THE THREAT OF FOREIGN COMPETITION TO U.S. HIGH TECHNOLOGY INDUSTRIES: NATIONAL SECURITY CONSIDERATIONS

STAT

Consultant
Science, Technology and National
Security Policy

A Study Prepared under Contract with the U.S. Department of Commerce
Contract No. TA-82-SAC-00891

April, 1982

Table of Contents

Preface

This study was prepared as a part of the team effort of the Working Group Staff of the Cabinet Council on Commerce and Trade Study on "An Assessment of U.S. Competitiveness in High-Technology Industries." In accordance with the operating procedures of the CCCT study, each member of the Working Group Staff was responsible for the area assigned to him. This draft, therefore, does not incorporate the information and findings of the independent submissions by the other members of the Working Group Staff.

The views presented in this draft study are those of the author and do not necessarily represent the views of the Cabinet Council on Commerce and Trade or the U.S. Department of Commerce.

Executive Summary

This study examines the extent of the threat which foreign economic and technological competition presents to national security of the United States, now and in coming years. The term "national security" is used here in a dual sense: (a) national defense; and (b) viability and power of the nation in the longer run, embracing military and nonmilitary elements. The sources of the competitive threat analyzed here are Western Europe and Japan.

The central core of the U.S. defense industrial base enjoys a substantial degree of protection under the existing legislation and is thus largely immune to foreign competition. However, there are a number of defense-relevant industries which are not so protected and they have been seriously affected by foreign competition.

In electronics, U.S. surge capability for conventional war has been curtailed. As a result of an indirect competitive pressure, current U.S. defense production has become extensively dependent on imports of electronic components from the Far East. The Japanese technological and commercial dynamism in semiconductors (e.g., 64K RAMs and 256K RAMs) has the potential for a further erosion of the U.S. defense industrial base. The pressure of foreign competition combined with the failure of the U.S. machine tool industry to capitalize on the potential of the expanding world market were important factors in the nation's current inability to meet the requirements of wartime surge production in machine tools, if such were to arise. Foreign competition in both electronics and machine tools is eroding U.S. viability as an industrial power and the nation's ability to compete in other areas, thus undermining America's longer-range security.

The United States is still dominant in the world computer market, but competitive pressure is arising from both Western Europe and Japan. The Japanese challenge is particularly serious. The Japanese project for fifth-generation (voice-controlled) computers, to be completed in early 1990s, is intended both to capture world leadership in the computer field and to arm the Japanese people with highly advanced computers, thus enhancing their ability to compete in other economic and technological fields. Although the Japanese computer strategy has its areas of vulnerability, Nippon's rapid progress in R&D related to fifth-generation computers buttresses its credibility. The success of Japan's challenge in computers would have far-reaching implications for U.S. capability for defense and the nation's world role as a superpower.

NATO RSI (Rationalization/Standardization/Interoperability) policies, initiated by the DOD, exempted NATO nations from nearly all protective measures applicable to the U.S. defense industrial base and allowed foreign companies from these nations to compete for U.S. defense contracts. In the interest of the alliance as a whole, NATO RSI also encourages co-development and co-production of weapons with U.S. European allies. No adequate comprehensive studies on the impact of RSI have been conducted; therefore, present conclusions, based on limited research, are tentative.

It appears that, to a degree, foreign competition under NATO RSI does help to envigorate certain sectors of the U.S. defense industrial base by introducing a new challenge to American companies. Direct foreign competition does not seem to be significantly jeopardizing the U.S. defense industrial base, although most industry representatives appear to prefer a degree of protection. There is a DOD policy which requires that, if a foreign company wins a DOD procurement contract, a corresponding domestic capability to fill in in the event of interruption of foreign supplies must exist. This policy, apparently, is being carried out by individual commands, but it is not being systematically monitored by the DOD and its true effectiveness could not be ascertained.

The United States benefits from technology transferred from its NATO allies under RSI. Also, RSI reduces costs of R&D and procurement for the United States and the alliance as a whole. Moreover, the memoranda of understanding (MOUs) generated under NATO RSI tend to open the door to increased arms sales from the United States to U.S. NATO allies. However, on balance, the transfer of technology under RSI from the United States to its NATO allies is more extensive than vice versa. In the longer run, NATO RSI thus tends to strengthen foreign industrial competition abroad in the manufacture of armaments and in the civilian sector.

The United States is also involved in military co-production programs with Japan. There is evidence that the technology transferred to Japan under these programs is used by the Japanese in civilian manufacturing, thus potentially strengthening commercial competition to U.S. products in the world market.

Between Western Europe and Japan, the latter is by far the more formidable challenger to U.S. technological and economic leadership. Of the three key factors crucial to the rise in power - quality of manpower, organization and purposiveness, and technology - Japan leads the world in the first two, and is rapidly gaining in the third. There are distinct indications that the challenge of Japan is political, not economic. Its objective is status and power, and Japan uses technological and economic means to attain this objective.

If present trends continue (which is not necessarily inevitable), the Japanese will take over leadership from the United States in a number of key areas of power-relevant technology (other than military nuclear). As a result, by the year 2000, a significant change in the world balance of power will take place. The following likely or possible national security consequences were envisioned:

1. The U.S. industrial base will be eroded to a considerable degree, which would impose constraints on America's ability to support her military power.

2. The United States will be increasingly dependent on Japan for components and other products relevant to emergency mobilization. Such dependence will be detrimental to both U.S. war fighting capability and deterrence posture.

3. With the loss of leadership in high technology, the United States will lose direct control over the transfer of most advanced technologies to the Soviet Union, since then such technologies will be generated in Japan. As a technological and economic superpower, Japan will be considerably more independent from U.S. influence with regard to technology transfer to the Soviet Union. When transferred to the USSR, Japanese technology could augment Soviet military power. The United States would thus be squeezed between the economic pressure of Tokyo and enhanced military pressure of Moscow.

4. Given the relative decline of the U.S. world position, America's diplomacy, freedom of action, and decision-making on the world arena would be increasingly constrained by the presence (political, economic, or military) of the other superpowers - the Soviet Union and/or Japan. American foreign policy will have to undergo a major re-orientation to adjust to the new realities of world power.

The largely zero-sum-game policy which the Japanese are pursuing in the economic and technological sphere can be harmful to Japan and to the international system at large. It may lead to friction and conflict with Japan, with unpredictable consequences. It could be seriously damaging to the fabric of free trade, on the very existence of which the success of the Japanese policy depends. The Japanese erosion of America's power and security is, in the long run, detrimental to Japan's own security.

America's response to the Japanese challenge requires an enlightened, broad-gauged policy which would safeguard the interest of the United States, of world order, and of Japan herself. It should not be confined to an economic response. In its political dimension, its focus might be on diffusing the Japanese thrust into the self-centered economic and technological aggrandizement.

A number of selected policy-relevant issues raised by the threat of foreign competition were briefly considered. Reduction in the cost of capital is essential to enable the United States to meet foreign competition; a concerted policy to this end, including measures to stimulate personal savings, is needed. There is a distinct need for improving, and perhaps re-defining, government-business relationship. The tendency by the government to micromanage business proved to be counterpoductive; a degree of macroguidance, however, might be appropriate. Anti-trust legislation handicaps U.S. business in international competition, and a judicious revision, especially in R&D, appears to be advisable. The issue of technology transfer deserves a new look, wherein technology's societal value is appropriately recognized. The U.S. lag in manpower capable of bolstering the nation's competitive viability requires a concerted remedial action, especially in the light of an unusual strength of Japan in this area (with about a half of U.S. population, Japan graduates more engineers than the United States; in the 13-23 age brackets, Japan has 1.8 million people with an IQ of over 130 while the United States has only 850,000).

I. Introduction

In recent years, there has been a growing concern in the United States about the threat of foreign commercial competition, emanating principally from Western Europe and Japan. The focus of the public attention has been primarily on its economic implications for the United States. Among these, the impact of foreign competition on employment and on the large deficits in the U.S. balance of trade has virtually become the subject of a national debate.

This study is addressed to the impact of foreign competition on U.S. national security, an area which received relatively little attention. In particular, it focuses on the present and future effect of foreign competition on U.S. high technology industries and its implications for national security. These industries are relevant to national security in a dual sense, (1) that of near-term consideration of national defense, and (2) the broader sense of the viability and power of the nation in the longer run, which embraces both military and nonmilitary components. "National security" is thus viewed here primarily in its political, and not just its military, meaning.

Recent history indicates that leadership in what were high technology industries at the time was critical in the rise of nations to power, in their vitality in peacetime, and survival in wars. Crucial, little opposed, and sometimes not clearly perceived, changes in the world distribution of power and security of nations took place in peacetime as a result of the ability of some nations to capitalize on advanced technology in the development of their industrial base. The outcome of wars often merely reflected the change which had taken place beforehand.

Several question thus arise. Is the competitive vigor of U.S. allies eroding America's security-relevant high-technology industries, thus undermining the nation's viability as a superpower and its capability for defense? If so, which industries have been affected, how seriously, and what is the outlook for the future? Does competition from U.S. NATO allies under Rationalization/Standardization/Interoperability (RSI) policies envigorate or weaken the U.S. defense industrial base? Can a distinction be made between the various countries or regions as to the extent of the foreign competitive challenge?

Available evidence suggests that the threat to America's security is serious. Its impact is likely to be more severe in the longer run, but even now America's viability is being materially eroded. In the defense sector, competitive pressure has made the United States dependent on overseas supplies of electronic components essential for military production, and the nation's surge capability has been impaired in several critical areas.

In part, the economic and technological competition affecting America's security is coming from Western Europe. Japan, however, clearly emerges as by far the most formidable challenger to U.S. technological and economic leadership. Of the three key factors crucial to the rise in international power - quality of manpower, organization and purposiveness, and technology - Japan leads the world in the first two, and is rapidly gaining in the third. There are distinct indications that, contrary to the prevailing opinion, the challenge of Japan is not commercial. It appears to be political, whose objective is status and power; technological and economic preeminence is merely a means of that objective.

How, then, can the United States meet the international economic and technological competition to safeguard the nation's security? A spectrum of differential policies, tailored to specific regions, appears to be in order. A purely economic response is not likely to be sufficient; the spectrum must embrace political, economic, and technological initiatives.

An initial discussion of potential policies appears in the last two chapters of this study. Chapter VI deals with certain relevant aspects of foreign policy, with a principal focus on Japan. Chapter VII explores various policy-relevant issues which emerged in this study, including some possible approaches to coping with those issues.

II. Industrial Power and National Security

When placed in the context of history, the critical importance of industrial power to security of nations is a relatively recent phenomenon. Although certain industries had been important in the rise to power of individual nations in earlier periods of history (e.g., shipbuilding in the case of Great Britain in the 17th and 18th centuries), industrial power did not begin to emerge as the backbone of military power until the last quarter of the 19th century. The rise of nationalism in Europe, the second industrial revolution, a widespread introduction of conscription accompanied by the emergence of the concept of "the nation in arms," and developments in military technology (especially smokeless power, rapid-fire artillery, and improvements in the machine gun) all contributed to the demise of a century (1815-1914) of relatively short wars based on the striking power in-being. A shift thus took place to protracted wars of power potential, based on industrial might capable of continuously replenishing the battlefield until victorious or exhausted. The prime examples, of course, are World War I and World War II. 1/

The emergence of nuclear weapons at the end of World War II was a radical departure from the past in that they made it possible to destroy the very essence of power -- power potential itself -- in a matter of days, and not years. The pendulum thus swung back to the striking power in-being and, potentially, short wars. However, the destructiveness of nuclear weapons and the elaborate system of mutual deterrence created by the superpowers by the late 1950s led to the realization that a protracted conventional war, leaning on power potential, remained a distinct possibility. 2/

Where, then, do we stand now with regard to the relevance of industrial power to military power? What kind of industrial base do we need to support our military establishment? This would depend on the kind of war we would expect to fight.

If we assume an all-out nuclear war as being most likely, we still need a sophisticated industrial base and preeminence in military technology to maintain the essential nuclear striking power to serve the interests of deterrence and to fight the war, if deterrence fails. However, if we focus primarily on a nuclear conflict, the industrial base required would be highly specialized and it would need no expansion with the outbreak of the conflict. Be definition, the war would be decided by the striking power in-being. 3/

If, however, we assume that the strategic nuclear deterrence is effective, then we return to the possibility of an all-out war of power potential which would bring into play a much broader industrial base over a protracted period of time. Given this scenario, an appropriately wider spectrum of the nation's industrial

Germany's breakthrough to the heights of chemical success came with the establishment of a powerful synthetic dyestuffs industry, based on coal tar, a by-product of the manufacture of coke. The milestones in this development was the discovery of synthetic aligarin (1870) and indigo (1897). The first replaced madder and dealt a mortal blow to the French enterprises in Provence which were cultivating it. The second destroyed hundreds of thousands of acres of indigo plantations in India within about sixteen years. Germany made the rest of the world almost completely dependent on German synthetic dies or their coal-tar intermediates.

The German government facilitated and promoted the expansion of the chemical industry in a number of ways. Patent laws were used in a manner giving advantage to the German manufacturers. Subsidies were granted to the individual chemical industries and an effective tariff policy was developed which gave the German chemical industry protection at home and allowed a differential price structure in the competitive fight for the world markets. Cartels and syndicates were supported, and in some cases their formation was made virtually compulsory. In the support by the German government, the earlier economic considerations were augmented by military motives as the relevance of the industry to war became to be increasingly appreciated.4/ By the outbreak of World War I, Germany had become the leading chemical producer in the world -- a picture very different from 1870, when Great Britain dominated industrial chemistry and France (the second largest producer) was not even a close rival.

The chemical industry was critical to German power in war. Since most of the components of high explosives were derivatives of coal tar, the synthetic dyestuffs industry became the backbone of the German manufacturing of high explosives. Because all explosives (propellants and high explosives) are essentially nitrates, nitrogen in one combination or another was also an indispensable ingredient. The Haber-Ostwald process, introduced in 1913, enable Germany to fix adequate quantitites of nitrogen from the air at a fairly low cost, thus neutralizing, for the purpose of ammunitions production, the effect of the interruption of imports of nitrates from Chile by the British naval blockade. It has been estimated that, if not for the synthetic production of nitrogen, Germany could not have waged the war longer than three months. The pre-war dependence on American cotton for production of gunpower was solved during the war by developing nitrocelulose from wood. Numerous other substitutes were produced to counter the effect of the naval blockade.

The chemical industry was even more effective in serving Germany's war needs during World War II. To give but one, yet telling, illustration: in 1943, the peak year of German wartime petroleum production, over 99 percent of German aviation fuel was produced synthetically.5/

The development of telecommunications by Great Britain in the inter-war period (1918-1939) differed in two important respects from the case of the German chemical industry. Unlike the Germans who had to work their way to the top from a relatively inferior position, Great Britan moved into the era of modern (wireless) telecommunications from a platform of a very solid achievement in submarine telegraph cables: by the outbreak of World War I, the British had already developed the most extensive system of submarine cables in the world which connected the various parts of their empire.6/ Also, the British government was not quite as single-minded and purposeful in promoting telecommunications as the German government was in promoting the chemical industry. And yet, on the whole, quite impressive results were achieved.

The existence of a world-wide empire was an important factor in fostering an awareness of the importance of telecommunications within the British government, in the telecommunication industry (which was quite vibrous and progressive), and in the public at large. Thus, whenever the British government -- which was principally responsible for the development of telecommunications in the United Kingdom - exhibited an occasional tardiness in acting, an initiative or prodding from the other two sectors tended to rectify the situation.

In 1924, the British government undertook the development of an Imperial system of wireless telegraphy, to augment the overloaded service of the cable network. In 1929, both were amalganated into a new company, Imperial International Communications, Ltd., which provided cheap and efficient telegraph service throughout the Empire. The credit for improving and vastly expanding the initially inefficient telephone network belongs to the Post Office which, by 1922, had made the decision to reconstruct the telephone system of London. This gave impetus to upgrading the entire telephone network of the United Kingdom and eventually led to another initiative by the Post Office: to build, in cooperation with the Dominions and Crown Colonies, a radio-telephone network all over the Empire. By 1930, a complete network, with more than 100,000 circuit miles, had been in operation, thus helping to cement the sprawling Empire.

The British Broadcasting Corporation was established in 1923 and, in the late 1920s, it began to urge the reluctant government to establish an Empire-wide service to cement the loyalty of the British subjects. Finally, the Empire service was established in 1932, on the personal initiative of the BBC's Director-General and financed by its own funds.7/ It proved to be a success, in terms of its receptivity by the listening public and in terms of its political effect. It helped to shield the Empire from the increasingly aggressive propaganda broadcasts of the Axis Powers in the second half of the 1930s and provided an effective instrument of psychological warfare when foreign language broadcasts were inaugurated in 1938.

On the eve of World War II Great Britain had the best developed global telecommunications system of all the Great Powers. It was not only adquate to meet the needs of the far-flung Empire, but it served many foreign countries as well. London was the communications center of the world and the United Kingdom derived commerical and political advantages from this fact. Largely because of the requirement that all telecommunications equipment must be domestically manufactured, the United Kingdom had a strong communications industry which was also a significant exporter. However, there were some shortfalls in the development of British telecommunications. Although they reached out to remote Dominions and Crown Colonies, the inland penetration of the networks was, in many cases, sparse. As a result, the contribution of telecommunications to the integration of the Empire and to its economic development was less than optimal.

The British telecommunications system was of vital significance to the United Kingdom in World War II. It proved to be a major factor in winning the war. In one respect the British revealed a distinct weakness: the telecommunications industry of the island nation was not capable of producing adequate quantities of equipment to meet the vastly increased wartime demand, and extensive imports from the United State became necessary. The war also provided another telling illustration of the quantitative importance of industrial power. Under the pressure of wartime requirements, the United States built a vast global telecommunications network which, by the end of the war, had exceeded that of Great Britain by a wide margin.8/

The foregoing discussion suggests that, although the concerns of the military planner responsible for industrial preparednes for war and those of the government official responsible for the viability of the nation's industrial base in support of national security are overlapping, they also differ in certain important respects. The military planner is primarily concerned with the adequacy of resources to fight the most likely wars in the near to mid-term future. His task is to strike an optimal balance between industrial prepardness and war reserves within the context of fiscal constraints existing at the time. The government official must be mindful of the nation's capability to win near- to mid-range wars, but his responsibility is broader. Its dimensions extend into the longer-range future and into the aspects of national security which are not purely military, but embrace technological trends as they change the nature of international power and its global distribution. In assessing the adequacy of the industrial base for national security, he must be mindful of actual or potential changes in the relative importance between military and economic elements of power in a given period of history. Finally, in designing policy options in response to perceived threats to national security, he must give due consideration to a broad spectrum of response on the technological, the economic, and the political level, domestically and internationally.

The analysis in the following chapters pays attention to the concerns of the military planner, but its focus is on the competitive viability of the U.S. industrial base in support of America's national security in the broader sense.

NOTES

1. It is noteworthy that the criticality of industrial power to warfare was not realized by nearly all contemporary observers until after the outbreak of World War I. All pre-World War I military plans of the Great Powers were based on the assumption of a relatively short war, fought with the striking power in-being, not power potential. As late as 1906-07, in a war between two Great Powers - Russia and Japan - the Japanese fought and won the war with all their large (over 3,500 tons) naval ships purchased abroad (England and Germany), because they did not have the capability of building them. Mainly a conflict of striking power in-being in an era when power potential had already emerged as critical in warfare, the Russo-Japanese war was somewhat anachronistic and could be largely explained by the fact that it was fought by the industrially least developed Great Powers. See Victor Basiuk, "The Differential Impact of Technological Change on the Great Powers, 1870-1914" (Ph.D. Dissertation, Columbia University, 1956), pp. 218-326. A principal mistake of Hitler was his assumption that the strategic and tactical mobility made possible by the tank and the aircraft signified a re-ascendancy of the striking power in-being over power potential and thus a return to short wars.

2. Henry A. Kissinger, Nuclear Weapons and Foreign Policy (New York: Council on Foreign Relations, 1957) and Robert E. Osgood, Limited War; The Challenge to American Strategy (Chicago: University of Chicago Press, 1957) were the two principal works which provided an early comprehensive analysis of limited war in a nuclear context and were influential in the shift of strategy towards the subnuclear-umbrella level.

3. This should be qualified by the consideration of limited strategic war, which is conceivable. Some industrial mobilization may accompany the outbreak of a limited strategic war, but it is extremely unlikely that such a war would be sufficiently protracted to require reliance on power potential. It would either be terminated within a short period of time, escalate to an all out nuclear war, or be transformed into a convential ("limited") war.

4. Prior to World War I the importance of the chemical industry to warfare was not adequately understood, principally because of the blitzkrieg mentality prevalent at the time. However, to the extent that the role of industrial chemistry in support of the war effort was understood before 1914, it was best understood in Germany.

   The present discussion of the German chemical industry is largely based on Victor Basiuk, Technological Change and the Balance of Powers, 1870- (book in progress), Chapt. III.

5. Computed from U.S. Strategic Bombing Survey, Oil Division, Final Report, 2nd ed. (Washington, D.C.: U.S. Government Printing Office, 1947), p. 19.

6. Although advanced for its time and invaluable to the viability of the British Empire, the submarine cable network proved to be inadequate to meet military, administrative, and economic needs of the country in World War I and it was too slow and expensive to satisfy the needs of the immediate post-war years. See S.G. Sturmey, The Economic Development of Radio (London: Duckworth and Co., Ltd., 1958), pp. 103-04.

7. Asa Briggs, The Golden Age of Wireless (London: Oxford University Press, 1965), pp. 374-75, 379. It is noteworthy that, in those early years, the United States was viewed by BBC as a potential rival for the loyalty of the English-speaking subjects, which had to be offset by an Empire broadcasting service.

8. The contribution of telecommunications to Great Britain's power and security are more extensively discussed in Basiuk, Technological Change and the Balance of Power, 1870-, op. cit., Chapter XI.

9. This is not necessarily to say that military planners do not think in these broader terms. Indeed, some of them do. But to the extent that they do, they exceed the framework of the conventional military planning.

III. The U.S. Defense Industrial Base and Foreign Competition

In recent years, foreign economic competition has dealt a severe blow to a number of sectors of the U.S. economy. The U.S. defense industrial base, however, was considerably less affected by competitive forces from abroad. The single most important reason for this lies in the relationship between the U.S. military establishment and its industrial base.

As a result of the existing legislation and DOD fiscal policies, the defense industrial base enjoys a substantial degree of protection. The Department of Defense funds nearly all military R&D. Some of military and military-related R&D is also funded by other government agencies, like the Department of Energy (nuclear energy), NASA, NSF (e.g., physics), and the Department of Human Services (health). This funding ensures that the military technology base is largely shielded from foreign competition.

In the Defense industrial base proper, the actual or potential leverages for protection are multiple. DOD owns a significant portion of defense industrial equipment and a number of production facilities, including most of the plant space and equipment in the munitions and strategic missile industries and about one-third of the aircraft industry.

Two principal legislations - the Defense Production Act of 1950, as amended, and the Defense Industrial Reserve Act of 1948, as amended and augmented by appropriate administrative orders -- both require and enable the Department of Defense to maintain a viable industrial base. 1/ A noteworthy DOD instrument for increasing productivity and responsiveness of the defense industrial base is the Manufacturing Technology Program ($209 million in FY 82), mostly carried out in the private sector. 2/

A law not originally intended to protect the defense industrial base in particular, yet historically important in strengthening its viability, is the Buy American Act. It provides that only materials and articles substantially of U.S. origin (i.e., over 50 percent) shall be acquired for public use. While exceptions could be and have been made, the act favored U.S. production of materiel for the Department of Defense, thus stimulating the growth of the U.S. defense industrial base and helping to ensure the availability of surge capability in time of war. 3/

While the above discussion points out the existence of instrumentalities for the protection and growth of the U.S. defense industrial base, it is not intended to suggest that everything is well in that quarter. In fact, in recent years the U.S. defense industrial base deteriorated rather substantially. A number of factors accounted for this development. The single most important factor was the decline in demand for military hardware after Vietnam. Another important factor - which compounded the impact of the first - was the policies and regulations of the U.S. Government which were not conducive to the maintenance of the viability of the base. Competition from abroad was thus not the principal factor, but it did play a role in eroding the defense industrial base and, if present trends continue, it would be seriously damaging to U.S. national security in the long run.

The threat of foreign competition to U.S. national security becomes considerably more menacing if we view the concept of national security in the context of the analysis of the preceding chapter of this study. In the longer run, a nation's security does not depend on what is thought to be "the defense industrial base" at a given point in time, but on the viability of its economy as a whole and, in particular, on the ability to capitalize on new, power-relevant technologies and translate them into tangible assets of influence and power. As we shall see later, foreign competition is eroding U.S. national security in this broader sense which, among other things, might deny us a future defense industrial base commensurate with the nation's needs.

This study will not deal with the problems of the deterioration of the U.S. defense industrial base as a result of the post-Vietnam reduction in defense procurement and the policies and regulations which aggravated those problems. This subject has been adequately covered in published literature.4/ Moreover, the decline in the U.S. defense industrial base attracted attention in the Congress5/ and in the Department of Defense, and a serious effort is underway to remedy the situation.6/

The analysis of the following chapters will focus on two levels at which foreign competition produced its impact on the U.S. defense industrial base:

1. Direct impact of foreign competition. Several defense-related industries have been affected by foreign competition in varied degrees or are threatened in the future. These include electronics, machine tools, specialty steels, motor vehicles, aerospace industry and computers.

2. The impact of foreign competition through NATO Rationalization/Standardization/Interoperability (RSI) policies of the Department of Defense. In the interest of strengthening the North Atlantic Alliance as a whole, RSI policies removed certain barriers to competition from NATO countries. Accordingly, the implication of these policies for U.S. competitive viability and surge capability will be examined.

Although the current DOD efforts to revitalize the U.S. defense industrial base will not be addressed here, it must be kept in mind that they are relevant to the subject matter of this study. Even allowing for the measure of protection which exists with regard to the U.S. defense industrial base, foreign competition tends to creep into the vacuum created by neglect. Moreover, the ability of U.S. defense industries to compete rises in importance in the light of NATO RSI. Lastly, a strong and vital core of the defense industrial base has a spill-over effect into those defense-related high-technology industries which may not enjoy any special protection, and yet are critical to national security. Accordingly, the outcome of the DOD efforts to strengthen the defense industrial base will be important in the nation's ability to meet foreign competition and thus protect its security.

NOTES

1. These two acts can be found in 50 U.S. Code, Appendix, Sec. 2061 and 50 U.S. Code, Sec. 451, respectively.

2. The Manufacturing Technology Program (MTP) offers projects for bidding by companies, which projects are intended to provide "seed money" leading to a "factory floor" application of productivity enhancing technologies. See Lloyd L. Lehn, "Manufacturing Technology Program," Office of the Deputy Under Secretary of Defense (Acquisition Management), 2 November 1981, passim.

3. For the text of the Buy American Act, see U.S. Code, Title 10, Part 41.

4. See, e.g., Jacques S. Gansler, The Defense Industry (Cambridge, Mass: The MIT Press, 1980); Fred Charles Iklé, "Preparing for Industrial Mobilization: The First Step Toward Full Strength," in W. Scott Thompson (ed.), National Security in the 1980's: From Weakness to Strength (San Francisco: Institute for Contemporary Studies, 1980), pp. 55-68.

5. See U.S. House of Representatives, Committee on Armed Services, Defense Industrial Base Panel, The Ailing Defense Industrial Base: Unready for Crisis; Report (Washington, D.C.: U.S. Government Printing Office, December 31, 1980).

6. In response to an initiative by Dr. Fred C. Iklé, Under Secretary of Defense for Policy, an Industrial Task Force headed by Mr. Sol Love was established in the Department of Defense in August, 1981. Its purpose is to investigate those aspects of the industrial base that affect its ability to effectively respond to the requirements placed on it in time of crisis and to make policy recommendations as appropriate. The Industrial Task Force is intended to complement the permanent functional machinery of DOD, and not to compete with it. The Office of the Deputy Under Secretary of Defense for Research and Engineering (Acquisition Management) is a permanent component of the Defense Department involved with the strengthening of the industrial base to meet defense requirements.

IV. Direct Impact of Foreign Competition on the U.S. Defense Industrial Base: Recent Developments and Future Threat

Several industries which are components of the U.S. defense industrial base have been directly affected by foreign competition. Motor vehicles, consumer electronics, specialty steels and machine tools suffered substantial inroads of foreign products into the U.S. market. The aerospace industry and computers are still going strong, yet seriously threatened.

This chapter will examine three industries - electronics, computers and machine tools - as case studies, each of them representing a particular type of industry as related to competitive pressure from abroad. The electronics industry is a modern high technology industry which has already suffered a considerable direct damage. The U.S. computer industry is a related high technology sector which still enjoys a domineering position in the world market, but there are some serious menacing clouds on the horizon. The machine tool industry is an old, mature industry which is in the process of being revitalized by modern technology but which has not been able to compete effectively with its foreign counterparts.

Since each represents a particular type, it their aggregate these case studies might suggest a useful spectrum of policy implications. In each case, an effort will be made to delineate the industry's importance to national security and the extent to which it has been, or likely to be, affected by foreign competition.

Electronics

Trends in electronics reveal somewhat divergent data on the relative importance of the electronics industry to national security. The military and aerospace market was predominant in the electronics industry in the late 1950s and early 1960s. As late as 1965, military and aerospace programs were consuming over one-third of semiconductors produced in the United States.1/ Recent figures indicate that the military market has declined from 7 to 10 percent of the total electronics market2/ and to less than 7 percent in semiconductors.3/ At the same time, U.S. weapons systems have been becoming increasingly dependent on integrated circuits for detection, guidance and control. The penetration of weapon systems by semiconductors is continuing at a rapid pace, requiring an extremely sophisticated technology. Although, in recent years, commercial interests picked up leadership in most advanced areas of semiconductor technology (e.g., 64K RAMs and 256K RAMs), the Department of Defense continues to support highly advanced integrated circuit technologies where commercial application is as yet limited or non-existent (e.g., the Very High Speed Integrated Circuit, or VHSIC, program).4/

The considerably smaller share of the defense market in the total electronics market does not necessarily mean that the nation can afford to lose a large percentage of its electronics industry short of imposing constraints on defense interests. The defense establishment depends on a viable electronics industry, especially on its semiconductor sector. The rapid technological change in the semiconductor industry and, in particular, such developments as the advent of the large-scale and very large-scale integration technology make the industry dependent on large economies of scale and high-volume markets. Sales in these markets are essential to generate the requisite high investment rate for R&D, plant, and equipment to sustain the viability of the industry. 5/ Moreover, surge capability requires a large industrial base in semiconductors so as to provide the necessary reserve of highly skilled manpower for military needs. This is especially important in view of the large imports of electronic components from overseas to meet present needs of defense production, the imports which may be denied under wartime conditions.

The importance of the semiconductor industry to national security becomes even more pronounced when viewed in a context broader than that of national defense. Preeminence in semiconductor technology is critical to U.S. competitiveness in such industrial sectors as computers and telecommunications. Semiconductors provide the basic building blocks for CAD/CAM (Computer Aided Design/Computer Aided Manufacturing) technology. This technology promises to revolutionize industrial productivity through integration and automation of productive processes,6/ thus enhancing economic competitiveness of nations which capitalize on it. Timely and effective application of semiconductor technology provides a rejuvenation and a boost to competitiveness in some "traditional" products - such as automobiles - by improving their energy consumption, materials utilization, and overall utility. Semiconductor technology furnishes the foundation for advanced electronics equipment manufacturing, a market which is expected to reach $500 billion in annual sales by the late 1980s.7/ This would place the electronics industry among the world's largest industries - alongside with steel, petroleum, and automobiles - and perhaps establish it as the leading high technology industry in sales.

In sum, the electronics industry falls within the category of high technology industries which have been historically instrumental in changing world distribution of power and fundamentally affecting security of nations (see Chapter II of this study). In varied degrees, the United States can benefit from advanced electronics technology short of being the world leader in this field. However, as a superpower and the leading nation of the Free World responsible for its security, the United States can abrogate its preeminence in this pivotal technology only at the expense of its longer-range security interests and its leadership role.8/

The above situation would present a serious problem in the event of an armed conflict with the USSR, since the Far Eastern supplies of components could be easily cut off. Comprehensive studies of the implications of this contingency for defense production are not available, but there is some partial evidence of the magnitude of the problem. According to a testimony of the representative of one major Department of Defense contractor (Texas Instruments), it would take his company a minimum of 18 months to gear up U.S. production to reach 50 percent of the company's current production capacity in the Far Eastern facilities engaged in defense work. 16/

Computers

U.S. leadership in computers is critical to America's national security. The U.S. defense system heavily depends on computers for its functioning. Such key areas of defense as intelligence, logistics, command, control, and communications could not effectively perform under conditions of modern warfare unless equipped with highly advanced computers. In addition to their support role for defense, computers are also imbedded in the weapons systems themselves and largely account for the high performance of these systems.

Since the computers required for defense are of the state-of-the-art variety, the loss of U.S. leadership in computers to a foreign competitor - even if friendly - would present some rather unpalatable options to the U.S. military establishment. It must buy the best computers, and if the best computers are overseas, they will have to be imported. This would impose potentially serious constraints on the U.S. military, such as the interruption of supplies or possible political pressure associated with dependence. An alternative course of action for the U.S. defense establishment would be to support the R&D and production of the computers it needs in the face of the overall relative decline of the nation's computer industry. This would be a very costly undertaking, likely to produce budgetary complications.

The loss of U.S. leadership in computers would have even more serious and far-reaching consequences for U.S. national security when viewed in its broader dimensions. In different periods of history, different technologies rose and produced a profound impact on the well-being and power of nations which capitalized on them. Perhaps never before a single technology occupied such a pivotal and domineering position in societies as information technology occupies now or promises to occupy in the future. Computers comprise the central core of this technology. If another nation take over leadership from the United States in computers, the over-all economic health of the nation will decline and its position as a superpower will be significantly eroded.

As reflected in current statistics on production and trade, the U.S. position in computers appears to be very strong. In 1980, the United States produced $24.4 billion worth of computers, as compared with the combined output of $18.7 billion by its five principal competitors - Japan, France, West Germany, the United Kingdom, and Italy. In the same year, the United States had a favorable balance of trade in computers of $6.4 billion, while all of its rivals had a deficit ranging from $216 million for Japan to $427 million for Italy. The situation seemed to be improving for 1981. U.S. computer production increased to $29 billion (estimate) and trade surplus grew by $700 million, to $7.1 billion. 17/

The above picture would have been reasonably re-assuring, if not for signs of serious competition emerging from overseas. As far as competition from Western Europe is concerned, France's ambition to attain pre-eminence in information processing is noteworthy. As a part of its strategy in this field, the French government established, in January 1982, a World Center for Microcomputer Science and Human Resources. The center succeeded in attracting a number of the world's top computer scientists and its board includes at least nine French cabinet ministers. It is intended to design personal computer systems for education and training in industrialized countries and the Third World. The center places heavy emphasis on computer education in the Third World; pilot projects are scheduled for a number of developing nations.18/

A considerably more formidable challenge to U.S. preeminence in computers is coming from Japan. Exports by Japanese computer manufacturers are growing 20 to 25 percent annually, and by 1990, MITI has set as a national goal to win 30 percent of the world market and 18 percent of the U.S. market in computers.19/ In addition to emphasis on indigenous R&D, the Japanese computer strategy in the 1980s consists of three principal components:

1. Compatibility with IBM. Thus, if a foreign client chooses to replace an IBM computer by a Japanese product, his software and peripherals could still be utilized. In addition to its obvious advantages, this so-called "plug-compatible strategy" is especially advantageous to the Japanese because of their weakness in software.

2. Cooperation with foreign companies (especially American) and utilization of their facilities for a more effective penetration of foreign markets. Thus, for example, Fujitsu, Japan's leading computer manufacturer, formed a joint venture with TRW. In this venture, known as the TRW-Fujitsu Co., the Japanese company provides the hardware, while TRW furnishes a sales force, service personnel, and software developers. 20/

3. Sacrifice of short-term profits for the sake of market penetration and market control. In this regard, the Japanese have been particularly effective in competing with IBM. The latter is reluctant to sell below the list price, while Japanese companies have been known to discount from 50 to 60 percent below the IBM list price for plug-compatible mainframe computers. 21/

An even greater threat to the U.S. preeminence in computers comes from Japan's longer-range planning. In the Fall of 1981, the Japanese government unveiled a Fifth-Generation Computer Project, to begin in April, 1982, and to take at least ten years. 22/ This project is an outcome of a two-year study conducted by the Japan Information Processing Center (JIPDEC), which assembled Japan's top talent on this subject from industry, the government, and academia. The study appeared in the form of a JIPDEC report, a comprehensive and sophisticated document. 23/

As revealed by this report, the Fifth-Generation Computer Project basically attempts to achieve these objectives:

1. To attain world preeminence in computer technology and computer sales.

2. To arm the Japanese people with highly advanced, voice-controlled fifth-generation computers and thus significantly enhance its productivity and help attain world leadership in other technological and economic areas.

3. To help solve some of the Japanese societal problems and thus strengthen Japan's viability as a nation.

The rationale of the Japanese drive for fifth-generation computers is ingenious in its basic simplicity and will be briefly summarized here. Present computers are complex to use, they require a language, a program, and a programmer. All this consumes resources and creates a barrier between the computer and the potential user, thus limiting the use of computers. The solution lies in a technological leap into the fifth generation of computers, which would be voice-controlled and would respond in a human voice. The vocabulatory of the computers is expected to reach 10,000 words by 1990. Thus, practically every Japanese would be able to use a complex computer, which would greatly enhance his or her productivity.

Moreover, since the fifth generation will possess a human-like capability for learning, association, and inference (artifical intelligence), the productive capability of the Japanese would be increased by significantly expanding frontiers of their intelligence and knowledge. In a resources-poor Japan, the single most important resource is Japan's highly educated and dilligent manpower; therefore, information and knowledge associated with computers must be cultivated as a new resource comparable to food and energy.24/

The JIPDEC report further notes that while computers so far have significantly helped to increase productivity in the secondary sector (manufacturing) through computer-controlled manufacturing processes and assembly lines, productivity in the primary sectors (agricultural and fisheries) and the tertiary sector (services) has improved very little. Fifth-generation computers are expected to remedy this situation, thus increasing efficiency and reducing cost in the economy. In particular, it is expected that the productivity of the agriculture and fishery industries could be sufficiently improved to make Japan fully self-sufficient in food. Fifth generation computers would also help Japan save energy and resources and cope with the problems of its aging population.25/

Apparently motivated by high costs of the project, 26/ the Japanese invite international cooperation. However, the Japanese plan emphasizes that "it is difficult to make this an international project. Instead, it is desirable to execute it as a national project with Japan having the liberty to decide its course." 27/ There are political undertones in the Japanese plan. It states that Japan will "fulfill (her) duty as an economic power" by understaking the project and that the project "will also provide our country with barganing power." 28/ It is also expected to "elevate Japan's position in the world."29/ Moreover, with the completion of the Fifth-Generation Computer Project, Japan "can establish a foothold in the world by performing its role in the international division of labor, furthering qualitative improvements in economics, applying new technologies to other fields and cultivating new frontier industries." 30/ In terms of its potential impact on world power, such a role "in the international division of labor" is important indeed, although it is stated here in a subdued, low-key tone.

What is the outlook for Japan's aspiration for world leadership in computers? In the short to medium run, the Japanese position is distinctly vulnerable. IBM has the capability of undermining the viability of the Japanese plug-compatible strategy. This could be done by switching to a new computer architecture, by changing IBM's basic operating system, or by lowering its price umbrella. Japan's present reliance on U.S. companies to help penetrate the American market is also a weak component in the Japanese strategy. But countermeasures against Japan in both of these area would involve short-term financial sacrifices to U.S. companies (including IBM) and U.S. business has not been known in recent years for its far-sighted long-range strategy. If the Japanese drive is not effectively countered in the short- to mid-range term, it would be considerably more difficult to compete with the Japanese in the fifth-generation race.

At present, IBM tends to play down the Japanese challenge in fifth-generation computers by taking the position that the Japanese will not achieve their objective, although they are likely to have some useful fallout from the project's R&D. Other U.S. computer companies, pointing at Japan's track record in other fields, are less optimistic. However, the U.S. computer industry, including IBM, is not exactly complacent. Some twenty computer and semiconductor companies, including IBM, Intel, and Hewlett Packard, have formed a research cooperative. It will funnel R&D money (a total of $50 million by 1985) to select universities for basic research in information processing technology which all companies will then share. 31/

A more ambitious undertaking was initiated in February 1982 by Control Data Corporation. At a meeting of some sixteen U.S. semiconductor and computer companies - which, however, did not include IBM - CDC proposed to create the Microelectronics and Computer Technology Enterprises (MCE), a joint research corporation to be formed by the member companies. Given U.S. antitrust legislation, this approach is more daring and has not been tested in the Justice Department, but there are signs that it may not be opposed. 32/

Both of these research organizations - the IBM-inspired research cooperative and MCE - are primarily directed against Japanese competition. However, the projected establishment of MCE also has somewhat different undertones. R&D in computers and semiconductors requires huge resources, and, unlike IBM, the companies grouped around MCE are relatively under-resourced. They are thus pooling resources in order to avoid duplication of effort and to be able to compete, with the Japanese or IBM. 33/

While U.S. companies are taking steps to strengthen their R&D against Japanese competition, Japanese manufacturers are making progress in R&D and hardware distinctly relevant to fifth-generation computers even before the full operation of the Fifth-Generation Computer Project. Processing speed is important for fifth-generation computers, and the Japanese place a great deal of emphasis on speed and are leading in it. Fujitsu is expected to come out with a supercomputer, a machine capable of extremely high speed, late in 1982. According to Western observers of the Japanese computer scene, its performance is expected to exceed that of any U.S. supercomputers currently on the market. Parallelism in operations, developed in supercomputers, could be distinctly useful for artificial intelligence and fifth-generation computers. IBM has been working for a number of years on the Josephson junction, a tiny switch capable of working phenomenally faster than today's high-speed microchips, but in April, 1982, Nippon Electric Co. announced that it developed a Josephson junction faster than IBM's Josephson's device. 34/

Perhaps more important commercially was the development by Fujitsu, in the fall of 1981, of a high electron mobility transistor (HEMT). Josephson junctions require temperatures close to absolute zero (-273oC) for their operation and helium is usually used for the refrigeration. HEMTs are based on gallium arsenide rather than silicon and the temperature required is that of liquid nitrogen (-196oC). The cost is thus significantly reduced because nitrogen is less costly than helium and because less refrigeration is required. HEMTs are not as efficient as Josephson devices, but the difference is relatively small. 35/

The above discussion is not intended to suggest that the Japanese are about to overtake the United States in computer technology, but it does suggest the magnitude of their momentum. Does this momentum mean that the efforts of the U.S. computer industry to counter the Japanese drive are too little and too late and that, but the 1990s, the Japanese will succeed the United States as the leading computer manufacturers in the world? Such a development is not inevitable, but if present trends are to be taken seriously, the outlook for the United States is not particularly good.

A great deal depends on the effectiveness of IBM in countering the Japanese challenge, but IBM is not revealing its strategy or the status of its R&D to make an independent assessment of the situation possible. Outside observers who deal with IBM note that the company is very big now and is not as dynamic and foreward-looking as it used to be. When a question is presented to key IBM executives as to why they do not seem to have a comprehensive assessment of the impact of computers on society and a strategy based on such an assessment - something the Japanese have done in a very sophisticated manner - the response is that such an assessment is more appropriate for the U.S. government, rather than a company, to initiate. Perhaps IBM is right.

Quite apart from the quality of IBM's strategy and that of other U.S. computer manufacturers, the industry has to cope with certain external handicaps which impede its competitiveness with the Japanese. Shortages of skilled manpower, high cost of capital, and anti-trust restrictions are some of the more important ones. Thus, it appears to be a near-certainty that, in the 1990s, the United States will, at best, share world leadership in computers with Japan. The actual outcome could be significantly worse than that.

Machine Tools

The U.S. machine tool industry is not a high technology industry in the sense that the others discussed here are. It is an old, mature industry. In comparison with such giants as electronics or computers, it is quite small, with sales of only $5,093 million and a work force of 104,500 employees (1981).36/ It is a cyclical industry with a predominantly conservative mentality. The industry's R&D expenditures, at 2.3 - 2.5 percent of sales, 37/ are below the manufacturing sector's average of 3 percent and far below the usually lofty R&D of high technology industries (e.g., 9 percent in the semiconductor industry). However, because of recent technological developments, the industry does have a significant potential for growth.

The advent of semiconductors and computers and, with them, of numerical control (NC) and computer numercial control (CNC) technologies has substantially broadened the horizons for the industry. Moreover, the machine tool industry is the principal potential vehicle for computer assisted manufacturing (CAM) technology. As noted in Chapter IV of this report, this technology, in conjunction with computer assisted design (CAD), carries the promise of revolutionizing manufacturing by greatly increasing its productivity. Thus, the machine tool industry, if effectively rejuvenated by modern technology and if its advanced products penetrate broadly the manufacturing sector, could significantly strengthen America's competitiveness in the world markets. The industry could thus be an important factor in enhancing the nation's vitality in the international arena and buttressing its national security in the broader meaning of the term.

The machine tool industry is also important to national security in the more immediate and narrower sense. Expansion of production in practically any industry--unless the industry merely capitalizes on its underutilized capacity--requires additional machinery and an efficient machine tool industry to produce it in a timely fashion. The machine tool industry is therefore essential to enable the nation to expand its production in war. The importance of machine tools for defense mobilization has been recognized by the U.S. Government and is expressed in two principal instruments: (1) a large reserve of machine tools, maintained by the Department of Defense; (2) the Machine Tool Trigger Order Program, administered by the Department of Commerce, which is intended to provide for automatically triggered orders for machine tools in the event of mobilization.

In recent years, the U.S. machine tool industry has lost substantial ground to foreign competition. While the world market for machine tools has been continuously expanding, the share of U.S. machine tool industry in it declined from 35 percent in 1967 to less than 19 percent in 1980.38/ Imports of machine tools have been increasingly penetrating the U.S. domestic market. Between 1972 and 1980, the share of imports increased from 9.4 percent to 23.2 percent.[39] In 1978, U.S balance of trade in machine tools became unfavorable for the first time in U.S. history; by 1980, the deficit grew to $513 million.40/

Although Western European countries made significant inroads into the U.S. market, by far the most significant intruder was Japan. Her exports of machine tools to the United States jumped from $62.6 million in 1975 to $492 million in 1980.41/

Alarmed by the Japanese competition, the National Machine Tool Builders Association (NMTBA) sent, in 1981, a mission to Japan. It consisted of industry executives accompanied by members of the NMTBA staff, and its purpose was to study the reasons for Japan's effectiveness. Somewhat to its own surprise, the mission concluded that the standard explanation of Japan's economic performance--such as wartime destruction, subsequent modernization, copying Western technology, government subsidies and low wages--may have been of some importance in the past, but they are not significant factors in Japan's current competitiveness in machine tools.

The mission emphasized the importance of management-labor relations in Japan which resulted in a highly motivated, well-trained and productive workforce. The study noted that the average level of manufacturing technology was roughly equal to American, but equipment utilization and quality control were much more effective; the output was estimated at approximately twice that of a comparable U.S. operation. Other factors of significance in Japanese competitiveness stressed by the NMTBA Japanese mission were the Japanese manufacturers' world view of the market; their long-range goals for market share and willingness to sacrifice short-term profits; supportive government-business relationship; and the encouragement of capital investment by the government in the machine tool industry.42/

The recommendations of the Japanese study mission are noteworthy in that they differ significantly from the conventional position of the NMTBA staff. The latter usually emphasizes the constraints on the machine tool industry--e.g., low capital formation in U.S. manufacturing, U.S. Government restrictions on East-West Trade - as being the basic causes of the the industry's problems. The Japanese study mission mentioned some constraints, but it addressed its recommendations primarily to the need for changes in the industry itself. Its recommendations are thus of interest as a case of top industry executives reexamining the status of the industry in the light of their exposure to Japanese experience.

The study mission recommended that, to meet the Japanese challenge, "the American machine tool industry must be aggressive." U.S. companies should study the manufacturing and marketing techniques of their competitors; they should adopt them and also devise additional competitive tactics to capitalize on each company's unique strengths." The study stressed that "meeting the Japanese competition will require increased risk-taking by American machine-tool builders, coupled with foregoing short-term returns in favor of long-term objectives and actions." The industry should "aggressively invest in the latest, most efficient means of production that incorporate the newest manufacturing technology...in order to improve productivity and reduce costs." Similarly, it should "make heavy, aggressive investments in research and development." The Japanese study mission called on the industry's managers to raise their horizons beyond America and view the entire world as their market place.43/

The recommendations of the Japanese study mission identified a number of important shortfalls of the industry. However, in order to have a realistic picture of its status, one must take account of the contraints under which it operated and to which it succumbed.

The machine tool industry has been significantly conditioned by its past: it evolved from the family-owned shops which supported America's early industrialization. Thus, the industry at present consists of some 1,300 establishments, only nine of which have more than 1,000 employees, while two-thirds have fewer than 20.44/ The small size of many firms has been a factor inhibiting the conduct of R&D, especially in view of the anti-trust legislation which precluded the pooling of resources. Although not uniformly, the industry did succeed in being in the forefront of technological advance, in part because technologies were transferred from other industries (e.g., the introduction of NC was made possible by the digital computer), in part because of the U.S. Air Force which subsidized certain technologies for application in aerospace, and in part because of the R&D conducted by some major machine tool companies.45/

The cyclical nature of the industry conditioned its conservative outlook and operations. Companies produce in response to firm orders, tailored to the needs of the customer. Long backlogs (from six months to two years) are prevalent, since expansion of capacity entails risk. No off-the-shelf machine tools are produced, which makes the industry vulnerable to the more agile foreign competition--such as Japanese--with its ready-made products. An aggressive pursuit of expanding foreign markets could have helped the industry to minimize the cyclical impact of the domestic economy, but machine tool manufacturers did relatively little to expand abroad. A strategic thrust within the industry is in part handicapped by the fact that its larger companies are often found within a conglomerate structure which may or may not consider machine tools a significant components of its strategic planning policies.46/

The sluggish capital investment by U.S. manufacturers in the past 15 years impeded introduction of new machine tools into industry. As a result, two-thirds of the machine tools installed in U.S. plants are over ten years old. The United States thus leads all major industrial countries in the Free World with the highest percentage of old machine tools in its industry, while Japan is the leader in terms of having the largest percentage of modern machine tools in use.47/ Less than four percent of machine tools installed in the United States are advanced, efficient tools equipped with numerical control.48/ The condition of the installed machine tools in the United States thus constrains U.S. economic productivity and seriously handicaps surge capability in the event of war.

The machine tool industry itself has very limited surge capability. It is small. With the exception of a few larger firms, the industry has not maintained a modern production base and its own productive equipment is old. The industry's present backlog of orders is six and a half months.[49] The normal utilization rate of the industry is at least 85 percent, which leaves little room for expansion.[50] Moreover, a majority of the workforce of the industry consists of highly skilled machinists. They are in short supply now and the workforce is aging (the average age is 47). Manpower is thus likely to impose a severe constraint on expansion of the industry in war.51/

Although the U.S. Government has, on paper, a formidable structure to meet the nation's need for machine tools in war, the reality is different.

The DOD maintains its inventory of machine tools under three main groupings. The first group consists of machine tools for use in government-owned production facilities, arsenals, and depots. The second group consists of machine tools identified for inclusion into Plant Equipment Packages (PEP). These are both active and idle assets retained by each service to support production or repair of specific items in the event of mobilization. The third group consists of a general reserve.

The conditions of readiness and quality of equipment differ among these various groups, with the first group being in the best condition. But, on the whole, the condition of all government owned machine tools is poor. Their total number is approximately 97,000 and their average age is about 25 years. Much of equipment in the PEP category (about 20,000 items) has been in storage for many years and is probably inoperable. In the general reserve (13,400 items), only 22 percent were identified as serviceable as of December, 1980. Although there is a policy in the DOD for systematic modernization of its industrial resources, inadequate funding and manpower in recent years precluded its effective implementation.52/

The Machine Tool Trigger Order Program, administered by the Department of Commerce under the Defense Production Act of 1950, also is not a particularly effective instrument for reducing lead times for mobilization, which is its intended purpose. The program has not yet provided standby contracts to actually "trigger" their production. According to a recent study, it needs a better DOD-DOC coordination to link defense requirements with the Trigger Order Program, to be eventually translated into a system of standby contracts. While progress in this direction is, apparently, being made, it is slow.53/

In summary, the machine tool industry exemplifies a traditional industrial sector which has the potential for being significantly rejuvenated and envigorated by modern technology, thus strengthening the nation's economic competitiveness and its security in the short and the long run. The industry, however, failed to exhibit the required dynamism, did not capitalize an potential opportunities in the expanding world market, and succumbed to the multiple obstacles within it and in the economy at large, which development is detrimental to U.S. national security. The U.S. Government has not been effective in compensating for this shortfall by its own measures.

Conclusions

The above analysis of the three industries with regard to foreign competition suggests both some common elements applicable to all three as well as significant differences. Perhaps the single most important common element is the nature of the threat. In all instances, by far the greatest threat comes from Japan.

In the case of two industries - electronics and machine tools - the competitive threat of Japan is unequivocally reflected in the balance of trade figures; not so in computers. What is noteworthy, however, is the amazing speed of the deterioration of the American position after the Japanese had achieved their momentum. In the case of electronics, it took the Japanese only three years to widen the gap in the balance of trade from marginally unfavorable to that of nearly a quarter of a billion dollars (1980). In the case of machine tools, the balance of trade had become unfavorable earlier (1974), but it was only within a period of three recent years (1977-80) that it zoomed to alarming proportions from $83 million to $443 million.54/

It thus appears that, for policy purposes, the balance of trade provides us with poor guidance to measure and counter the Japanese challenge. Considering the lead time required to remedy the situation in a particular sector, its alarming signal comes usually quite late. The study of the Japanese organization and planning would offer us a much better measure of the competitive threat and how to counter it.

In this light, the two documents discussed in this chapter - the Japanese plan for the fifth-generation computers by JIPDEC and the study of the Japanese machine tool industry by the NMTBA mission - are particularly revealing. Although one document is Japanese and the other American, and although they deal with different industries, the documents suggest the magnitude of the response required if the United States is to be effective in meeting the Japanese challenge. Among other things, they suggest the need for a U.S. re-evaluation of the basic premises of international commercial competition, the policy requirements stemming therefrom, and the price for failure.

If we view national security in purely military terms, the impact of foreign commercial competition has not been very seriously damaging so far. The computer sector has not yet been affected at all. In electronics, surge capability in war has been curtailed through losses to foreign countries in consumer electronics and semiconductors. Perhaps the most serious problem is the dependence for defense production on electronic components from the Far East, but foreign competition is only partially responsible for that development. The constraints on war production imposed by the sad situation in machine tools is serious, but the failure of the machine tool industry to effectively meet foreign competition is also only partially responsible for this situation. Governmental policies with regard to preparedness in machine tools left a great deal to be desired.

However, the threat of foreign competition to U.S. national security in the three sectors discussed is much more serious when we look into the future and when national security is viewed in the broader sense, beyond its purely military dimensions. In this context, the computer sector probably deserves top priority for a forward-looking policy concern.

NOTES

1. See U.S. Department of Commerce, International Trade Administration, A Report on the U.S. Semiconductor Industry, (Washington, D.C.: U.S. Government Printing Office, September 1979), p. 46. Thirty-six percent of semiconductors were used by the U.S. Government, primarily in military and space programs. In addition, 24 percent of semiconductors were used in computers, some of which were employed in defense. For the early, military-dominated phase of the semiconductor industry (1958-64), see Michael Borrus and James Millstein, "Trade and Development in the Integrated Circuit Industry," in American Industry in International Competition, a project conducted by L. Tyson and J. Zysman (Institute for Governmental Studies, University of California, Berkeley, September, 1980), pp. 15-18.

2. Defense Science Board 1980 Summer Study on Industrial Responsiveness (Office of the Under Secretary of Defense for Research and Engineering, Washington, D.C. January 1981), p. 11.(Hereafter cited as DSB, Industrial Responsiveness, 1980.)

3. Industrial College of the Armed Forces, Defense Industry Analysis Summaries, May 1981, p. 12-4.

4. See ibid, pp. 12-4 to 12-6; U.S. Department of Defense, The FY 1982 Department of Defense Program for Research, Development and Acquisition: Statement by The Hon. William J. Perry, Under Secretary of Defense for Research and Engineering, to the 97th Congress, First Session, 20 Jan. 1981, pp. V-7 to V-9.

5. The International Microelectronic Challenge (Cupertino, Calif.: The Semiconductor Industry Association, May 1981), pp. 8-9, 24. The combined investment rate for plant, equipment and R&D in the semiconductor industry is between 22 and 27 percent, about twice the national average.

6. See Gene Bylinsky, "A New Industrial Revolution Is on the Way" Fortune, Oct. 5, 1981, pp. 106-114.

7. The International Microelectronic Challenge, op. cit., p. 11. It is noteworthy that the share of semiconductors in the world electronics market is projected to increase from 5.5% in 1968 to 10%, or $50 billion, in 1988.

8. A similar argument has been developed in Michael Borrus, James Millstein, and John Zysman, "International Competition in Advanced Industrial Sectors: Trade and Development in Semiconductor Industry" (Institute for International Studies, University of California, Berkeley, January 1982); see pp. 135, 144 and passim.

17. Source of figures: Science and Electronics Division, Office of Producer Goods, Bureau of Industrial Economics, U.S. Department of Commerce.

18. Michael Schrage, "France Plans Computer World Center," The Washington Post, January 27, 1982. p. D11. It is noteworthy that the center's chairman of the board is Jean-Jacque Servan-Schreiber, the author of The American Challenge and a former cabinet minister. He reports directly to the French President Mitterand.

19. "A Worldwide Strategy for the Computer Market," Business Week, December 14, 1981, p. 65.

20. Kathleen K. Wiegner, "It's the Response That Counts," Forbes, November 23, 1981, pp. 124-125.

21. "A Worldwid Strategy for the Computer Market, Business Week, op. cit., pp. 65-66.

22. "A Fifth Generation: Computers That Think," Business Week, December 14, 1981, p. 94.

23. Japan Information Processing Center, Preliminary Report on Study and Research on Fifth-Generation Computers, 1979-80 (Tokyo, Fall 1981); cited hereafter as JIPDEC, Report.

24. JIPDEC, Report, pp. 16-18, 22-24, 26-27, and passim.

25. Ibid., pp. 17 and 26.

26. The Japanese government approved a total of $285 million for the Fifth-Generation Computer Project and related projects ($85 million for a supercomputer and $80 million for an optical computer), effective April 1, 1982. "Will Japan Leapfrog America on Superfast Computers?" The Economist, March 6, 1982, p. 95. Some independent estimates place the cost of R&D for fifth- generation computers at $1 billion or more.

27. JIPDEC, Report, p. 89.

28. Ibid., p. 24.

29. Ibid., p. 86

30. Ibid. p. 28

31. Kathleen K. Wiegner, "Preemptive Strike," Forbes, April 12, 1982, p. 116.

32. Thomas W. Lippman, "Computer Companies Join Forces," The Washington Post, May 30, 1982, p. F1; "America's Reposte," The Economist, March 6, 1982, pp. 95-96. The companies participating in exploratory meetings on MCE included Rockwell, Xerox, United Technologies, Sperry, Burroughs, NCR, and Motorola. Projected funding of MCE is $20 million for the first year, eventually reaching $100 million per year.

33. Lippman in The Washington Post, op. cit.

34. "NEC Develops Josephson IC, " Electronic News, April 19, 1982, p. 61. Nippon Electric Co. claims a switching speed of 10.8 picoseconds (trillionths of a second) for its Josephson logic circuit.

35. The speed of HEMTS is 17 picoseconds, as compared with, reportedly, 13 picoseconds for IBM Josephson junctions. "Will Japan Leapfrog America on Superfast Computers?" The Economist, op. cit., p. 95.

36. Source: National Machine Tool Builders' Association.

37. The machine tool industry does not officially compute R&D expenditures. The figure of 2.3 percent is the average of the top ten machine tool corporations in 1978. U.S. Department of Commerce, Office of Producer Goods, Bureau of Industrial Economics, Office of the Chief Economist, "The Metal Cutting Industry" (May 15, 1980), p. 25. The figure of 2.5 percent is the median of those major companies which reported their R&D expenditures to the National Machine Tool Builders' Association for 1980.

38. "Defense Machine Tools and Industrial Machinery," in Industrial College of the Armed Forces, Defense Industry Analysis Summaries (Washington, D.C., May 1981), p. 4-21. In the same period, world machine tool output grew from $5 billion to $26.5 billion. National Machine Tool Builders' Association, 1981-82 Economic Handbook of the Machine Tool Industry (McLean, Va., 1981), p. 163. (Hereafter cited as NMTBA, 1981-82 Economic Handbook.)

39. Ibid., p. 126.

40. Source: National Machine Tool Builders' Association, Statistical Office.

41. NMTBA, 1981-82 Economic Handbook, p. 128. In 1980, the two principal West European exporters to the United States were West Germany ($236 mil.) and the United Kingdom ($117 mil.). Ibid.

42. See National Machine Tool Builders' Association, The Japanese Study Mission, Meeting the Japanese Challenge (McLean, Va., September 14, 1981), pp. 5, 21-23 and passim. The study further noted that the Japanese are making strides with operatorless machini

43. Ibid., pp. 6-7.

44. NMTBA, 1981-82 Economic Handbook, p. 60. The figures are as of the 1977 Census of Manufacturers.

45. See Lawrence Livermore National Laboratory, Technology of Machine Tools, prepared for U.S. Air Force Materials Laboratory, Wright-Patterson Air Force Base, Oct., 1980; Vol. I (Executive Summary), pp. 4-6. This study concluded that "the major changes in machine tool technology have been brought about more by influences and pressures from outside the industry than by machine tool builders' selfinitiative" (ibid., p.4).

46. See U.S. Department of Commerce, "The Metal Cutting Industry," op. cit., pp. 28-30.

47. NMTBA, 1981-82 Economic Handbook, p. 257. The percentage of machine tools under ten years old in use in the United States is 31 percent and in Japan 61 percent.

48. John B. Deam, "Machine Tools and Their Importance to Our Industrial Responsiveness," a talk given at the 13th Annual Manufacturing Technology Conference, San Diego, California., Nov. 30 - Dec. 3, 1981, p. 9.

49. Source: National Machine Tool Builders' Association, Feb. 1982.

50. "Defense Machine Tools and Industrial Machinery" in ICAF, Defense Industry Analysis Summaries, op. cit., p. 4-12.

51. Testimony of Charles P. Downer, Industrial Preparedness Representative, NMTBA, in U.S. House of Representatives, Committee on Banking, Finance and Urban Affairs, Subcommittee on Economic Stabilization, Revitalization and the U.S. Economy; Hearings (Washington, D.C.: U.S. Government Printing Office, 1981), p. 48.

52. For details, see ibid. pp. 53-54 and "Defense Machine Tools and Industrial Machinery" in ICAF, Defense Industry Analysis Summaries, op. cit., pp. 4-14 to 4-16.

53. See ibid., pp. 4-18 to 4-19.

54. Source: National Machine Tool Builders' Association.

V. DOD Rationalization/Standardization/Interoperability (RSI) Policies and Foreign Competition

The origin of Department of Defense NATO RSI policies goes back to the so-called "Calver-Nunn Amendment" to the DOD Appropriation Authorization Act of 1976, but it was not until 1978 that they became sufficiently developed and began to be vigorously pursued. Among other things, NATO RSI undertook to remove barriers to foreign competition from NATO nations with regard to the U.S. defense industrial base and to invite such competition. The rationale of this unprecedented development will be briefly explained.

The declared objective of NATO RSI policies with regard to the production of weapons is to reduce their cost by avoiding duplication of resources and by promoting "a technically advanced, industrially productive and economically viable defense industry on both sides of the Atlantic."1/ There are basically three means to achieve this objective (1) General Memoranda of Understanding (MOUs) dealing with reciprocal purchasing; (2) co-production (or "dual production," as the term was used earlier) in NATO countries, and (3) the concept of the Family of Weapons.

The purpose of the general MOUs is to stimulate competition within NATO defense industry (U.S. and European) by waiving various "buy national" restrictions on a reciprocal basis. At present, the United States has general MOUs with eleven NATO allies. 2/ The existence of these MOUs means that the provisions of the Buy American Act do not apply to the parties to the MOUs and they are free to compete with American companies for DOD procurement contracts. In fact, the current policies not only allow such foreign competition for U.S. defense contracts, but they solicit and facilitate it. For example, international arms collaboration seminars are conducted for industry and government executives which attempt to familiarize the participants with procurement practices in various NATO countries.3/ The U.S. Defense Acquisition Regulations (DAR) specifically provide that no unusual technical and security requirements may be imposed solely to exclude participating country sources from competition.4/

However, in the interest of national security, current regulations impose certain restrictions on the extent of foreign competition. Thus, the DAR (1-2207) provides a list of items excluded from foreign competition so as to safeguard U.S. defense mobilization base requirements. These restrictions, however, can be waived. If it has been determined that U.S. domestic manufacturers are producing sufficient quantities of a listed item to sustain the mobilization base, then bids from an MOU country may be solicited and awards made.5/

A relevent question to ask is: What is the extent of penetration of the U.S. defense industrial base by foreign companies, supplying components from overseas? Did it effect a significant displacement of U.S. production? Again, no comprehensive, in-depth studies on this subject were conducted and information is fragmentary and "soft," largely based on estimates of personnel interviewed. According to some estimates, over 15 percent of the F-16 aircraft manufactured in the United States consisted of European-built components. For other systems, estimates were considerably smaller. Some episodic examples were cited of the reduction of the number of companies (e.g., microwave tube producers, from 12-15 in the past to 5-6 at present), ostensibly because of foreign competition. However, no independent assessment of the reasons for their decline was made in this study.

Spot checks with industry and industrial associations sources on the effect of opening up competition for defense procurement did not reveal a strong consensus of opinion. Virtually no one subscribed to the view that the general MOUs are significantly jeopardizing the U.S. defense industrial base, although it has been noted that, along with benefits, there are some undesirable repercussions of RSI policies on the defense industrial base, especially in the area of offsets (more about offsets later). Most industry representatives appear to prefer the protection of the Buy American Act. A surcharge of 6 to 10 percent on foreign contracts is viewed by many as needed to compensate U.S. companies for certain special costs they must bear (e.g., environmental restrictions, affirmative action). Others, however, held the view that now that the new system is here they can live with it. They felt that, in the defense area, the U.S. Government subsidizes R&D and provides other forms of assistance and this helps to offset the protectionist tendencies on the part of foreign governments with regard to their companies. And American firms do have an opportunity to bid abroad under the MOUs and they often win.

The issue of technology transfer under RSI appears to present more of a problem to U.S. national security that the opening up of the defense industrial base to foreign competition. One of the key objectives of RSI is to strengthen and integrate the defense technological and industrial base of NATO nations on both sides of the Atlantic. Technology transfer is an important instrumentality in this process.

To be sure, technology transfer is not a one-way street; the United States also benefits from technology transferred from its NATO allies under RSI programs. However, the United States is considerably more advanced in military and militarily-related technology than Western European nations and, on balance, they have been the greater beneficiaries of technology transfer under RSI. In fact, Western Europeans, being behind the United States in military technology and defense-related production capability, have been making a deliberate effort to strengthen their position in this regard in order to rectify the present imbalance in arms trade so heavily unfavorable to them. U.S.-promoted RSI policies tended to facilitate this process.

Co-development and co-production programs have been important vehicles for technology transfer to U.S. NATO allies. Another highly important instrument of technology transfer from the United States to Western Europe has been the so-called "offsets."

Actually, offsets are not a product of RSI; as a part of foreign military sales (FMS), they long preceded it. Initially offsets were related to the balance of payments in connection with arms sales; they committed the seller (usually, a U.S. arms manufacturer) to "offset" the imbalance in arms trade by applying a certain percentage of the purchase price (say, 30 percent) to (usually specified) purchases from the buyer nation. In recent years, however, offsets have in many cases lost their relationship to the consideration of the balance of payments and have simply become certain favorable conditions, other than the price, which the buyer extracted in connection with a purchase.11/ In some cases, the size of the offset (e.g., a commitment to buy certain goods) exceeded the price of the arms purchase.

As RSI became a policy, the practice of offsets has become intricately intertwined with the various activities conducted under it. Technology transfer, in various forms, plays a major part in offsets. Offsets - in the form of production licenses - may accompany an RSI-inspired co-production MOU. Or a co-production agreement by the manufacturer may become an offset in a major arms sales.12/

The effect of the technology transfer to NATO countries appears to be the following:

1. In the longer run, the competitiveness of European companies will be strengthened, thus helping them to obtain a larger share of defense contracts in the United States and thus, possibly, diminish the U.S. defense industrial base.

2. With the strengthening of the European defense industry, U.S. ability to sell arms to Western Europe is likely to decline, thus resulting in a reduction of U.S. production and surge capability in weapons.

3. Transfer of U.S. technology to European manufacturers strengthens their competitiveness for defense-related production and sales to third nations. This in turn has repercussions on the vitality of the U.S. defense industrial base. 13/

4. Spillover of technology transferred via military programs into the commercial sector of Western European nations strengthens the competitiveness of their industries and thus could be detrimental to U.S. industrial viability.

As noted earlier, the economic well-being of West European nations heavily depends on foreign trade which, in turn, has been an important factor in their propensity to transfer technology to the USSR. In the absence of an in-depth study on this subject, it is difficult to say how much, if any, technology transferred to NATO nations finds its way to the Soviet Union. However, some individuals interviewed noted that commercial licensing of technology transfer for sensitive programs has considerable room for improvement. There are thus reasons to believe that at least a portion of U.S. technology transferred to Western Europe finds its way to the USSR. Accordingly, a more thorough examination of this subject and a strengthening of appropriate mechanisms in this area would be appropriate.

To conclude: while RSI policies bring certain distinct benefits to the United States, little analytic work has been done to assess fully their various ramifications. Such analysis, which would help to optimize RSI in the interest of U.S. national security, is needed. In fact, steps in this direction - some of which are reflected in the above paragraphs - are under consideration in the Department of Defense at present. In particular, the point is being raised that, in the application of RSI, technology was viewed perhaps too much as an instrumentality subordinate to other - mainly political - objectives of RSI. The current approach appears to place greater emphasis on technology as a value in its own right and attempts to readjust priorities of the various components of the policy accordingly.14/

NOTES

1. The Honorable William J. Perry, Under Secretary of Defense for Research and Engineering, The Department of Defense Written Statement on NATO-Improved Armaments Cooperation, presented to the Research and Development Subcommittee of the Committee on Armed Services of the U.S. Senate, 96th Congress, First Session, 4 April 1979, p. 5.

2. Except for the agreements with France and Turkey which are not published, MOUs appear in the Defense Acquisition Regulations (DAR). The other nine NATO countries are: the U.K., FRG, Italy, Norway, th Netherlands, Portugal, Belgium, Denmark and Canada.

3. U.S. Department of Defense, Rationalization/Standardization Within NATO; a Report to the United States Congress by Harold Brown, Secretary of Defense, 19 January 1981, p. 82.

4. David B. Dempsey, "Foreign Procurement under Memoranda of Understanding and the Trade Agreements Act," Public Contract Law Journal, March 1982, pp. 231-232.

5. Ibid.

6. Under Secretary Perry, op. cit., pp. 6-7.

7. Secretary Brown, op. cit., p. 83.

8. Source: ODUSDR&E (Acquisition Mgt.). No longitudinal data, however, are available to compare the impact of RSI over time.

9. Source: ODUSDR&E (Acquisition Mgt.). The list in DAR 1-2207 is not the only source of items exempt from foreign competition under the MOUs. There are some "excluded" items listed in DAR 6-1405; there is also the protection rendered to certain industries (e.g., shipbuilding) provided by Congressional legislation.

10. It should be noted that the Trade Agreements Act of 1979 also liberalized foreign competition with regard to the DOD procurement market to the signatories of the Act which included - in addition to most NATO countries - Japan, Sweden, Austria, Switzerland, Ireland, Finland, Hong Kong and Singapore. The provisions of this Act are distinctly not as liberal as those of the MOUs. They removed the application of the Buy American/Balance of Payment restrictions to some 60 specifically listed items, some of which could be a part of defense procurement. The act specifically excluded a number of defense-related items, such as weapons, ammunition, aircraft, aircraft components, ships, engines, and communications. See Agreements Reached in the Tokyo Round of the Miltilateral Trade Negotiations; 96th Congress, 1st Session, House Document No. 96-153, Part I, pp. 162-165.

11. Thus, at present, a distinction is made between direct and indirect offsets. The former pertain to compensatory manufacturing activity provided to the purchasing country and involving the individual defense system itself. Indirect offsets apply to compensatory activity from the purchasing government's industrial facilities unrelated to the item being purchased.

12. Since May 1978, it has been the policy of the Department of Defense to discourage direct DOD commitments or involvement in offset agreements. By and large, agreements on such offsets are left to industry. Although the Department of Defense does not encourage commercial offsets, it does rely on the companies involved to fulfill their commitments on offsets to the purchasing country.

For a more extensive treatment of offsets, see Col. Ronald L. Carlberg, USAF, Director for International Acquisition, Office of the Under Secretary of Defense (Research and Engineering), "Statement" before the Subcommittee on Economic Stabilization of the House Committee on Banking, Finance, and Urban Affairs, First Session, 97th Congress, Sept. 24, 1981, and Electronics Industries Association (EIA), "Statement on the Subject of 'Offsets'" for inclusion in the record of the Hearings of the Subcommittee on Economic Stabilization of the House Committee on Banking, Finance and Urban Affairs, Sept. 24, 1981.

13. According to one industrial association executive, SRI-induced co-production drives industry to offsets and technology transfer. In turn, this leads to West Europeans winning in competition for third country markets and, in the longer run, deterioration of the U.S. defense industrial base. Similar conclusions were reached by a study on NATO arms collaboration conducted for OSD (ISA). According to this study, European governments and defense industries are pushing for involvement of European firms in co-development and co-production arrangements. "The benefits accruing to the European economy through these arrangements include national income generation, increased local employment, foreign exchange savings, technology transfers and the establishment or strengthening of competitive threats to U.S. industry in worldwide markets." Jack Baranson, "Problems and Consequences of Technology Sharing Under NATO Arms Collaboration," Report prepared by Developing World Industry and Technology, Inc., Washington, D.C., 1980, pp. 10-11.

14. E.g., see Draft Report of the DOD Task Group to Review International Co-Production-Industrial Participation Agreements, 12 Feb. 1982.

VI. Technological Impact, Foreign Competition, and Implications for U.S. National Security: Western Europe vs. Japan

In order to provide a fuller understanding of the national security implications of foreign competition to U.S. high technology industries, the analysis of the preceding sections must be placed in the context of a broader phenomenon, viz., the impact of technology on international power. In particular, in the last hundred years or so, technology changed the relationship between the location of natural resources and power.

Historically, technology has played a major role in creating new resources or helping to exploit traditional ones; in doing so, it was affecting distribution of international power. In the 19th century and the early decades of the 20th, this power-developing role of technology was closely tied to the location of resources. In particular, major industrial centers were built around coal-iron ore complexes such as those in the Durham-Cleveland (Britain), the Great Lakes-Pennsylvania (U.S.), the Ruhr (Germany), and the Krivoi Rog-Donbas (USSR) regions. The development of railroads was closely tied to the availability of resources - either mineral or agricultural - on the land that the railroads crossed. Electricity made water power a significant source of energy, but hydroelectric stations and the economic activity stimulated by them were narrowly confined to rivers and their vicinity.

A more recent trend has been the decline in the importance of the location of raw materials and sources of energy as a determining factor in economic development and in the rise of new power centers. No single invention was responsible for this decline, but the most significant technologies initially responsible were chemistry and transportation. We have seen in Chapter II of this study how effective chemistry was in freeing Germany from her dependence on imported raw materials and building up her power in general, although, in its early beginnings, the German chemical industry heavily depended on coal tar, a by-product of the German coal-iron ore complex. Technological advances in transportation, resulting in the reduction of costs, greatly increased the mobility of raw materials. Perhaps the most striking example of this is the post-World War II development of Japan's steel industry which, by 1964, had become the third largest in the world (after the United States and the Soviet Union). A great majority of raw materials for the Japanese steel industry are imported over an average distance of 5,500 miles. 1/

In short, what may be called "the deterministic effect of resource location" has lost a great deal of its old importance. The horizons for organized human will, backed by advanced technology, have broadened immensely. In the present era, the principal elements of power are (1) highly skilled population; (2) availability of highly advanced technology; and (3) an effective societal organization, foresight, purposiveness, and drive in capitalizing on technology's potential. 2/ Historically, the United States rose to power largely on the strength of its resources. At present, the importance of resources has declined and, to add insult to injury, America's resource base is no longer as rich as it used to be. The third and probably the single most important element in the strength and vitality of contemporary world power centers - an effective societal organization for capitalizing on technology's potential - opens new and broad horizons for America's future. But this is precisely an area where U.S. competitors have been more effective than the United States.

The threat of foreign competition to the United States comes basically from two regions: Western Europe and Japan. The impact of competition from Western Europe has been considerably smaller than from Japan. Moreover, the nature of that competition appears to be more typically economic, with some undertones of old mercantilistic policies. Western Europe as a whole does not have a common policy to capitalize on opportunities offered by advanced technology. Although there are efforts under the aegis of the European Community to integrate policies of its members with regard to economic and technological matters, the relative success of such efforts is quite modest. Within the framework of the European Community and its common market, individual governments have competing and often conflictual policies.3/

Western Europe thus falls considerably short of meeting our third - and critical - criterion for comprising a power center whose competitive dynamism seriously affects U.S. national security. 4/ However, one should not overlook the fact that individual European companies can - and do - present their U.S. counterparts with a stiff challenge in certain sectors (e.g., electronics, machine tools, aircrafts, automobiles).

Japan represents a case significantly different from that of Western Europe. It appears that, more than any other major region in the world, Japan has the essential attributes for capitalizing on technology to promote her power.5/

As early as 1960, Japan had the highest literacy in the world, 99.8 percent. 6/ In 1980, with a population about half that of the United States, Japan graduated more engineers than did the United States.7/ In Japan, engineers are extensively imployed in managerial positions in both government and industry. About half of both the senior civil service and industrial directors hold degrees in engineering or related subjects.8/

Moreover, Japan has a much larger base of highly capable manpower to lean upon than does the United States. According to a recently released study, the mean IQ of the Japanese has risen spectacularly in this century. In the younger generation, people who are now 13 through 23, ten percent have IQs above 130, while in the United States only two percent of population of the same age have corresponding IQs.9/ To put this into absolute figures: there are now 1.8 million Japanese in the above age brackets with an IQ over 130, but only 850,000 Americans.10/

While in the case of other nations, "availability of highly advanced technology" and "an effective societal organization to capitalize on the technology's potential" are usually two separate and not necessarily commensurate attributes, 11/ a strong point of Japan is that she succeeded in combining the two in a continuous and mutually supporting process, with synergistic effect. Japan provided ample evidence of her ability to transfer technology from the West, to improve upon it, and to make it commercially extremely successful. In one respect Japan's capability has not been fully proven: to do highly original research and to be a true leader in the most sophisticated high technologies. However, the Japanese did display capability for doing original research in a number of areas and came out with innovations which were distinct "firsts" or are now doing research at least equal to, if not exceeding that, of the West.12/

MITI stated that Japanese brainpower may well be the nation's only resource and it called for an all-out drive in the 1980s to develop creative technologies. 13/ While the present extent of Japan's original work in scientific and technical R & D does not yet allow definitive predictions for the future, there is no strong evidence to suggest that Japan cannot become an effective originator of the most advanced technology.14/

A great deal has been written in recent years about the effectiveness of "Japan, Inc." in capitalizing on technology in order to promote her economic growth and competitiveness in the world market. There is no need to repeat here what has already become generally known. The discussion below will focus on certain aspects of the Japanese phenomenon which have not received adequate attention or are particularly relevant to the subject matter of this study.

The term "Japan, Inc., " is grossly misleading. It connotes that (1) the kind of organization and unity which Japan displays is analogous to a corporation, and (2) the underlying motives of Japanese behavior are fundamentally economic. Both are inaccurate. Japan is not a corporation. It is an unusually cohesive - not always internally, but certainly with regard to the outside world - nation, imbued by a unique kind of nationalism which, like any strong nationalism, finds its roots in human psychology and emotions. 15/ The challenge of Japan is thus not economic; it is political. Its primary objectives are status and power and it uses technological and economic means to achieve them.

It appears that the initial focus of Japan after World War II on economic growth was primarily economically motivated. Defeated and humiliated in the war and devoid of natural resources, Japan faced the problem of economic survival. As, however, she became unusually successful in the assimilation of imported nonmilitary technology and, especially, in its application to economic pursuits, economic self-aggradizement became a national objective. Its initial component - the desire to increase the economic well-being of the Japanese people - was not entirely lost, but a new one has come to the fore: to satisfy a combination of the nationalistic and psychological craving for status and power. Their success notwithstanding, the Japanese still have remnants of an inferiority complex vis-a-vis Westerners, and to be the greatest economic power in the world has become an important means of quenching this complex, a desire that motivates factory workers and high government officials alike.16/

In the late 1960s and early 1970s, when Japan's economic growth was about ten percent annually, the Japanese prospect of becoming an economic superpower was widely discussed in the Japanese and Western press and on various other platforms. With the advent of the energy crisis in 1973-74 17/ and the decline in the Japanese growth to 5-6 percent annually, the outlook for Japan to become and economic superpower was postponed further into the future. 18/ The recent call by MITI for a drive to generate original technologies and ambitious Japanese plans with regard to the fifth-generation computers suggest that Japan's strategy has shifted its emphasis towards preeminence in technology and not just economic growth itself. Superiority in high technology, combined with a healthy rate of growth, would bring Japan much closer to a superpower status than a mere achievement of a very large GNP short of technological preeminence. If Japan is successful in her objective of technological preeminence, the lead time for achieving the desired status and power 19/ could well be considerably shorter than that of becoming an economic superpower comparable to the United States at the present rate of Japan's growth. 20/

If the Japanese drive is primarily nationalistic and political then in what particular form is its character manifested? It is manifested in the centrality of Nippon in Japanese decision-making, motivations, and the technologico-economic strategy.

As Peter Drucker pointed out, 21/ in Japanese decision-making the national interest comes first. If a particularistic interest wants to be listened to and have a measure of success, it must justify its claims in terms of its contribution to Japan, and not its own concerns. In the consensual process which governs Japanese decision-making, the consideration which ultimately prevails is the national interest of Japan. In the highly collectivistic Japanese society, loyalty - and the motivation which stems from it - is a continuum which starts in the family, extends to the company, and culminates in the nation. 22/ Thus, the company anthem, which is usually sung at the beginning of each working day by all employees and the management and which psychologically spurs them to produce, is only one manifestation of nationalism operating through multiple channels and accounting for the strength of the Japanese drive.

Lastly, the Japanese industrial policy, orchestrated principally by MITI, is national in scope. It is long-range; it continuously modifies the composition of the Japanese industrial structure by placing emphasis on those sectors which are the most advantageous to Japan in a given period of time, and it gradually reduces or phases out those which are not. If necessary, the policy rationalizes and overhauls entire industries, as it did in the case of the formerly backward and fragmented machine tool industry. 23/

The threat which the Japanese competitive challenge presents to U.S. national security is as follows:

1. Japan, over time, could significantly erode the U.S. economic base upon which, in the last analysis, U.S. military power depends. Moreover, if Japan is successful in capturing leadership in certain key areas of high technology - such as semiconductors, computers, composites, and biotechnology - the United States could become increasingly dependent on Japan for components and other products relevant to emergency mobilization.

2. In addition to U.S. military power, the present U.S. superiority in high technology is a critical factor in safeguarding U.S. security with regard to the Soviet Union. To obtain the most advanced technology, the Soviets have no place to go except the United States. If the Japanese seize leadership in key areas of high technology, the United States would lose direct conrol over the critical margin of technological superiority with regard to the USSR. As an economic and technological superpower, Japan would be freer from U.S. influence in technology transfer to the Soviet Union. Japanese technology, transferred to the USSR, could augment Soviet military power. The United States would thus be squeezed between the economic pressure of Tokyo and enhanced military pressure of Moscow.

3. Last but not least, the rise of Japan as an economic and technological superpower would reduce America's power since power is always relative and not only military. U.S. freedom of action and decision-making would be increasingly constrained by Japanese presence and influence in many areas on the globe. Security interests will inevitably be affected, even if Japan remains a basically friendly - yet competitive - power.

What are the implications of the above analysis for U.S. policy with regard to the two regions from which the competitive threat to the United States emanates, Western Europe and Japan?

The competition from Western Europe is essentially economic and much less intense than that from Japan. It can be met essentially by economic means. Under RSI, avenues for cooperation with European NATO allies in defense R&D and production have been opened which offer the United States certain advantages. Perhaps this cooperation could be expanded into certain areas which might help the United States - and Western Europe - to meet the Japanese challenge. At the same time, the competitive position of U.S. companies with regard to their European counterparts needs to be stregthened. Among other things, it might be useful to take a closer look at technology transfer to Western Europe and perhaps slow it down.

As noted earlier, the Japanese challenge is essentially political and it is very doubtful that it could be adequately met by purely economic means. The United States cannot energize its employees into a single-minded pursuit of productivity by such means as the singing of a company anthem. Nor is it likely that U.S. companies will systematically accept the national interest of the United States as overriding the consideration of profit. Conventional economic means are not likely to be adequate in a situation where non-tariff barriers to trade existing in a highly cohesive, nationalistic country are often difficult to identify, let alone to counter.

What seems to be needed to meet the Japanese challenge is a spectrum of mutually supporting economic, technological, and political measures. Economic and technological measures will be discussed at greater length in the following chapter; at this point, just a few general comments will be made.

An internal domestic climate which would strengthen the competitiveness of American companies needs to be developed. To the extent possible, the internal Japanese market should be penetrated; this would help to minimize the practice by Japanese manufacturers of differential prices at home and aborad. In the area of technology, there does not seem to be an alternative to ensuring U.S. preeminence in certain key areas. A serious consideration should be given to a policy in civilian technology somewhat similar to the one the United States has in military technology with regard to the Soviet Union: to maintain a consistent technological margin of safety with regard to Japan.