addition, in the case of semiconductors, military chips typically lag three to five years behind commercial ones.[4] In view of these factors, it is probable that Japanese electronics components, especially semiconductors, are not widely used at present in U.S. high-tech weapons systems.

Regardless of the actual degree of dependency at the moment, though, the important point is that Japanese electronics components will be used more extensively from now on because U.S. weapons will start to use those components made in the late 1980s, when Japanese companies were competitive.

There are still other reasons to believe that Japanese dual-use components will be used more extensively in U.S. weapons systems in the near future.

First, the effectiveness of high-tech weapons was proven in actual battle during the Gulf War, and this will lead to the further electronicization of weapons. In 1988, 36% of the purchases and 42% of the R&D expenses incurred by the Department of Defense were electronics-related. These figures are expected to increase in the future.[5]

Second, the Gulf War also showed that high-tech weapons themselves are becoming very expensive, and, unless effective cost-cutting is undertaken, the U.S. will be

able to afford fewer and fewer weapons. This development comes in conjunction with the likelihood of cuts in the defense budget. One way to deal with this situation to substitute dual-use components for military-specific components, which are much more expensive.

These trends point to the likelihood that Japanese dual-use electronic components will be incorporated into U.S. weapon systems at an increasing rate. Consequently, the dependency problem will become an even more important topic in U.S.-Japan relations in the near future. This is the reason that both the U.S. and Japan should start now to seek ways of approaching the dependency problem.

In this paper, I will present some possible solutions to the dependency problem aimed at the private sector. It is important for the Japanese private sector, which usually has little interest in military affairs, to take the initiative. This is because these companies actually possess the important dual-use technologies. I will devote the next section to summarizing the arguments in both countries concerning the dependency problem. I will also point out the possibilities for overreaction on both sides. In the third section, I will present an analysis of the dependency problem. In the fourth, I will present three policy recommendations.

II. Opinions in the U.S. and Japan

Unfortunately, there are wide perception gaps between the two countries. The arguments on both sides are outlined below.

The U.S.

The dependency problem started to gain attention in the U.S. in the late 1970s. In 1980, the Defense Industrial Base Panel of the Committee on Armed Services published a report that showed concern about the increasing dependency on foreign sources "for critical raw materials as well as for some specialized components needed in military equipment." The report also warned of the increasing competitiveness of Japanese semiconductor manufacturers.[6] That same year, Jacques Gansler published a book on the U.S. defense industry and, in it, he mentioned the dependency problem.[7]

The concern regarding the dependency on Japanese electronic components became particularly strong in the latter half of the 1980s, and a number of reports were published on the topic. These reports were written by governmental agencies, congressional committees, university institutes and private think tanks, and they take highly diverse views. Below, I will divide these views into four categories and summarize each. Since it is difficult to discuss at length the detailed differences among all of the reports, I believe that categorization will be useful for clarifying the substance of the dependency arguments.

1) The argument that there is no serious vulnerability arising from dependency

No report based on this argument has been written. There are, however, those who argue this position. In general, representatives of prime contractors are said to take this view. The argument, in the case of semiconductors, is as follows: Although semiconductors are critical components, they are only a small part of military systems. In

addition, truly critical semiconductors are only a small part of the total, and prime contractors could produce these critical semiconductors in-house, if needed. Therefore, the argument goes, there would not be any serious vulnerability problem, even if there was reliance on commodity-type semiconductors from overseas suppliers.[8]

2) The argument for procurement of critical components from U.S. suppliers and less important ones from Japanese suppliers

The most important report taking this position is the one written by the Northeast Asia-United States Forum on International Policy at Stanford University.[9] The argument in this report is that Japan is an ally of the United States; therefore, there should be no serious concern about Japanese companies supplying electronic components to U.S. prime contractors and subcontractors. Under such an arrangement, the U.S. could even take advantage of Japanese electronics technology. Since there is uncertainty involved in the technology transfer mechanism, however, the U.S. should maintain the capability to produce only the truly critical components.

The report warns that, if the U.S. tries to protect its ability to produce critical parts, this might lean towards protectionism. Therefore, the U.S. should try to preserve its ability to produce only the truly critical components and seek to avoid broad government intervention.

A similar attitude, emphasizing technology transfer and cooperation with Japan (in both military-specific and dual-use technologies), can be found in reports by the

National Research Council and by the Defense Science Board on technology cooperation.[10]

3) The argument favoring industrial policy

This position favors broader U.S. government intervention than argument 2) and supports industrial policy to protect strategic industries. A typical argument of this type can be found in a report written by the Defense Science Board on semiconductor dependency.[11] The main thrust of the report is that U.S. military forces depend heavily on technological superiority and that electronics--especially semiconductor--technology is essential for maintaining that superiority. It is, therefore, unacceptable for the U.S. military to rely on foreign sources for state-of-the-art technology. To maintain a dominant position, this argument goes, U.S. industry should lead in commercial markets as well, due to the dual-use nature of military technology. It suggests the adoption of a de facto industrial policy to achieve this objective.

Another difference between this argument and argument 2) is that this approach tends to view Japan as a strong competitor rather than a cooperating colleague. This is understandable because, in order to encourage the government to adopt an industrial policy, it is politically more expedient to view Japan as threatening to U.S. strategic industries.

4) The argument for managed competition

Michael Borrus suggests the following approach to revitalizing the U.S. semiconductor industry and acquiring national security as well as economic competitiveness.[12] He argues that the U.S. government should negotiate a five-year restraint on investment in new chip production capacity by Japanese producers, while the U.S. should grant special accelerated depreciation for U.S. producers so that they can increase their investment in production capacity.

If these measures were adopted, U.S. producers would have an opportunity to increase their share of the semiconductor market. Even if these measures did not succeed, Borrus has an alternative policy: to encourage foreign direct investment and have "U.S. policy rather than Japanese strategy" be adopted in the U.S. He argues that this second-best policy would contribute to insuring U.S. national security and strengthening the U.S. economy. Clearly, this approach is suggesting abandoning free trade in the electronics sector and adopting managed competition to protect U.S. interests.

Japan

Compared to the situation in the U.S., where the dependency problem draws wide attention and a number of reports have been written, in Japan, although the problem is widely recognized, it has not generated serious discussion or detailed analysis.

One reason for this is that the dependency problem is a problem for the U.S.; Japan is only indirectly influenced. In addition, due to the dual-use nature of the

technology, once Japanese electronics manufacturers supply components to U.S. companies, they don't know whether the products are used for commercial or military purposes. Since these Japanese manufacturers are afraid of being criticized by the media or the opposition parties on the grounds that the components they produce are used in weapons, they try to avoid discussing the issue openly.

However, the dependency problem attracted considerable attention during the Gulf War. The fact that U.S. high-tech weapons, weapons that were so effective, actually contained Japanese electronics components was widely mentioned in the media. Because of this, arguments about the dependency problem began to emerge in the press. They can be summarized as follows.

1) The argument that emphasizes technological excellence in Japan[13]

This argument claims that the Gulf War proved the excellence of Japanese high technologies; U.S. high-tech weapons used such Japanese-made components as semiconductors and charged coupled devices, without which they would not have functioned so well. Supporters of this argument, therefore, believe that Japan aided the Gulf War effort from a technological standpoint. In addition, they claim that the high quality and reliability of Japanese dual-use technology was indirectly proven through the Gulf War.

2) The argument that emphasizes pacifism[14]

Japan imposes strong controls over weapons exports through its Three Principles on Arms Export, which prohibits shipping of weapons to: 1) communist bloc countries, 2) countries subject to embargoes on arms export under United Nations Security Council resolutions, and 3) countries engaged in or likely to be engaged in international conflicts. Japanese electronics manufacturers, however, indirectly supply components to U.S. high-tech weapons. Therefore, supporters of this argument say, the Three Principles have become meaningless. In addition, they warn of increasing pressure from the U.S. to transfer Japanese high technology to the U.S. military.

Worrisome Gap Between the Arguments

Neither of the Japanese arguments grasps the substance of the dependency problem. Instead, they emphasize the excellence of Japanese technology and the philosophy of pacifism, respectively. This is worrisome because, if Japan does not grasp the substance of the problem and continues to avoid serious discussion of and involvement with it, the possibility of overreaction in the U.S. will increase.

At present, the U.S. position is believed to be swinging between arguments 2) and 3); that is, even though there is a move, especially in Congress, toward nurturing strategic industries, an obvious industrial policy approach is strongly opposed by the administration. If Japan continues to be uncooperative towards the U.S. with regard to the dependency problem, this will push the U.S. toward argument 3). This is because, if Japan is judged to be an unreliable ally as a result of its uncooperative attitude towards

the dependency problem, this will increase U.S. incentives to adopt a policy of protecting its strategic industries.

III. Analysis

Differences Between the U.S. and Japan in the Backgrounds of Electronics Development

One of the main reasons for the large gap between the U.S. and Japanese arguments concerning the dependency problem accrues from the fact that the two countries faced totally different environments surrounding the electronics industry during the early stages of its development. Figure 1 illustrates this point. In the figure, the vertical axis shows the level of national security related to electronics technology. If a country has domestically owned R&D and manufacturing facilities for electronics components within its own borders, its vulnerability to shortage of electronics supplies in a crisis is reduced; therefore, its security position is strengthened. On the other hand, if ownership and the location of these facilities are foreign, the country's security position is weakened.

The horizontal axis shows the economic opportunity cost incurred by the commercial sector in shifting resources to the military sector. Therefore, this figure shows the relationship between the level of security and economic cost incurred by the level of security in terms of electronics technology.

First, let's look at the U.S. The U.S. security position was ideal in terms of electronics technology during the period from World War II to the mid-1960s. The superior level of U.S. electronics technology remained unchallenged throughout the globe, and weapons that embodied advanced electronics technology were made by U.S.-owned companies in manufacturing facilities located in the U.S. No dependency problem existed during this period.

The U.S. did, however, pay an economic security cost to establish and maintain this position; the U.S. government spent a large amount of its R&D funds for military purposes. On average, for example, 54% of the government's R&D funds were earmarked for military- and space-related purposes during the period from 1955 to 1965.[15] If a larger budget had been allocated for commercial purposes, development in that sector would have been more rapid. This is because it is more efficient to spend R&D dollars directly in the commercial sector rather than wait for spin-off technology from the military.

After World War II, the U.S. needed to strengthen her security position vis-a-vis the USSR, even though this was costly. In any case, the U.S. could afford to do this because of the strength of her economy at the time. Therefore, the U.S. started in the upper left of Figure 1, a combination of strong security and high economic cost.

This started to change in the 1970s, as the relative economic position of the U.S. began to decline. Fiscal and trade deficits became particularly acute problems for the U.S. in the 1980s. Therefore, the U.S. could not afford to strengthen her security position

at the expense of her economy. In other words, although security issues were significant in U.S. policymaking, economic issues were a significant constraint. Therefore, the U.S. is believed to have moved to the lower left of Figure 1, requiring it to maintain a strong security position while cutting costs.

The development of the electronics industry in Japan started differently. There, the only purpose of developing electronics technology was to gain commercial competitiveness by catching up with the U.S., i.e., purely economic. Therefore, economic efficiency was the most important consideration in developing electronics technologies. Japan did not need to reduce economic efficiency by shifting precious resources to military ends, and she did not show a strong interest in the military implications of electronics technologies. This was probably a rational choice for Japan because its security position was assured by the security treaty with the U.S. Thus, Japan's development of electronics technology started in the lower-right-hand quadrant of Figure 1, i.e., a combination of a weak security position and low spending.

Japan's position also started to change in the 1970s. The security aspects of Japanese electronics technology became more important with its rapid advance to world level. This advance is reflected in the fact that U.S. high-tech weapons started to incorporate Japanese-made electronics components. This did not mean, however, that Japan was trying to gain world leadership by strengthening her military power using her electronics technology. In the postwar period, Japan has placed more emphasis on her economic role in international affairs and has minimized any military aspects. Thus, Japan has been unwilling to sacrifice economic efficiency for the military potential of

electronics technology. In Figure 1, then, Japan moved from the lower right to the lower left quadrant, maintaining an emphasis on economic efficiency while recognizing the security aspects of electronics technology and using it properly for her security ends.

Both countries, thus, have moved into the lower left quadrant of Figure 1, where they have similar interests in a strong security position and low spending. Since the U.S. and Japan are allies, technological cooperation between them in the military field by sharing technologies in which they have comparative advantages should be mutually beneficial. This kind of cooperation, however, has not advanced smoothly. One important reason for this is that neither country fully realizes its current position in relation to national security and spending and sometimes try to behave as if they were in their original position.

The U.S. was originally in a position where it could strengthen its security without many economic constraints. Although it is now prohibitive to return to the original security position (R&D, manufacturing and ownership all stay within the U.S.), there are still some advocates of technonationalism who would like to see this happen.

For her part, Japan behaves like she is still in the lower- right-hand quadrant of Figure 1, where she can ignore the security aspects of electronics technology. Although technological advancement has started to attach security implications to the technologies, Japan still tends to ignore this and look only at the economic implications. This is typical of Japanese electronics manufacturers, and one reason for this is that these manufacturers' technological roots are purely commercial.

In conclusion, one of the major reasons for the large gap between the U.S. and Japanese arguments is the difference in the backgrounds surrounding the early stages of electronics technologies in the two countries. In order to make military-technological cooperation between the two nations smoother and more beneficial, it is necessary for both of them to realize that their current positions are different from their original ones.

Two layers of cooperation

It is important to distinguish two kinds of military technological cooperation between the U.S. and Japan. Figure 2 illustrates this. The upper part of the figure shows the prime contractors and subcontractors in the U.S. and Japan, among whom mainly military-specific technologies are exchanged or transferred. On the legal side, the Three Principles on Arms Exports are applied to technology transfer. Although the Principles were relaxed in 1983 and the transfer of military technology to the U.S. was approved as an exception, various legal restrictions still exist. Codevelopment of the FSX is a typical project in this category of military relations.

On the other hand, the dependency problem discussed in this paper is shown in the lower part of the figure. The relationship mainly involves parts suppliers in the U.S. and Japan, who are exchanging or transferring dual-use technology. There is no legal restriction on the exchange or transfer of these technologies, thus, no difference from dealing with commercial technology in general.

Therefore, due to the differences in the types of players, technologies involved, and legal framework, it is necessary to distinguish these two layers to avoid confusion in discussing military technical cooperation between the U.S. and Japan.

Ownership vs. Location

The first step in approaching the dependency problem is to examine the relative importance of the nationality of a corporation's ownership and location of its facilities as they relate to national security. This is because the internationalization of high-tech industries tends to separate nationality of ownership from location of facilities.

Let's look at the case of the U.S. semiconductor industry. U.S. semiconductor companies started to build their assembly plants abroad as early as the 1960s. Fairchild first established a manufacturing affiliate for assembly in Hong Kong in 1961. Other semiconductor manufacturers followed suit, looking for cheap labor, and established assembly plants in Hong Kong, South Korea and Taiwan. In the late 1960s, these locales were expanded to include Mexico, and, in the 1970s, Singapore, Malaysia, Indonesia, Thailand and the Philippines. As a result, by the late 1970s, more than 80% of U.S. semiconductors were being manufactured abroad.[16]

On the other hand, Japanese manufacturers are building semiconductor production facilities in the U.S. The first, NEC, built full-line manufacturing facilities in California and began volume production of DRAMs in 1985. Hitachi, Fujitsu and Mitsubishi emulated NEC in the late 1980s, establishing similar manufacturing facilities in the U.S. Although this move was partially in response to trade friction over

semiconductors, which became particularly intense in the 1980s, Japanese companies' production of semiconductors in the U.S. is steadily increasing.[17]

Figure 3 shows an analysis of the problem of ownership vs location made by the Office of Technology Assessment of the U.S. Congress.[18] The figure displays four different combinations of ownership and location of companies in terms of national security. The best combination is obviously position (1), where corporations are largely owned by U.S. interests and conduct their R&D and manufacturing operations domestically. The U.S. was in this ideal position right after World War II. It became very difficult, however, to maintain this position due to the internationalization of high-tech industries and to the fact that the U.S. lost competitiveness in some of its high-tech sectors. In short, it has become prohibitive for U.S. companies to manufacture domestically all the components they need for high-tech weapons.

The worst case is position (4), where the location of both ownership and R&D and manufacturing facilities is overseas. This situation is not acceptable for U.S. security. Therefore, the U.S. is forced to make a choice between the better of two evils: position (2), U.S. ownership with foreign R&D and manufacturing, and position (3), foreign ownership with domestic R&D and manufacturing. The choice, thus, rests with which is more important for U.S. national security, ownership or location.

The Office of Technology Assessment concluded that position (3) is preferable to (2). This is because, in position (3), "the corporation and most of its employees would be subject to the laws of the United States and could be required to give priority to U.S. national security needs in a crisis." This situation is believed to be better than having to

rely on supplies from manufacturing plants located overseas in a crisis, regardless of the nationality of ownership. This conclusion by the OTA provides one important key to solving the dependency problem.

IV. Policy Recommendations

Recommendation (1): Supplies from Japanese subsidiaries located in the U.S. and localization of the subsidiaries

As the OTA assessment shows, the U.S. security position can be improved if supplies of components made by Japanese manufacturers come from factories located in the U.S. rather than in Japan. Japanese manufacturers, therefore, should supply components from their U.S. factories if and when these components might be destined for military applications.

There is an additional issue involved in supplying components from Japanese manufacturers, i.e., assured access of Japanese supplies in a crisis. There is a doubt as to whether Japanese subsidiaries would put priority on U.S. interests over their commercial interests in U.S. military crisis.[19]

Localization of Japanese subsidiaries in the U.S. is necessary to remove this doubt. In so doing, Japanese manufacturers could come to more closely resemble their American counterparts and reduce the level of suspicion against them. Before R&D,

localization of production in the U.S. is desirable, and the local content of Japanese products should be raised to the level of that in similar U.S. companies. This is because, if Japanese subsidiaries in the U.S. rely on input supplies from Japan, U.S. vulnerability towards Japanese manufacturers will increase, causing problems for U.S. security.

After local production is established, R&D should follow. If Japanese companies establish R&D facilities in the U.S., this will be advantageous for U.S. security because transfer of Japanese technology will likely take place and then the U.S. would have easier access to that technology in a crisis.

It is also necessary for Japanese subsidiaries to localize their management. Certain doubts about Japanese companies in the U.S. are based on how their management would act in a crisis for the U.S. If the management positions of Japanese subsidiaries are occupied mainly by Japanese nationals, this doubt becomes stronger. And indeed, this is still the case. For example, an American Electronics Association survey reported that, as of 1989, 98% of the top managers in Japanese electronics companies in the U.S. were Japanese nationals.[20]

If localization advances in terms of production, R&D and management and if components to be used for military applications are supplied from U.S. subsidiaries, the pacifism argument mentioned above cannot be supported. In other words, when critics claim that Japanese components are used in high-tech weapons, it can be clearly argued that those "Japanese" components are actually made by U.S. workers, managed by U.S. managers, and made in U.S. factories using local materials. Such products can hardly be called "Japanese" components.

Recommendation (2): Keep the supply of truly critical military components within the U.S.

For analytical purposes, it is necessary, first of all, to distinguish between two types of military components. The first is a military-specific component that is truly critical for weapons systems. The second is a general dual-use component. The dependency problem with Japan lies in the latter, rather than the former.

U.S. vulnerability would not increase very much, even though the U.S. depends on Japanese dual-use components, if Recommendation (1) is implemented from Japan's side. If a problem in truly critical military-specific components arises, however, vulnerability increases significantly, creating an unacceptable situation for U.S. security. Therefore, it is important for U.S. companies to maintain production and assembly of truly critical components within the U.S. Even if this involves moving these activities back from Asia, it is important. Additionally, the U.S. government should implement policies that would strengthen R&D capabilities in creating critical military components. Such policy changes in funding and budgeting, R&D organizations, acquisition procedures and education systems as suggested in various reports on military reform are necessary to achieve this goal.[21]

Complexities arise, however, because the two types of components (military-specific and dual-use) are not independent from one another; in fact, they are technologically linked. This linkage did not cause problems when military technologies were more advanced than commercial ones. This was the situation in the U.S. right after

World War II when technology developed in the military market was spun off to the commercial market. Under these circumstances, the U.S. could strengthen its military technology by concentrating only on the development of military technology.

The situation since then, however, has changed due to the rapid pace of technological development in the commercial market. Thus, today, some of the dual-use technologies developed in the commercial market are more advanced than their counterparts in the military market. As a result, these advanced dual-use technologies have started to be spun off to military uses.

The manufacturing technology for semiconductors is a case in point. The requirement for volume production in the commercial market made its manufacturing technology increasingly refined and advanced. As a result, the military market could not produce leading-edge components without the manufacturing technologies developed in the commercial market. This means that, in order for critical military components to be made in the U.S., the U.S. has to maintain leading-edge manufacturing technologies in the commercial market.

This does not, however, lead to the argument that the U.S. dependence on dual-use technologies is unacceptable for U.S. security. This problem caused by the linkage between commercial and military technologies brings up my third recommendation, a strategic alliance between U.S. and Japanese electronics companies.

Recommendation (3): A strategic alliance

"Strategic alliance" refers to a management strategy to create a partnership with another company in areas such as R&D, manufacturing, and marketing, and to cooperate in business activities without merger or acquisition. There are various forms of strategic alliances, including joint ventures, cooperative R&D, license agreements and alliances in sales and marketing. Through these strategic alliances, companies try to obtain resources in which they are lacking. My last recommendation is for U.S. and Japanese companies to form strategic alliances with a view to solving the dependency problem.

Japanese dual-use technologies that are more advanced than those developed by the U.S. military could be transferred to the U.S. through strategic alliances. For instance, manufacturing technology could be transferred to the U.S. if U.S. and Japanese companies form joint ventures and build manufacturing facilities in the U.S. In addition, if appropriate mechanisms are established, it is also possible to transfer the technology further to U.S. companies. In the automobile field, General Motors and Toyota have formed a joint venture (NUMMI) and are now making cars in the U.S. mainly using Japanese manufacturing technology. A similar kind of joint venture in the electronics sector would make the same kind of transfer of dual-use technology to the U.S. possible.

In addition, cooperative R&D between U.S. and Japanese companies and technology transfer from Japanese companies by licensing agreements should be encouraged for the same reason.

A U.S. alternative to the strategic alliance solution is to implement industrial policy or cooperative R&D projects backed by the government to nurture critical dual-use technologies. But this is probably a more expensive way to approach the problem. It would appear easier and less costly to obtain the necessary technologies from those who actually have them rather than carrying cooperative projects without them.

The industrial policy approach, however, places an additional burden on U.S.-Japan relations. As already mentioned, Japan tends to be seen as a strong competitor, even an enemy in extreme cases, in the political argument to push industrial policy. In other words, it is the U.S. and Japanese companies that are actually competing with one another. Industrial policy arguments, however, sometimes turn this competition into competition between countries. This would, of course, increase tension between the U.S. and Japan.

One of the major advantages of the strategic alliance approach is that it is a market-driven solution to the problem and goes well with the trend towards the globalization of industry. Even in the absence of national security considerations, a number of strategic alliances among companies have already been formed. There are economic and technological reasons for this: 1) R&D and capital investment has been increasing rapidly in the high-tech sector, and one company alone cannot bear all the expenses and risks of this; 2) due to the interdependence of various sectors of high technology, one company alone cannot be competent in all the technical fields necessary for the success of the business; 3) an alliance is a convenient step to set the technical standards that are crucial for successful business operations in high-tech fields;

4) companies can gain better access to foreign markets by forming alliances. I am suggesting the addition of one more axis of national security in forming the strategic alliance that would advance naturally by market forces.

If Japanese electronics companies become more sensitive to national security issues and become active in transferring dual-use technologies to the U.S., Japan could obtain such intangible benefits as less friction between the two countries over economic security issues and, in turn, better U.S.-Japan relations. In addition, if transfer of military-specific technologies from the U.S. becomes smoother as a result of successful transfer of dual-use technology from Japan, this would surely serve Japan's national interests.

Interrelated Economic and Security Problems

Historically, security problems between countries have been solved mainly through governmental initiatives. The rapid pace of advancement in dual-use technologies, however, is making this process more difficult. This is why the three recommendations made here are aimed at private companies.

Symbolically, this shows that economic and security problems are increasingly interrelated via technology. This means that it is now necessary for electronics companies to be aware of the national security implications of their activities and be sensitive to that. On the other hand, government should also be aware of the economic implications of security policy. If national security considerations encourage the government to

intervene in private sector policy, the repercussions on the private sector would be more significant than in the past and might hurt the healthy development of high-tech industry.

One additional implication of this study is that, due to the globalization of high-tech industry, it is becoming very expensive for one country alone to solve national security problems related to technologies. Thus, it is now important to cooperate with allies, balancing the advantages of using one another's resources and the vulnerability attached to reliance on them. This is one of the first steps to obtaining a high level of national security at an affordable price.

1. Shintaro Ishihara (Tr. Frank Baldwin), The Japan That Can Say No: Why Japan Will Be First Among Equals, New York, Simon & Schuster, 1991, p 21.

2. Business Week, February 25, 1991, p. 20.

3. See National Advisory Committee on Semiconductors, A Strategic Industry at Risk, Arlington, VA: National Advisory Committee on Semiconductors, 1989, p. 13.

4. The President's Blue Ribbon Commission on Defense Management, A Quest for Excellence, 1986, p. 60.

5. The Electronic Industry Association expects that the percentages will rise to 39% and 47%, respectively, by 1997. Electronic Industry Association, 1988 Edition Electronic Market Data Book, 1987. A similar trend is predicted by Daniel I. Okimoto, Henry S. Rowen and Michael J. Dahl in The Semiconductor Competition and National Security: A

Special Report of the Northeast Asia-United States Forum on International Policy, Stanford University, 1987, p. 32.

6. Defense Industrial Base Panel of the Committee on Armed Services, House of Representatives, The Ailing Defense Industrial Base: Unready for Crisis, Washington, D.C., U.S. Government Printing Office, 1980.

7. Jacques S. Gansler, The Defense Industry, Cambridge, MA, MIT Press, 1980, pp. 156-159.

8. Ibid, Okimoto et al, p. 41.

9. Ibid, Okimoto et al.

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19. For instance, see Martin C. Libicki, What Makes Industries Strategic, Washington, D.C.: National Defense University, 1989, p. 14.

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Figure 1 Relationship between Level of National Security and its Economic Cost in terms of Electronics Technologies: Cases for the U.S. and Japan

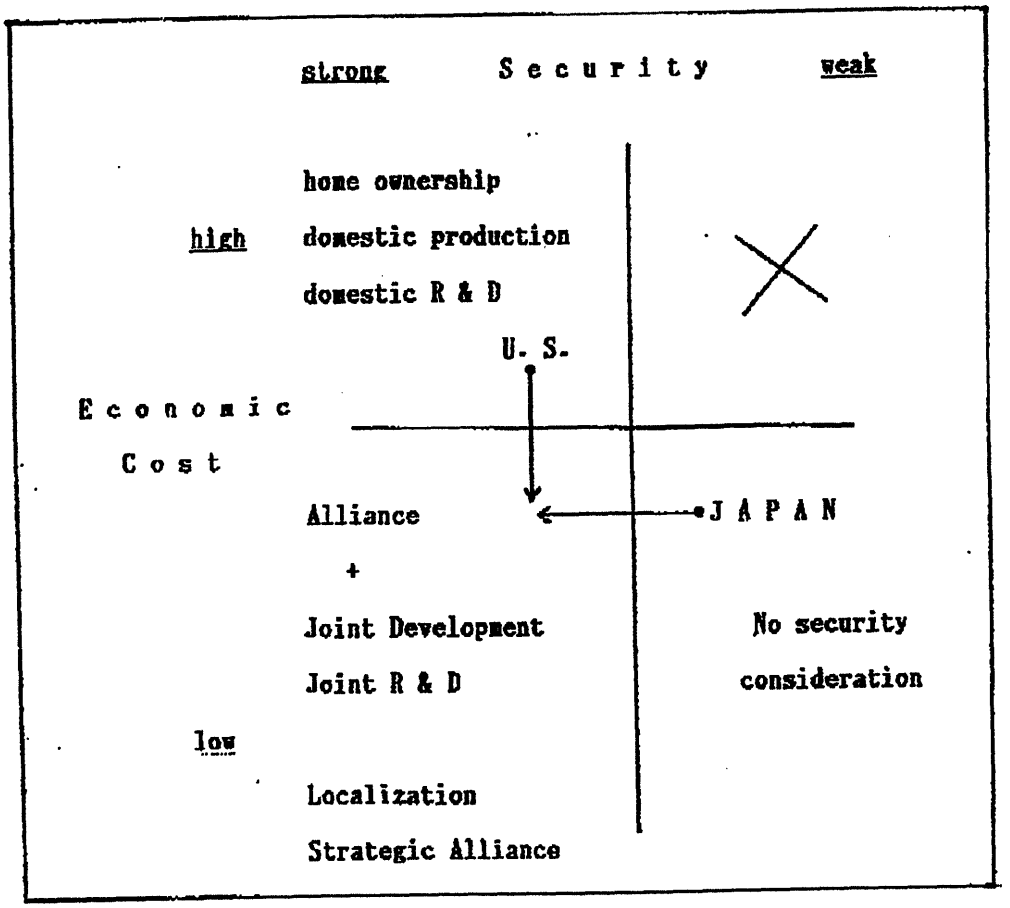

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Figure 2 Technological Relationship between the U.S. and Japan in Military Field

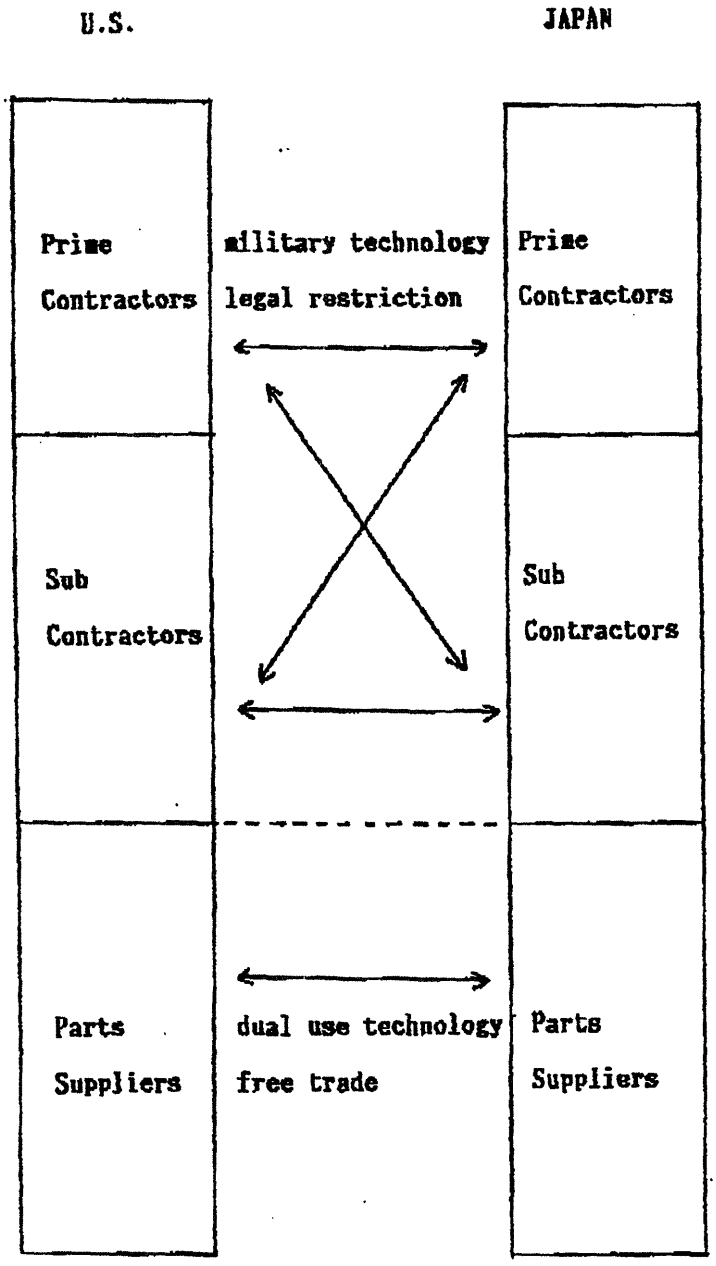

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Figure 3 Military Dependence on Foreign Industry

Ownership v.s. Location

LOCATION OF MANUFACTURING/ R & D CAPACITY	OWNERSHIP: U.S.	OWNERSHIP: Foreign
U.S.	1.Promotes military security	2.Acceptable, subject to U.S. priorities in a crisis
Foreign	3.Risk depends on specific technologies and nations	4.Less acceptable in terms of military security (#3 also applies)

Source: Office of Technology Assessment, Holding the Edge, p.181.