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THE FUTURE SECURITY ENVIRONMENT

Report of the Future Security Environment Working Group, submitted to the Commission on Integrated Long-Term Strategy

October 1988

20100902303

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The Report of the Commission on Integrated Long-Term Strategy, Discriminate Deterrence, was published in January 1988 and is available for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402 for $6.50.

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COMMISSION ON INTEGRATED LONG-TERM STRATEGY

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The Working Group on the Future Security Environment is pleased to present our report to the Commission on Integrated Long-Term Strategy.

This report is in general consonance with the Commission's report, *Discriminate Deterrence*, which made substantial use of our preliminary findings and conclusions. The Working Group report provides more comprehensive and detailed information in support of the Commission's report. However, the report is the responsibility of its authors and the Commission does not necessarily subscribe to all of its details.

Because a separate working group addressed issues of "low-intensity conflict," this report gives limited attention to smaller regional wars, insurrection, and terrorism.

The members of the working group include Eliot A. Cohen, David F. Epstein, Fritz Ermarth, Lawrence Gershwin, James McCrery, Jeffrey Milstein, James Roche, Thomas Rona, Stephen P. Rosen, Dennis Ross, Notra Trulock, Dov Zakheim, and Barbara Bicksler (rapporteur).

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INTRODUCTION

In the next two decades America's security environment will change as a result of both broad economic, demographic, and military trends visible today, and specific shocks and discontinuities that, at present, can be recognized only as possibilities. Defense planners must attempt to anticipate the future security environment, despite the difficulties of doing so, not only to guide decisions about weapons development and procurement, but also to inform the development of strategy.

An important goal of national strategy is to influence--not simply react to--the future security environment, but that subject is beyond the scope of this report. In order to characterize the environment the U.S. will face, this report does not focus on the ways in which U.S. policies might shape that environment, nor on how developments within the United States might shape our policies. Rather, this report concentrates on external developments and, in particular, on the ways in which the future security environment may be most different from that of the present.

Although the U.S. and other countries can shape the security environment by their objectives and strategies, there are a number of aspects of the situation that none of them can control. Technology, for example, is partly exogenous in its development, not determined by any of the states, although they can influence its evolution by their investment decisions. Nor can states completely control other factors such as economic performance and demographic trends. National policies and alliance relationships might adapt smoothly and gradually to economic and technological changes; or they may at some point shift more rapidly from customary patterns in response to a new situation that has evolved.

This report distinguishes between broad trends on the one hand, and particular shocks and discontinuities on the other. In the first category are economic and demographic trends that can operate gradually over a period of 20 years to significantly alter the relative size or role of different states. Another broadly predictable trend is the coming period of rapid technological change, with all of its economic and military implications. Due to the many uncertainties in such forecasts (as well as the imprecision of knowledge about some important aspects of the world's *current* situation), in several cases this report explores alternative scenarios.

Under shocks and discontinuities, this report groups a number of more discrete events that could take place in the next 20 years that would have a special impact on the security of the United States. These problems cannot be planned for, as they are unpredictable. On the other hand, planners should

consider such possibilities, if only to test strategies to see how robust they would be if some of these plausible shocks and discontinuities occur.

This report summarizes the Working Group's views of the future security environment, and is organized as follows. The first section characterizes major economic, demographic, and technological trends. The second section describes the major changes those trends will probably bring about in the future security environment. The third section presents a number of possible shocks and discontinuities. The final section discusses the major issues that strategic planners ought to focus on, or that need more study in the future.

I. MAJOR TRENDS

It is a reasonable assumption that the security environment of the next 2 decades will differ at least as sharply from the present environment as the present differs from that of the 1960s. Indeed, the next 20 years is likely to be a period of major change. While this report does not claim to predict the future security environment with precision, it does identify some of the broad global trends that will shape the future environment. The aim is to delineate these major trends and to highlight some of the interactions among them. No great precision should be attributed to attempts to quantify some trends. Alternative projections are presented where there is greatest uncertainty.

This section looks at past and future trends in Gross National Products (GNP), demography, and military budgets and capital stocks; trends in the global distribution of military power; and future trends in military-related technology, and their implications as seen by the Soviet military. Technological developments are likely to be one of the major sources of change over the next 20 years.

A. ECONOMIC TRENDS

Economic trends can gradually change the relative military power of different states if they differentially affect the level of military spending and military technology that states are able and willing to support. Moreover, nations that become wealthier and technologically advanced can influence the security environment by exporting weapons or other goods useful for the production or enhancement of weapons; by their foreign aid or investment decisions; and simply by their inherent potential for developing greater military power in the future. The wide variation among policies of different nations means that the link between economic performance and military power is very loose (compare, for example, the current situations of Japan and the Soviet Union); but gradual economic shifts can, over a long period, change the conditions under which security policies are pursued.

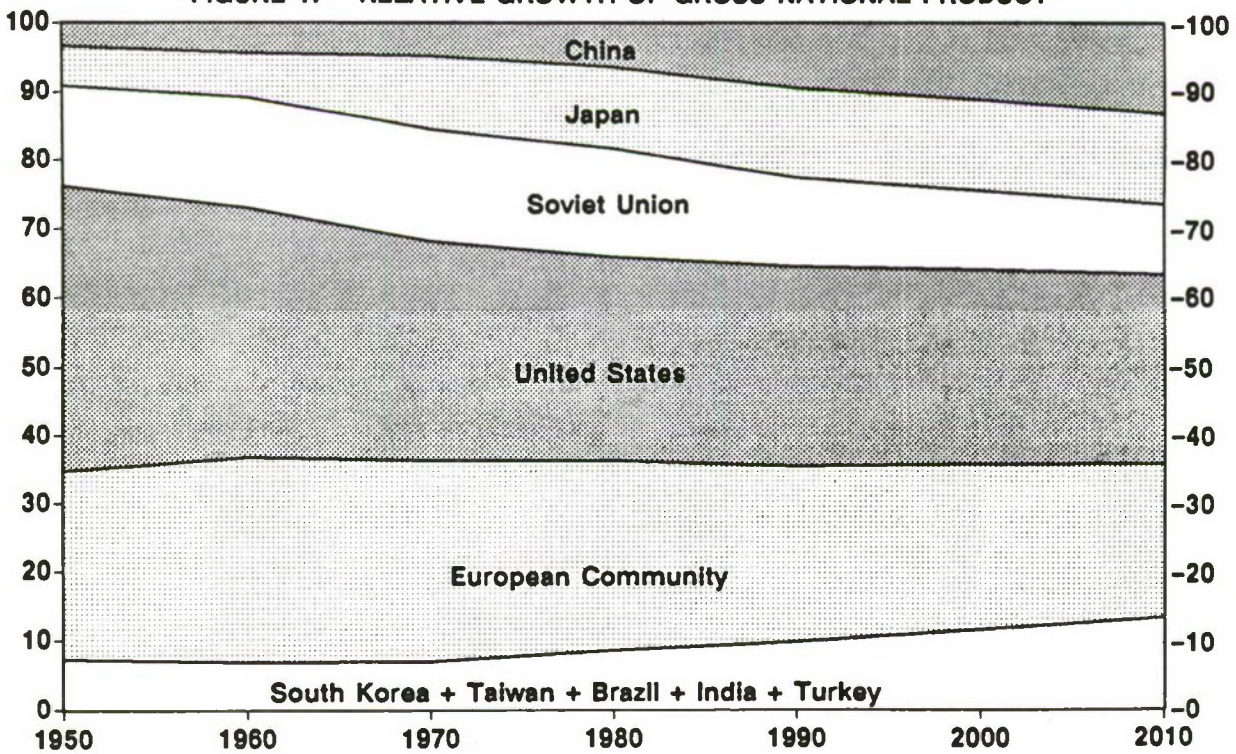
How will the world's distribution of economic capacity differ 20 years from now? To address this question, the Working Group commissioned aggregate economic forecasts for a sample of 15 countries,* including the major current and prospective world economic powers, most of the major current or prospective

* United States, Soviet Union, Japan, China, West Germany, United Kingdom, France, India, South Korea, Taiwan, Brazil, Argentina, Turkey, Mexico, and Egypt. The methodology used in making the GNP estimates is summarized in Appendix A.

regional economic powers, and several potentially fragile economies. The countries included in the sample produce over two-thirds of the global product, and provide some basis for extrapolation to countries not included (e.g., the rest of Western Europe). A simple model was used to derive economic growth from anticipated changes in the labor force, capital stock, and productivity of each country. This procedure results in future trends consistent with estimated economic performance for the 1950-86 period, although the forecasts depend heavily on judgments about trends in investment and especially in the rate of productivity growth. Although these judgments are based on historical data and take into account (but do not predict in detail) cyclical ups and downs, the forecasts assume that there will be no drastic discontinuity in the world economy (e.g., lasting depression triggered by protectionism or a debt crisis—see section III.H). The estimates were done in constant U.S. dollars in order to portray past and likely future shifts in the relative size of the different economies (see Figure 1).

The most striking change projected for the two decades ahead results from the strong relative growth of countries in East Asia. By 2010, the combined national products of four East Asian countries (Japan, China, South Korea, and Taiwan)

FIGURE 1: RELATIVE GROWTH OF GROSS NATIONAL PRODUCT*



* GNP shown as percentage of the total for these countries (about 80% of global GNP in 1986).

will exceed the U.S. GNP (8.5 trillion 1986 dollars vs. 7.9 trillion for the U.S.). These estimates imply that Japan's average annual growth rate over the 1990–2010 period will be about 2.8 percent, China's 4.7 percent, Korea's 4.9 percent, Taiwan's 5.8 percent, and that of the U.S. 2.6 percent.

The projection for Japan is somewhat slower than its recent average annual rate of growth, which has been about 3.7 percent in the 1980s--slightly above that of the United States. While the estimate for Japan, like those for the other countries, is obviously uncertain, the expected slower growth rate is attributable to several principal factors: (1) Demographic changes that are already under way will result in a substantial aging of the Japanese population, and a decline of more than 50 per cent in the ratio between Japan's working population and its retired population; (2) Japan's already visible progress in implementing aspects of the Miyakawa report will tend to increase domestic consumption and reduce rates of savings and capital formation; and (3) Japan's export markets, as well as its domestic market, are likely to experience continually increasing competition from the exports of the newly industrialized countries, especially South Korea, Taiwan, Hong Kong, and Singapore, and later perhaps China as well.

The estimates for China probably entail a wider band of uncertainty than most of the other projections. The uncertainty arises from the difficulty both of establishing a dollar figure for China's current or recent GNP, and of deriving a reasonable estimate of its expected growth over the next 2 decades.

Expressing China's recent GNP in dollars depends on using an appropriate exchange rate to convert data in yuan into dollars; this is especially difficult because of the very different structure and weights of China's production of goods and services from those of the United States. The GNP estimate that results can vary as much as threefold, depending on the particular conversion rate that is selected. This report's estimate of China's recent GNP in dollars employs a purchasing power parity rate, derived as described in Appendix A, to make the conversion from yuan to dollars. In principle, this rate reflects the relative value of yuan and dollars in purchasing the combinations of goods and services produced in both countries. The resulting estimate for China's approximate recent GNP--about 1.2 trillion 1986 dollars--is much higher (and the Working Group believes it to be more reliable) than most other published estimates.*

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* A crude impressionistic check is useful to confirm this conclusion. If one acknowledges that the Chinese are generally living at least at subsistence levels of consumption (a judgment that is readily inferred from observations of living standards in China), and if one further acknowledges that over 80 percent of the Chinese national product is devoted to consumption, and if one adopts U.S. dollar prices in converting this proportion to dollars, then a 1986

The second source of uncertainty relates to the method we have used to estimate China's aggregate growth through 2010. This method, described in Appendix A, results in an estimated average annual growth rate of about 4.7 percent over the next 2 decades, considerably slower than China's recent record and well below the 6–7 percent envisaged by the Chinese themselves for the rest of this century. Of course, whether this report's estimate, let alone the still higher one of the Chinese, is actually realized will depend on many factors not directly included in the Working Group's estimation model--including, especially, the persistence and effectiveness of China's market-oriented reform efforts.

In any event, while this report's resulting estimates place China's GNP in 2010 roughly equal to Japan's (and second only to the United States), China's product *per capita* would remain considerably below that of the other major powers--only about one-tenth as high as that of Japan, West Germany, and the United States, and about one-third that of the Soviet Union (see Figure 4).

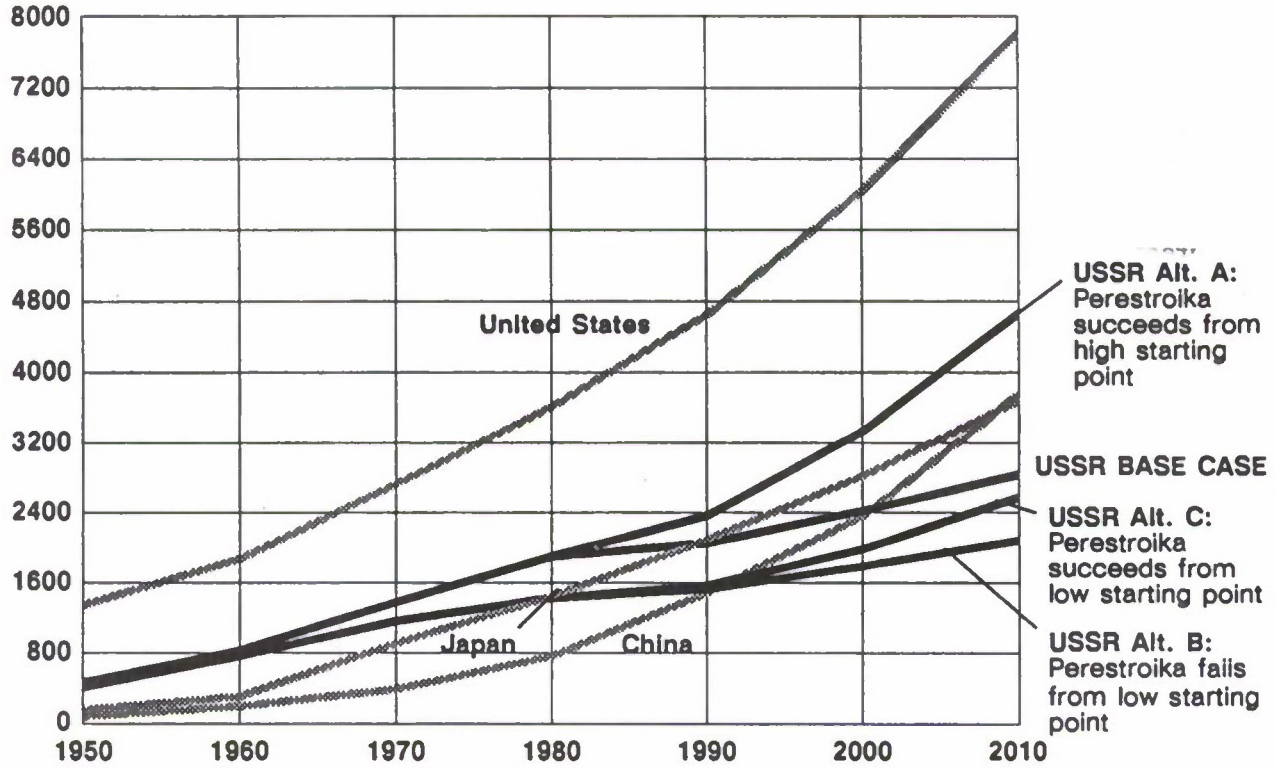
The Soviet Union's GNP, recently surpassed by Japan's, will probably be surpassed by China's as well by the year 2010. Although the relative decline of the Soviet economy may be an important feature of the future security environment, assessment is clouded by several sources of uncertainty. First, there is uncertainty and controversy about the past and present size of the Soviet economy compared to other countries. Estimates of its size range from slightly more than half of U.S. GNP to a third or less of U.S. GNP. Second, Gorbachev's economic reform program is intended to improve Soviet economic performance dramatically, and may (even if unsuccessful) disrupt recent economic patterns. This would make extrapolation from past Soviet productivity trends questionable even if our knowledge of those past trends were not so uncertain.

Alternative projections intended to reflect these uncertainties are depicted in Figure 2. In the base case estimate--which assumes that the Soviet economy today is slightly more than half the size of the U.S. economy, and that it will grow at 1.6 percent annually over the next 20 years--China's national product was about 40 percent of the Soviet Union's product in 1980, but will reach 70 percent of the Soviet level by 1990, and exceed the Soviet level by 2010. A variant estimate, assuming that the current size of the Soviet economy is significantly smaller than the base case asserts, results in China surpassing Soviet

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estimate for China's Gross Domestic Product per capita in the neighborhood of $1,000 is entirely reasonable. Combining this figure with China's population estimates (by the Bureau of the Census and other sources), which vary between 1 billion and 1.15 billion, results in an estimate of China's national product remarkably close to this report's estimates. It is reassuring that the two methods produce such closely consistent results.

FIGURE 2: ALTERNATIVE SOVIET GNP PROJECTIONS

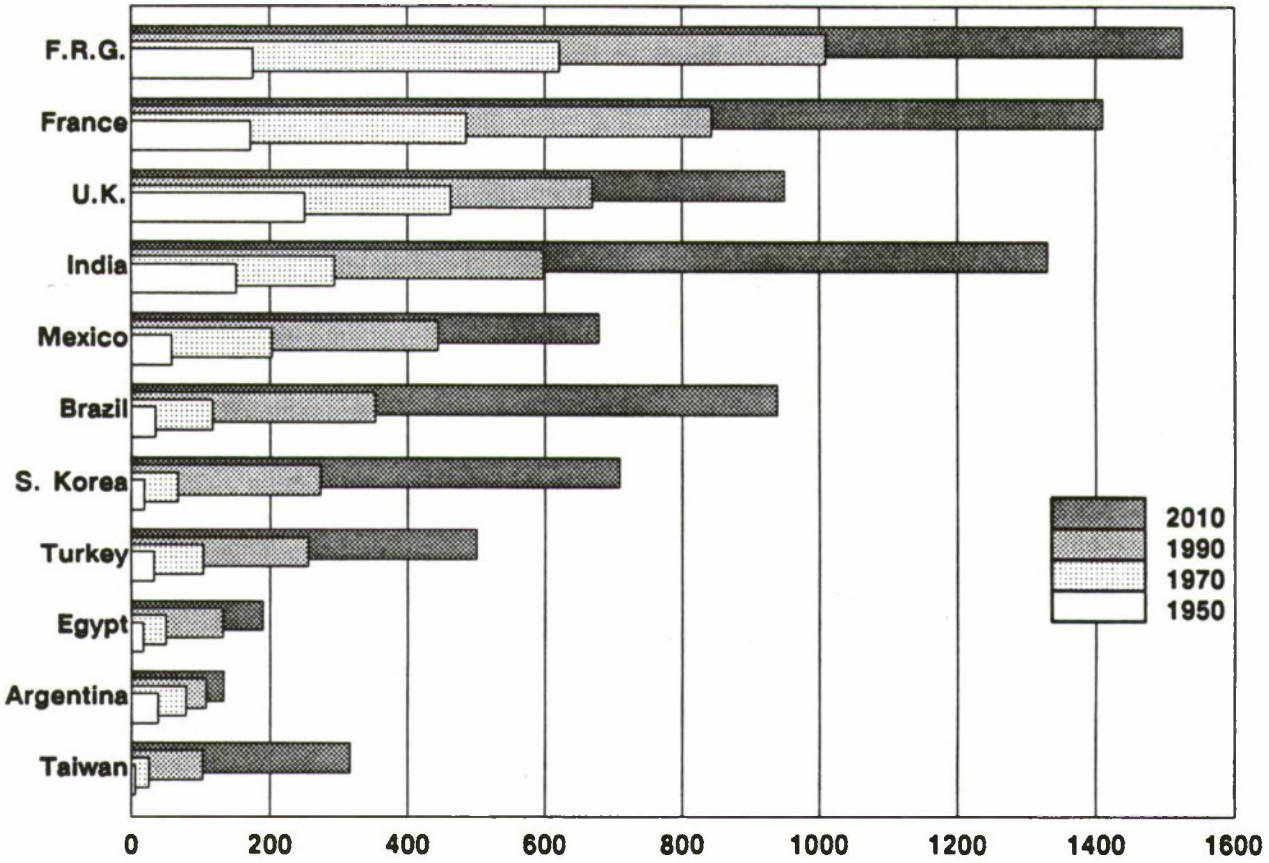


GNP within a few years from now (Alternatives B and C). If, on the other hand, Soviet economic reforms succeed dramatically and if the 1985 level of the Soviet economy is assumed to be relatively high (53 percent of the U.S. GNP), then in 2010 the Soviet economy would be the world's second largest (Alternative A). The alternative projections imply annual growth rates between 1.5 percent and 3.5 percent, associated with different assumptions about the effect of perestroika on Soviet productivity.*

As Figure 1 indicates, the countries of Western Europe in the aggregate will remain a major economic power. By 2010 the combined national products of the European Community countries will probably be more than double the Soviet Union's GNP (the annual growth estimates for 1990–2010 for West Germany, France, and the United Kingdom are 2.1 percent, 2.6 percent, and 1.8 percent, respectively). Whether this wealth will support Western Europe as a major actor

* In the base case, Soviet total factor productivity growth is assumed to be 0.5 percent per year, 1990–2010. Alternative A assumes a rate 3 times as high—i.e., an extraordinary success. Alternative B assumes that no gains in productivity are realized, but increased investment enables the Soviet Union to realize a 1.5 percent growth rate.

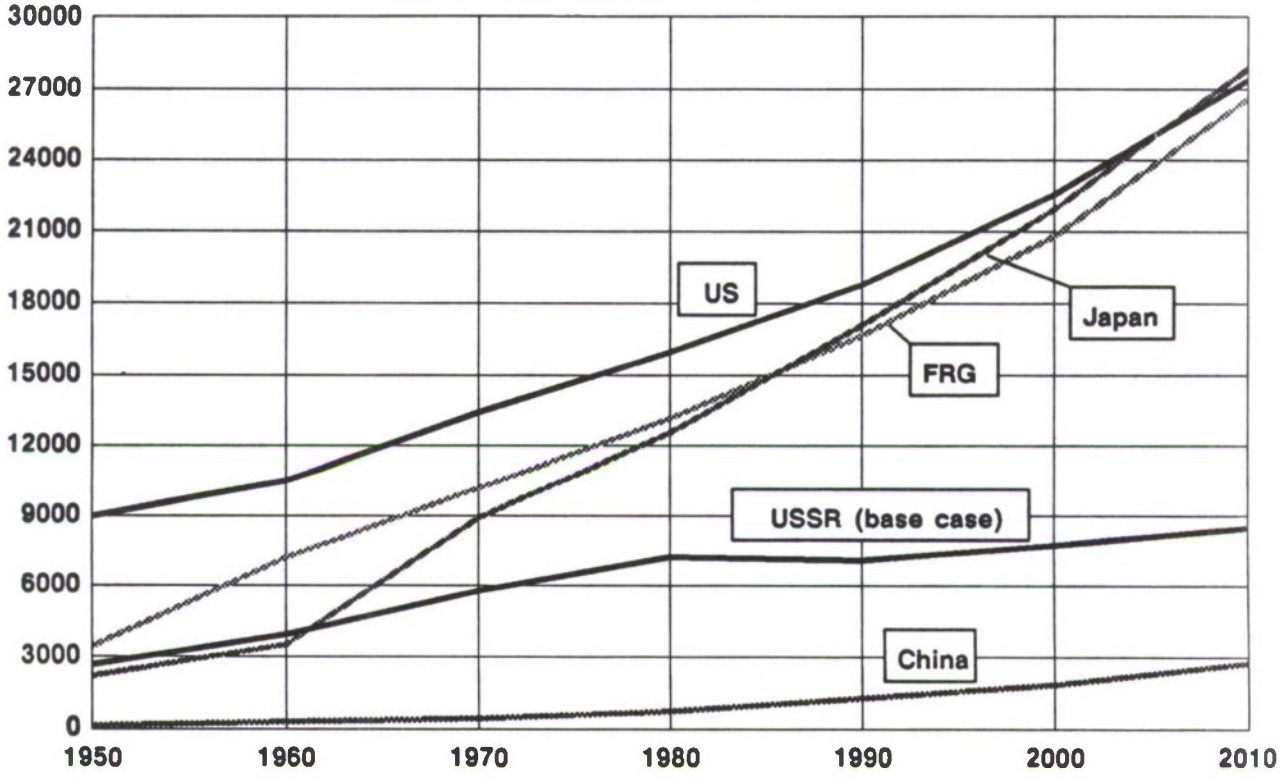
FIGURE 3: GROSS NATIONAL PRODUCTS (Billions of 1986 dollars)



in world politics is another question, and depends upon the degree of political unity that the Western European countries attain. Taken individually, the countries of Western Europe will be joined by a new group of medium-sized powers that will grow substantially relative to the already advanced economies of Western Europe (see Figure 3). For example, our projections suggest that by 2010 India's GNP will approach that of France, and Brazil's will roughly match that of the United Kingdom (the annual growth estimates for 1990–2010 are 4.1 percent for India and 5.0 percent for Brazil).

Taken together with demographic trends, these economic projections imply that the per capita GNPs of Japan and West Germany in 2010 will be as high or higher than that of the U.S., due in part to slow population growth in Japan and to a forecasted decline in West Germany's population (see Figure 4). As noted above, China's per capita GNP in 2010 is projected as about one-tenth of the U.S. level. Per capita GNP in Korea and Taiwan will be about half that in the U.S. and Japan by 2010. On the other hand, rapid population growth in Mexico, Argentina, and Egypt will probably result in stagnation or reductions in per capita GNP.

FIGURE 4: PER CAPITA GROSS NATIONAL PRODUCTS
US, USSR, Japan, China, and West Germany



Note: This figure was drawn incorrectly in "Sources of Change in the Future Security Environment," p. 6.

In sum, several striking and significant changes in the world economy appear likely:

- The rising economic importance of Asia and the Pacific Rim
- The relative economic growth of emerging non-European economic powers relative to those of an already wealthy Western Europe
- The likely further decline in the Soviet Union's share in the international economy
- The marked stability of the relative U.S. economic position in the global context--declining with respect to some of the components, inclining with respect to others.

The relative shrinkage we foresee in the Soviet economy compared to our own does not necessarily imply a diminution of the Soviet threat. As Table 1 indicates, in 1950 the Soviet economy was barely 35 percent the size of ours, and yet the Soviet Union posed a serious threat to our national security. Even if the

Soviet economy shrinks from a 1990 relative size of 45 percent to a 2010 size of 37 per cent, the Soviets will remain formidable competitors for several reasons. First, the Soviets will remain capable of devoting much more of their economy to military purposes than the U.S. does (see section I.D). Second, gross comparisons of GNP do not account for certain asymmetric advantages the Soviets have in the strategic competition--stability of long term planning, secrecy, a more highly integrated strategic decision-making system, etc. Third, under all foreseeable scenarios, the Soviets will continue to have one of the largest defense budgets in the world; even if we do outspend them, they would continue to be, in absolute terms, the other dominant global military power.

TABLE 1: GROSS NATIONAL PRODUCTS OF SELECTED COUNTRIES, 1950-2010*

	1950	1960	1970	1980	1990	2000	2010
United States	1380	1910	2770	3650	4680	6070	7860
Soviet Union	490	860	1410	1940	2090	2460	2870
Japan	190**	340	940	1480	2130	2860	3710
China***	110	230	420	790	1520	2400	3790
West Germany	180	400	620	820	1010	1240	1520
United Kingdom	250	350	460	560	670	810	950
France	170	280	490	700	840	1110	1410
India	150	200	290	410	600	900	1330
South Korea***	18	27	67	150	270	460	710
Taiwan	5	11	25	57	100	180	320
Brazil	34	65	120	270	350	570	940
Argentina	38	51	78	110	110	120	130
Turkey***	32	59	100	170	260	370	500
Mexico	58	100	200	380	440	550	680
Egypt	16	31	49	98	130	160	190

* Billions of 1986 dollars, converted from local currencies using purchasing power parities of 1980. All numbers greater than 100 billion have been rounded to the nearest 10 billion; even this presentation, however, greatly overstates the precision of the estimates, which should be regarded as very general indicators.

** Japanese GNP estimate for 1953.

*** Gross Domestic Product.

B. DEMOGRAPHIC TRENDS

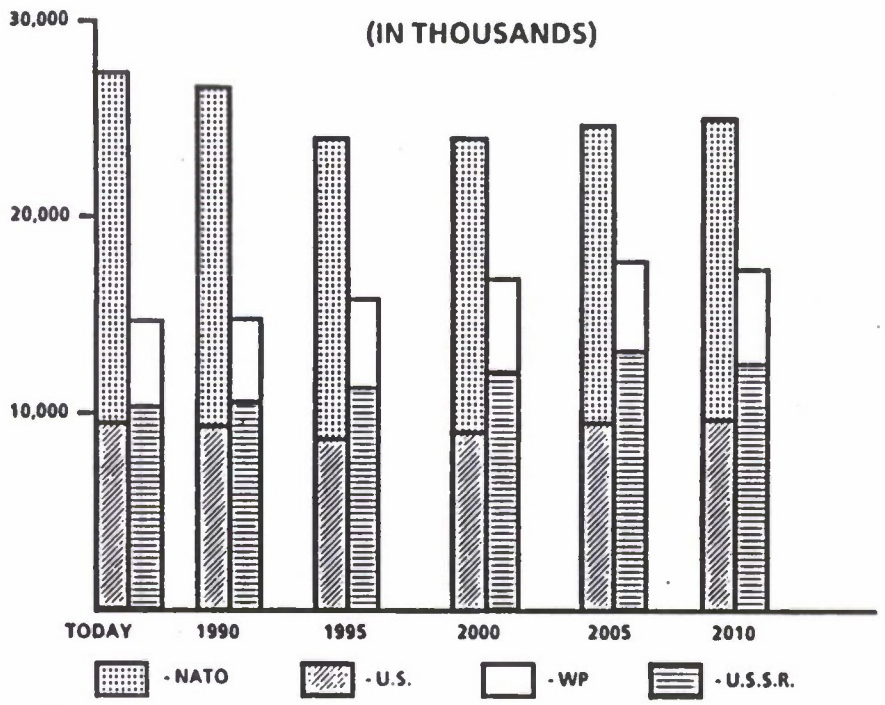
The principal impact of demographic trends on the future security environment arises from differential rates of population growth and differential changes in age structure in the various countries. Medium-range projections can be made fairly confidently; trends for the next 2 to 3 decades are unlikely to be

dramatically interrupted, although the Acquired Immunodeficiency Syndrome (AIDS) epidemic introduces new uncertainties about death rates in some areas of the world. For some rich countries, slow population growth will result in an aging population and constrain the manpower and probably the money available for military purposes. In much of the Third World, rapid population growth is a potential contributor to economic difficulties and political turmoil, although such effects and their impact (if any) on the security environment may vary widely among different countries.

What follows is a limited exploration of likely demographic trends and some of their implications. A good deal more can and should be done to further develop the analysis of demographic effects on the future security environment.

Impact on Military Manpower. Western Europe is where population trends pose the clearest problem for military recruitment. West Germany faces the severest decline in its male military-aged cohort, from 2.6 million today to 1.7 million in 2010. Such trends will encourage more use of women in combat support roles and longer terms of service (already introduced in several European countries). Manpower constraints will make it more difficult for NATO to maintain its current force structure, will make conventional force buildups and reduced reliance on nuclear weapons more difficult and expensive, and perhaps

FIGURE 5: SIZE OF MALE YOUTH POOL (18-22 YEARS)



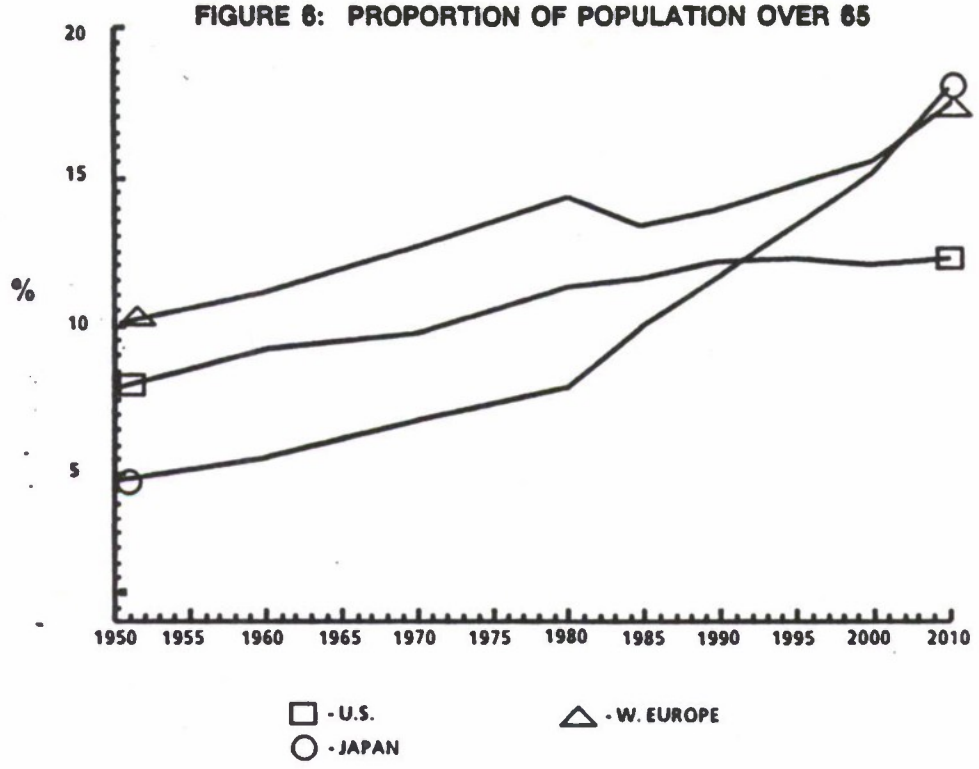
promote labor-saving military technologies. Declining, but still positive, population growth rates will characterize a few countries in the region, such as Ireland, Portugal, and Spain. More significant will be Turkey, where total population will increase some 54 percent and the 18–22 age cohort some 34 percent between now and 2010. An issue for NATO is whether an expanded role for Portuguese, Spanish, and Turkish troops would be feasible.

For the U.S. and the Soviet Union, military manpower pools are projected to be somewhat constrained in the near term. This will probably impose some costs on the U.S. defense budget (to pay the price of attracting volunteers) and on the Soviet economy (where, for example, military needs may divert increasingly scarce manpower from advanced education). But the shrinking military-age youth cohort in the U.S. will rebound before the turn of the century and reach current levels again by 2010. The Soviet Union's pool of 18-year-old males, after having fallen from 2.6 million in 1979 to 2.1 million in 1985, now appears to be increasing. The ethnic composition of the Soviet military pool will continue to shift away from the Russian nationality. Low fertility and a relatively high death rate will reduce the Russian share of total population from 52 percent in 1980 to 46 percent in 2010. Among potential military draftees, in 1980 16 percent of 18-year-old males were in Central Asian republics, whereas by 2010 that share is projected to be 26 percent. The proportion of Central Asians in the conscription cohort may be higher than these figures suggest, especially if Russians and other Slavs are more successful in avoiding or delaying military service. Past Soviet military experience and policies make it clear that this ethnic mix is seen as a problem. Non-Russian nationalities have generally been consigned to less sensitive positions in the Soviet military, owing to Soviet concerns about Russian-language proficiency, political reliability, and inter-ethnic hostility. Agreements to reduce conventional forces might be encouraged by Europe's reduced manpower pool, and the Soviet Union's reduced pool of Great Russians.

Impact on Social Welfare Budgets. In most countries, the decline of fertility rates and increases in life expectancy since 1950 have resulted in an aging of the population that will continue for the next 50 years. The situation is especially pronounced in the developed world, where the median age by the year 2025 will be almost 39 (compared to about 30 in the Third World as a whole, and appreciably lower in Africa).

High retiree-to-worker ratios and associated increases in taxes and social security expenditures will occur particularly in NATO countries and Japan, which have sizable welfare spending programs. Aging trends are shown in Figure 6. In Western Europe, the proportion of the population over 65 and related welfare spending levels are both higher than in the United States. Pensions and medical

FIGURE 6: PROPORTION OF POPULATION OVER 65



insurance account for about two-thirds of West Germany's total welfare spending, which itself now consumes about one-third of the nation's total economic output. West Germany now has 4 times as many workers as retirees; unless the retirement age is raised, by 2010 the ratio will be 3:1. In Japan, the ratio of workers to retirees is projected to decrease from more than 7:1 in 1980 to 3:1 by 2010. These figures may understate the impending shift, as they assume a fixed retirement age, whereas in the developed countries the average retirement age has declined in recent years, and may continue to decline.

Impact on Political Stability. The effects on security issues of rapid population growth in Third World countries are difficult to specify. Governments will vary in the extent to which their authority and policies successfully manage (or aggravate) the challenges that demographic trends pose. In the recent past, countries manifesting political instability (e.g., Iran, Nicaragua, El Salvador, and the Philippines) have been among the countries with the highest rates of population growth. Potential problems include the following:

- Urbanization (see Table 2). In 1950, 29 percent of total world population lived in urban areas. By 1985, that figure had risen to 42 percent, and by 2000 it will be nearly 50 percent. Problems of housing, sanitation, and pollution typically accompany this trend, which will be most

TABLE 2: THE WORLD'S TEN LARGEST CITIES
(population in millions)

	1950		1975		2000	
1.	New York	12.3	New York	19.8	Mexico City	31.0
2.	London	10.4	Tokyo	17.7	Sao Paulo	25.8
3.	Rhine–Ruhr	6.9	Mexico City	11.9	Tokyo	24.2
4.	Tokyo	6.7	Shanghai	11.6	New York	22.8
5.	Shanghai	5.8	Los Angeles	10.8	Shanghai	22.7
6.	Paris	5.5	Sao Paulo	10.7	Peking	19.9
7.	Buenos Aires	5.3	London	10.4	Rio de Janeiro	19.0
8.	Chicago	4.9	Buenos Aires	9.3	Bombay	17.1
9.	Moscow	4.8	Rhine–Ruhr	9.3	Calcutta	16.7
10.	Calcutta	4.4	Paris	9.2	Djakarta	16.6

SOURCE: C. Sunter, *The World and South Africa in the 1990s*, p. 24.

pronounced in Latin America (75 percent urban by 2010) and the Middle East (73 percent urban by 2010). Political uncertainties are introduced where migration to large cities disrupts traditional social and family ties, juxtaposes diverse ethnic groups, and makes the poor more immediately aware of vast economic inequalities. Burgeoning populations of capital cities built for far smaller numbers of inhabitants may create major administrative and control problems. For example, Cairo's population, 2 million in 1950, is now about 8 million; by 2010, its population may reach or exceed 20 million.*

- Unemployment. 600 million new jobs will be needed in less developed countries by the year 2000 just to employ persons already born and soon to enter the work force. Latin America, for example, must create about 4 million jobs a year for the remainder of this decade and well into the 21st century just to provide employment for young persons entering the job market for the first time. An estimated 40 percent of the working age population in that region is either unemployed or underemployed. Aggregate population growth

* It should be noted that urbanization projections are considerably more uncertain than total population projections, as new circumstances (including the effects of urban growth that has already taken place) can substantially disrupt trends.

rates will probably result in per capita GNP that stagnates or declines in Mexico, Argentina, and Egypt. Among other problems, automatic manufacturing techniques may continue to decrease the comparative advantages of cheap labor, and thereby deprive underdeveloped states of a path to economic growth and stability.

- Migration. Extensive migration is likely where low growth areas are near high growth areas (e.g., the Caribbean Basin to the U.S., and the Middle East/North Africa to Europe). During the period 1980–85, net immigration represented over 28 percent of total population growth in the United States, the highest rate in this country since the 1901–10 period. Western Europe had as many as 16 million legal immigrants resident in 1986. Despite the recent institution of more stringent controls by European governments, future below-replacement fertility rates may accentuate tensions of the kind already seen between native-born citizens and South Asians in Great Britain, North Africans in France, and Turks in West Germany. Similar tensions may emerge in the Middle East if immigration continues from culturally dissimilar areas (India, Pakistan, South Korea, and the Philippines).

More generally, greatly different demographic rates of growth in adjoining regions may lead to regional tensions, but do not seem to be direct causes of war. Ethnic differences and related historical enmities are a major source of conflict and warfare, but differential rates of growth are less clearly so. Nonetheless, France, Italy, and Spain are likely to focus increasing attention southward across the Mediterranean to the North African littoral as their security environment in that sector is perceived to change. The French are already concerned and parts of their population uneasy. Their projections of the growth in population in North Africa and its age composition increasingly preoccupy them. The problems anticipated are not well specified; they do not take the form of major military conflict, but are nonetheless likely to divert military resources increasingly to the Mediterranean. They will, perhaps, increase political tensions between France and the North African states.

The implications of demographic trends for the military and political situation between Western Europe and North Africa on the one hand, and between Western Europe and the Soviet bloc on the other, deserve much deeper study.

This has been an undeveloped area of analysis; undoubtedly, much improvement is possible.

C. AIDS

AIDS is a serious public health problem in the United States and is potentially catastrophic in several central African countries. Significant uncertainties exist about the Human Immunodeficiency Virus (HIV), but some possible effects of an HIV epidemic on the security environment deserve consideration.

Through October 1988 approximately 75,000 people in the United States and an equal or larger number outside the U.S. have been diagnosed with AIDS. Infection with HIV can precede the illness by many years, making it difficult to infer how many people are now infected or how fast HIV infection is spreading. As many as 10 million people are thought to be infected worldwide; the Center for Disease Control (CDC) currently estimates that 1 to 1.5 million Americans are infected.

Reflecting the initial pattern of infection, clinical illness in the U.S. is concentrated among intraveneous drug abusers, homosexual men, and their female sexual partners. Children of infected women constitute a growing group of infected persons. Black males (6:1) and Hispanic males (3:1) are disproportionately represented in the infected pool. Virtually every infected person becomes ill (of those infected in any given year, approximately 6 percent become ill each year after the first 2 years), and death inevitably follows symptoms. No scientific group is predicting the development of a vaccine, and the development of therapeutic drugs is (while probable) unpredictable.

CDC and the U.S. Public Health Service have been reluctant to project HIV infection or clinical AIDS beyond a 5-year period. Their last projection, for 1992, was for 80,000 new AIDS cases and 66,000 deaths in that year. The most recent and persuasive mathematical description of the spread of the epidemic* indicates that both new HIV infection and new clinical AIDS in a given year are a quadratic function of time, and that cumulative AIDS cases since 1981 have grown as the cube of time.** This leads to an estimate of 200,000 cumulative AIDS cases by 1992, 500,000 by 1995, and over 1 million by the year 2000. Uncertainties about the nature of the virus, the effect of public education, and

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* "A Behavior Based Model of the Initial Growth of AIDS in the United States," Los Alamos National Laboratory, 1988.

** $A = 174.6 \times (T - 1981.2)^3 + 340$, where A is the cumulative total of AIDS cases to date, T is the year.

the possible advances in immunology and pharmacology prevent confident projection beyond the early 1990s (i.e., beyond the period in which those already infected form the bulk of new AIDS cases).

While infection and illness of this magnitude create a serious public health problem, they do not portend an unmanageable supply problem for U.S. military manpower during the next decade. Current seroprevalance rates among applicants to the armed forces (1.5/1000 for males, 0.8/1000 for females) continue virtually unchanged since applicant testing began 2 years ago. Even with a four or five fold increase in seropositivity, continued screening will permit induction of an uninfected force throughout the next decade. U.S. military programs may be more affected by competition for funding, as increasing funds are devoted to AIDS research, public education, and health care. U.S. expenditures for AIDS health care alone will increase to about $8 billion annually by 1995 and to about $14 billion annually by 2000.* Some portion of these costs will be borne by the Federal government.

There is little accurate data on the extent of HIV infection and AIDS in most foreign countries. Central Africa is already heavily affected by AIDS. Genetics has not been proven to play a role in the epidemic, and the adverse social and medical conditions necessary for epidemic spread seem to exist in Latin America and South Asia. Countries in the Caribbean, northern Latin America, and Thailand are experiencing rapid increases in the number of cases.

In Central Africa, the disease has been disproportionately concentrated in elites and managerial groups. Public health expenditures in African countries are miniscule. Testing is not likely to keep up with the emergence of new strains of the virus, and control and educational efforts are less likely to be initiated. Given the dearth of trained people in most of the African societies, the projected early morbidity and early demise of the managerial and political elite suggest that a significant degree of political and economic instability in Central Africa may arise in the next 5 years.

Even with increased education, testing, and control measures, we must assume that worldwide HIV infection will continue to spread roughly as it is doing in the United States. This persistent spread will heighten already evident national concerns about infection by foreign visitors and, consequently, will increase the difficulty any nation has in deploying and maintaining military forces abroad.

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* Assuming $35,000 per year per case. The number of cases is projected using the Los Alamos model cited above, and results in a large downward revision from the cost projection offered in our earlier report, "Sources of Change in the Future Security Environment," p. 11. For comparison, total U.S. expenditure on health care totals $300–400 billion.

There will also be new financial and social costs associated with managing troops overseas and with bringing them home from areas of high HIV prevalence.* The U.S. policy of regularly testing all military personnel for HIV may ameliorate but will not eliminate these foreign or U.S. anxieties.

The uncertainties and morbidity associated with the HIV epidemic may affect public attitudes in ways hard to predict. The data described above imply that U.S. mortality rates will double, and the new deaths will be among the young. Africa, Latin America, and the U.S.S.R. have experienced the tragedy of deaths among the young on this scale, but we have not. A more wary or gloomy public mood may form the context within which national security issues are discussed.

D. MILITARY BUDGETS AND MILITARY CAPITAL STOCKS

One important effect of economic changes on the security environment is their possible impact on the relative military spending of different countries. Shifts in military spending can have immediate effects on readiness and manpower. More enduring, and also more gradual, are shifts in the balance of tangible military assets possessed by different countries. Spending devoted to weapons procurement, the construction of military installations, or military research and development constitutes an investment in the "military capital stock" that supports military capability for many years into the future. In order to suggest the broad direction and rate of change of the balance of military power, estimates were made of such a military capital stock for 15 countries for the years 1950 to 2010.** No such summary measure can give a complete picture of relative military power. For one thing, the estimates neglect intangible military assets such as the quality of training, morale, command, and tactics. Also, the estimates of military capital stock indicate only the general magnitude of tangible military assets, not the particular characteristics and functions of those assets that would be important in war, and that would vary widely in importance depending on the type and context of particular conflicts. Above all, any general assumption about the rate at which military stocks depreciate is inaccurate to the extent that some countries exploit technological innovations that more quickly make other countries' military stocks relatively obsolete. Impending changes in military technology may make this factor of competitively accelerated obsolescence particularly important in the next 2 decades.

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* Cuban policy (per a Cuban officer defector) is to retain infected troops in Africa.

** Due to data limitations, procurement and construction expenditures, but not research and development expenditures, formed the basis of the military capital stock estimates. See Appendix A for a discussion of the methods and data sources used in the military capital estimates.

The estimates below of military capital stock should be considered as very rough approximations--even of the historical data, and especially of the future trends. The estimates depend on information or judgments concerning past defense expenditures, the present and likely future share of GNP devoted to defense, the future growth rate of GNP (see section I.A), the share of defense spending devoted to military investment, and the rate of depreciation of military assets. For purposes of international comparison, all figures were converted to 1986 dollars. Where more precise information was unavailable, military spending figures in domestic currencies were converted to dollars using the same ratio as was used to convert Gross National Product to dollars.*

U.S. military spending has recently reached levels roughly equal to estimated Soviet military spending, although the Soviet military capital stock remains larger due to a protracted period of higher Soviet military investment. Over the next 20 years, if both countries continued to devote the share of GNP to the military that they now do, and if U.S. GNP grows faster than Soviet GNP, U.S. military spending, and later military capital stock, would reach and exceed Soviet levels. But great uncertainties surround both the U.S. and Soviet figures. For the last several years, U.S. defense authorizations have lagged considerably behind GNP growth, while for the Soviet Union the range of economic possibilities described implies a variety of military spending scenarios.

Figure 7 and Table 3 present alternative projections for the U.S. and Soviet Union. For the U.S., the case that now appears most likely is for defense spending growth to average about 1 percent per year; this would cause the defense share of GNP to fall from 6.2 percent in 1988 to 5.1 percent in 2000 and 4.3 percent in 2010. A high alternative shows defense spending growth roughly keeping pace with the projected 2.6 percent annual growth of GNP, while a low

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* For the period from the present to 2010, the spending estimates are linked to the prior estimate of GNPs through parameters relating to each country's military burden (the ratio of military spending to national product). These burden parameters were derived from historical and recent experience in each of the 15 countries, combined with explicit judgments about how the parameters may in the future diverge from historical experience. The estimates of military capital stocks are based on two very rough, order-of-magnitude methods, applied to different countries depending on data availability. One method begins by indexing each country's military capital stock in 1980 on the military capital stock of the U.S. and other countries in that year. Military capital estimates for earlier years were then derived by subtracting from the 1980 estimates each prior year's military investment and adding each prior year's imputed depreciation. The second method builds the capital stock figures forward from 1950 by linking these to the military spending estimates discussed above. In both methods, military capital estimates for the period from the 1980s through 2010 were derived by adding new military investment, as a share of total military spending, and subtracting depreciation from the annual capital stock figures.

FIGURE 7: MILITARY SPENDING, 1950–2010 (billions of 1986 dollars)

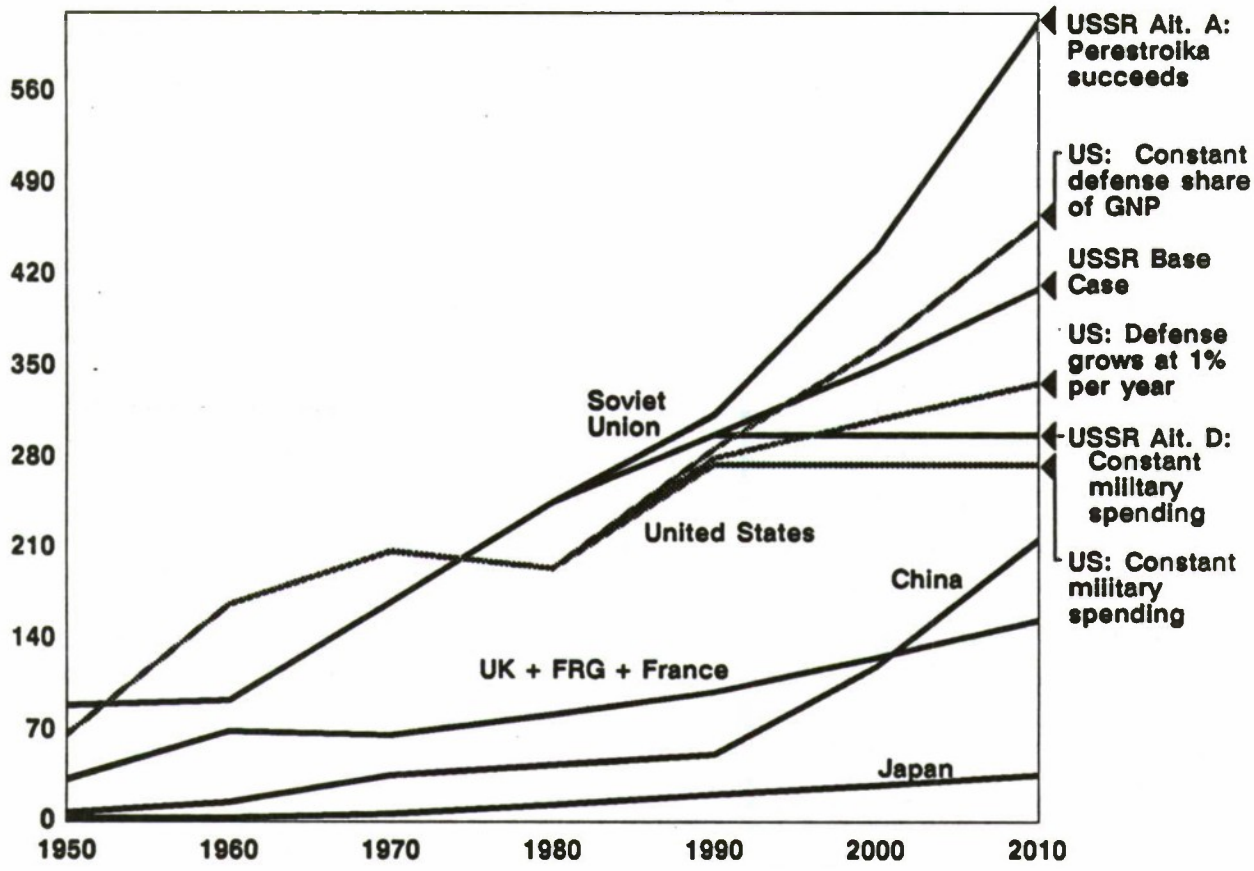


TABLE 3: U.S. AND SOVIET MILITARY SPENDING, ALTERNATIVE CASES
(Billions of 1986 dollars)

	1990	2000	2010
Soviet Union			
Base Case (defense share of GNP constant, GNP grows at 1.6% 1990–2010)	300	350	410
Alt. A (Perestroika succeeds, GNP grows at 3.4% 1990–2010, defense share constant)	310	440	620
Alt. D (Constant military spending 1990–2010)	300	300	300
United States			
Base Case (1% annual growth military spending)	280	310	340
Alt. 1 (Constant military spending)	280	280	280
Alt. 2 (Constant military share of GNP)	290	360	460

alternative depicts a constant level of real military spending (with the defense share of GNP dropping to 3.5 percent in 2010). For the Soviet Union, the base case estimate assumes that military spending grows in tandem with Soviet GNP (which itself grows at the base case rate of 1.6 percent per year discussed in section I.A). Alternative A assumes that Soviet economic growth is much more rapid (3.4 percent per year), and that defense grows at the same rate as the economy. Alternative D shows Soviet military spending remaining flat over the next 2 decades.*

Even sluggish Soviet economic growth, with defense spending maintaining its share of Soviet output, is sufficient to sustain Soviet defense spending higher than U.S. levels if U.S. defense spending grows slowly. If Soviet economic reforms result in sharply raised productivity, and if Soviet military spending remains about as large a share of Soviet national product as it has been, constant or slowly growing U.S. military spending would be between 30 and 50 percent below that of the Soviet Union by 2010. On the other hand, perestroika's failure, with defense spending constrained to match the low GNP growth rate, or a trend of flat defense spending (perhaps imposed for the sake of economic improvement, whether that improvement results in fact or not) would result in defense spending closer to the constrained U.S. cases.

Similar comparisons of U.S. and Soviet military capital stocks are presented in Figure 8 and Table 4. In 2010, the base case Soviet military capital stock estimate remains above U.S. military capital stock if U.S. defense spending grows slowly, but would be surpassed by U.S. stocks if U.S. defense spending grew as fast as GNP. Constant military spending on both sides would result in military capital stocks roughly even by 2010.

The projections for China are based on an assessment that current and recent policies of restraining military spending during a period of agricultural, industrial, and technological modernization will be followed over the next 2 decades by a major military modernization program. If Chinese defense spending reaches 6 percent of GNP in 2010 (compared to about 3.5 percent today, and compared

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* All cases assume the same *current* level of Soviet defense spending measured in dollars. The share of Soviet GNP this represents in dollars differs in the various cases in accordance with alternative assumptions about the size of Soviet GNP measured in dollars. Although the defense share of GNP measured in rubles could in theory be unaffected by a revaluation of GNP in dollars, the alternative cases presented here for the defense share of GNP in dollars correspond to (and, if anything, cover a narrower range than) a plausible range of estimates of the defense share of Soviet GNP measured at internal resource costs. Separate military spending estimates for Alternatives B and C (see section I.A) are not included because they fall within the range of estimates for Alternatives A and D.

FIGURE 8: MILITARY CAPITAL STOCKS, U.S. AND SOVIET ALTERNATIVES
(Billions of 1986 Dollars)

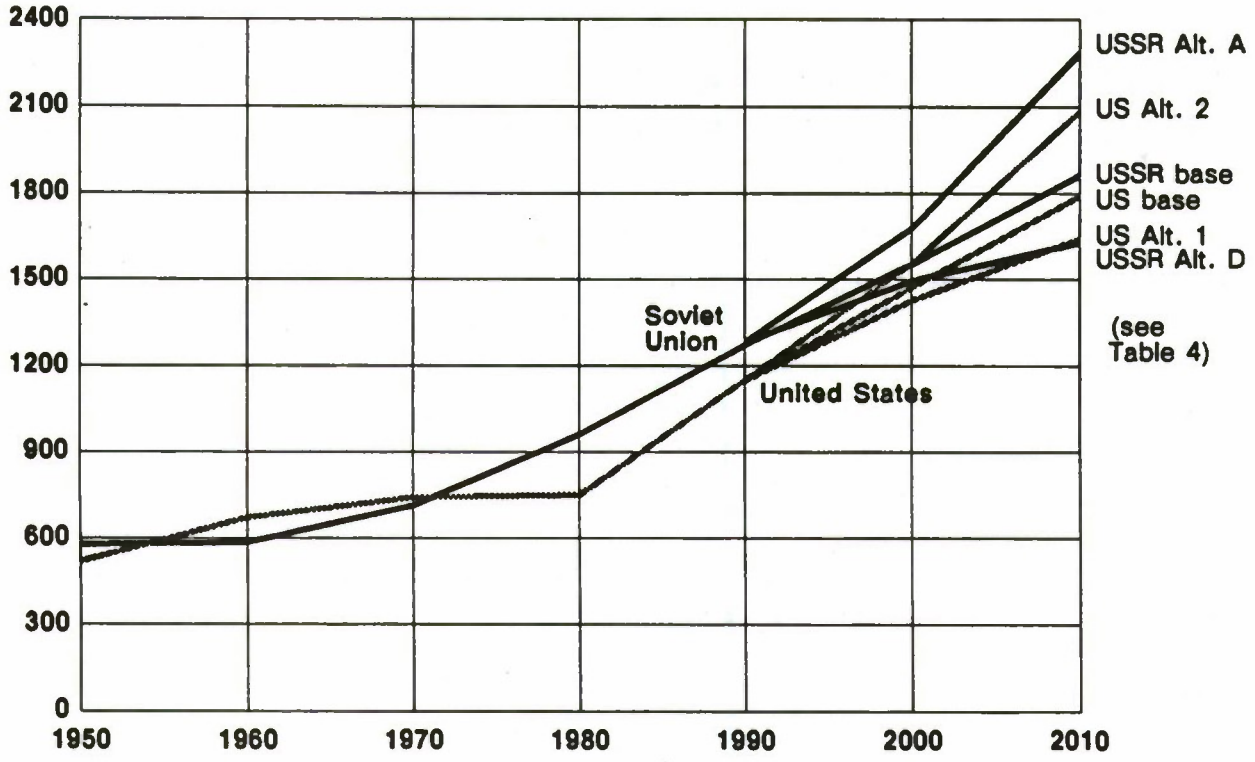
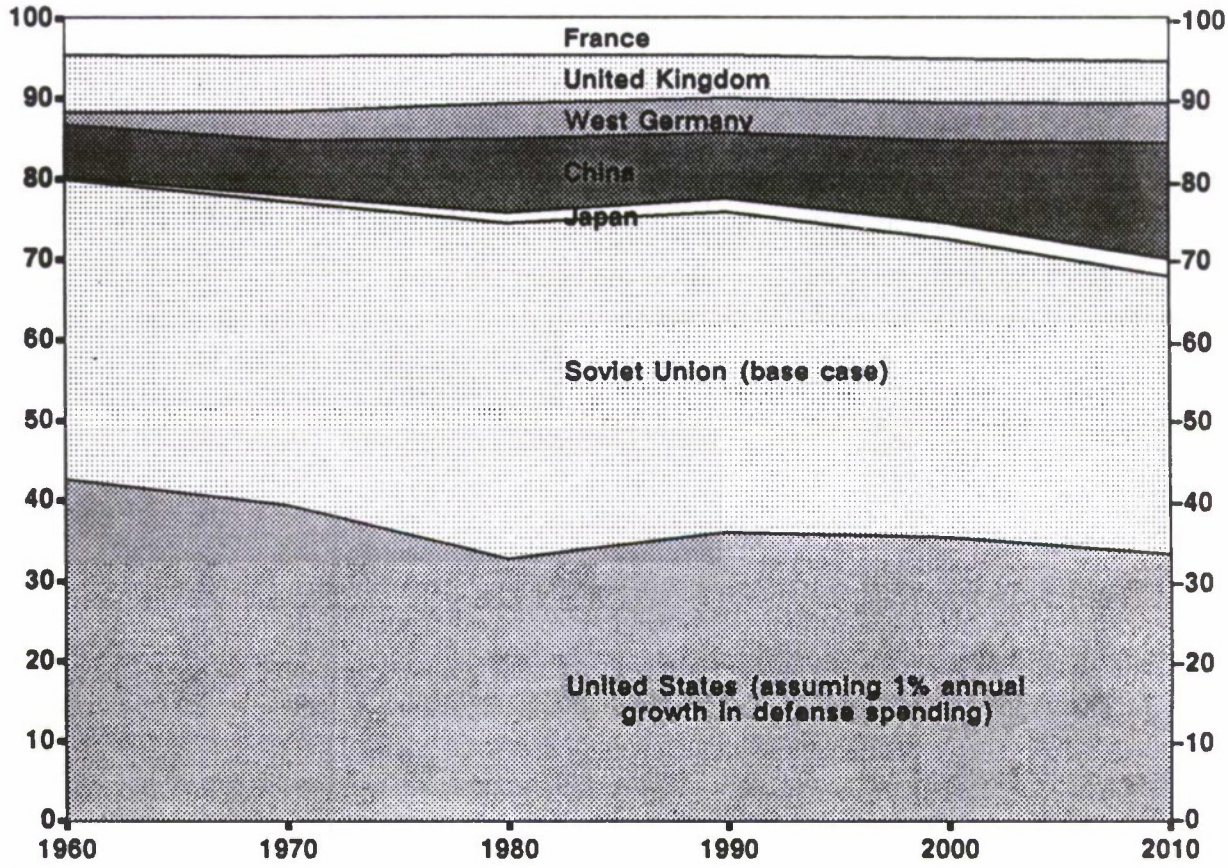


TABLE 4: ALTERNATIVE U.S. AND SOVIET MILITARY CAPITAL STOCKS, 1985–2010
(Billions of 1986 dollars)

	1990	2000	2010
Soviet Union			
Base Case (GNP and defense grow at 1.6% per year 1990–2010)	1280	1560	1870
Alt. A (Perestroika succeeds, GNP and defense grow at 3.5%)	1290	1690	2290
Alt. D (Constant military spending 1990–2010)	1280	1500	1630
United States			
Base Case (1% annual growth military spending)	1160	1480	1800
Alt. 1 (Constant military spending)	1150	1430	1650
Alt. 2 (Constant military share of GNP)	1160	1560	2090

FIGURE 9: MILITARY CAPITAL STOCK, SHARE OF SEVEN-COUNTRY TOTAL



to the roughly 6 to 9 percent of GNP it was in the 1970s), it will be more than 50 percent of the Soviet (base case) estimate, as compared to less than 20 percent today. Chinese military capital stock would remain substantially smaller than the Soviet stock, but the direction of change would be clear (rising from about 20 percent of the Soviet stock currently to about 40 percent by 2010). Repercussions from increased Chinese military spending might ensue elsewhere in Asia, especially in Japan and perhaps India, but these possibilities are not reflected in Tables 5 and 6.

The Western European countries are projected to maintain roughly the position they now have relative to U.S. and Soviet military spending and military capital stocks (see Figure 9). Defense spending by Japan remains small relative to that of the U.S. and the Soviet Union. Nevertheless, because of the expansion and size of its economy, even a relatively small defense burden results in a rising real level of Japanese defense spending, which, toward the end of the century, approaches the spending levels of each of our principal West European allies. If, in response to increased military efforts by China or for other reasons, Japan

were to boost its share of GNP devoted to defense to, say, 3 percent, the effects would be significant: by 1990, Japan's military spending would be over 60 percent as large as the combined military spending of the United Kingdom, West Germany, and France, and by 2000, the Japanese figure would be nearly 70 percent of their combined military spending. By 2010, Japanese military capital would reach $321 billion, about 24 percent above that of West Germany. Under these assumptions, Japan's actual margin would probably be appreciably higher because of the effect of technological change in accelerating obsolescence of prior accumulations of military capital.

Although the military capital of a number of emerging regional powers (South Korea, Taiwan, Turkey, India, Brazil, Egypt) remains quite small relative to that of the larger powers, it represents a formidable stock of weapons, very likely including advanced systems, during the rest of this century and in the beginning of the 21st century. Along with increases in their military capital stocks, as well as the growth of their economies and their technological sophistication, these developing countries will acquire a growing capacity to produce and export a wide range of weapons, featuring all but the most advanced technologies. One indication of this trend is the developing countries' increased share of the $30–40 billion annual level of world arms exports: from 2 percent in 1973 to 11 percent in 1983. For these countries, not the growth in size of military capital but the proliferation of the technical capacity to produce modern military capital, is likely to be the most important development over the next several decades (see section II.C).

TABLE 5: ANNUAL MILITARY SPENDING BY SELECTED COUNTRIES, 1950–2010*

	1950	1960	1970	1980	1990	2000	2010
United States	69	168	210	200	280	310	340
Soviet Union	91	95	170	250	300	350	410
Japan	4	4	7	14	22	29	37
China	8	16	37	45	53	120	220
West Germany	0	20	21	27	32	40	49
United Kingdom	23	29	26	29	35	42	50
France	11	22	21	28	34	45	57
India	2	4	9	12	24	36	53
South Korea	1	1	1	5	9	15	23
Taiwan	1	1	2	3	6	11	19
Brazil	1	1	3	1	3	4	7
Argentina	1	1	2	3	3	3	3
Turkey	2	3	5	8	12	17	23
Mexico	0	1	1	2	2	3	3
Egypt	1	2	9	7	9	11	13

* Billions of 1986 dollars converted from local currencies using 1980 purchasing power parities. All numbers greater than 100 billion have been rounded to the nearest 10 billion; even this presentation, however, greatly overstates the precision of the estimates, which should be regarded as very general indicators.

TABLE 6: MILITARY CAPITAL STOCKS (WEAPONS AND STRUCTURES) OF SELECTED COUNTRIES, 1950–2010*

	1950	1960	1970	1980	1990	2000	2010
United States	520	680	750	760	1160	1480	1800
Soviet Union	580	590	720	960	1280	1560	1870
Japan	0	6	15	31	55	82	120
China	110	100	130	210	240	390	780
West Germany		24	68	100	140	200	260
United Kingdom	78	110	130	140	170	230	280
France	52	74	91	110	150	220	290
India	8	9	15	21	42	81	130
South Korea	1	1	2	15	37	75	130
Taiwan	3	4	6	10	15	24	40
Brazil	7	6	8	9	10	12	18
Argentina	7	7	7	8	11	12	14
Turkey	5	8	12	23	33	48	68
Mexico	5	4	5	6	8	10	12
Egypt	18	14	17	37	39	44	51

* Billions of 1986 dollars converted from local currencies using 1980 purchasing power parities. See note to Table 5.

E. TECHNOLOGY

Over the next 20 years, probable revolutionary improvements in several families of military technology could fundamentally change the nature of warfare. That assessment is given particular emphasis in Soviet military writings about impending developments. Several new technologies now under development or in early use—in particular, long-range surveillance, target acquisition, and weapon delivery systems, and low-observables aircraft and missiles—will be gradually integrated into force structure and doctrine, at a pace depending on policy choices and resource constraints. At the same time, several additional families of technologies will be in earlier stages of development, and may emerge in deployed systems toward the end of the 20-year period. These later technologies may include directed energy weapons (including high-powered microwave), autonomous smart weapons, new families of explosives, earth-penetrating sensors and weapons, new biological agents, brilliant information processing, and advanced robotics.

The rapid pace of technological innovation in recent decades will probably be sustained through 2010 and may well accelerate. Since the final months of World War II, the pace of technological progress has increased rapidly in comparison with all preceding centuries. For example, the first electronic digital computer, ENIAC, began operating on a regular basis in 1946. In the 4 decades since, there has been a millionfold increase in the speed-density product of electronic computing components, and at least another thousandfold increase is expected by the year 2000. Superconductivity, advanced materials, and robotic manufacturing techniques are other areas in which similar trends may emerge by the turn of the century.*

The Working Group believes that the Soviets are correct in their assessment that the advent of new technologies will revolutionize war, and not merely make current forces marginally better at what they do. In the same way that long-range rifles and railroads transformed combat in the mid 19th century (and tanks and aircraft did in the mid 20th century), the new technologies will profoundly alter tactical requirements, operational possibilities, and even, in some cases, strategic choice in the early 21st century. New theaters of strategic concern—space, most notably—will open up, and previously discarded options

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* There will undoubtedly be significant technological innovations before 2010 that we will fail to predict, as well as unanticipated effects of innovations we do predict. The microelectronics revolution of the 1960s and 1970s was not widely foreseen in the 1950s; and although Soviet deployment of quieter nuclear submarines was foreseen well in advance, its implications are only now being fully understood.

(ballistic missile defense, for example) will again appear as feasible choices. This has, in fact, already begun to occur.

Probably only the United States and the Soviet Union will be involved in developing the full range of the most advanced military technologies, although the Soviets may have difficulties in sustaining this over the long run. The wealth and technological base of Japan will permit work on the full gamut of the new systems, but this is unlikely for political reasons; we are more likely to see extremely active research, development, and acquisition in selected areas, e.g., space and anti-missile systems of various kinds. The Chinese will probably not develop the most advanced military technologies within the next 20 years, although they will continue to upgrade their current technologies. West European developments depend heavily on the degree of political cohesion of the European countries, although for the foreseeable future they are unlikely to achieve the economies of scale open to the United States. Other countries (Israel is a good example) will compete in selected areas, such as remotely piloted vehicles and explosives technology. Indeed, if history is a guide, such countries may be able, because of their small size and focused efforts, to introduce certain technologies earlier than the wealthier but more ponderous superpowers.

While the U.S. is in the process of fielding many of the new technologies, and is undoubtedly ahead in a number of yet more advanced areas, the Soviets may be more fully engaged in thinking through the implications of new technologies in war. U.S. thinking appears to center more on how new technologies can be used to enhance performance of existing military missions, whereas Soviet writings foresee a broad revolution in military affairs, requiring new forms of military organization and concepts of operations (see section I.E.2).

1. Emerging Technologies and Future War

It would be incorrect to say that the new technologies will make war easier or more difficult, or more or less costly in casualties and money. Much depends on the particular case under consideration and on the interaction between opposing organizations. On the one hand, the new technologies will enable armed forces to strike more deeply and accurately than ever before, with greater degrees of positive control from the center; on the other hand, the new technologies will also increase the likelihood of sustained and effective attacks on command and control organs, and may flood commanders with more information than the human mind can assimilate. The critical task before us is to understand how the rules of the game will be changed by the new technologies. It is too early yet to figure out who will benefit from them most.

Over the next 20 years **low-observables (stealth) technology** will probably be applied to a growing class of aircraft, missiles, and other vehicles. This line of technological advance, already under way for some years, will permit U.S. air vehicles to operate with a high probability of survival inside airspace defended by Soviet-style integrated air defenses. In the context of either theater war on the periphery of the Soviet Union or protracted global conflict involving U.S. and Soviet forces in non-nuclear combat, systems like the Advanced Technology Bomber (B-2), which has an important nuclear role, could make non-nuclear attacks against strategic targets deep inside the Soviet Union. In the case of a Warsaw Pact attack on Western Europe, stealthy aircraft like the Advanced Tactical Fighter (ATF) will give NATO the ability to attack Soviet air and antiair operations at their points of origin within Pact airspace. Similarly, the Navy's Advanced Tactical Aircraft (A-12) operating from U.S. battle groups on NATO's flanks, can attack Pact forces while maintaining a much greater degree of survivability. In power projection scenarios against Third World adversaries, the high survivability of stealth platforms combined with the use of advanced standoff weapons should reduce the danger that the prospect of American POWs would discourage appropriate U.S. military actions.

Stealthy attack systems for maritime warfare will pose new challenges to ship defenses. Antiair warfare will continue to depend on layered defenses, but early detection and warning and good air intercept direction will be even more important in defense against stealthy weapons. Surveillance will become critical, since the side that discovers the other's ships first will be able to fire first, and some weapons will probably get through. While a trend toward more vulnerable surface ships would on the whole be worse for the United States (given our reliance on aircraft carriers and sealift), the U.S. appears to have significant advantages in developing stealthy systems and fielding effective counter-surveillance systems and close-in defensive weapons.

Unmanned vehicles can encompass everything from remotely piloted vehicles to robotic systems capable of detecting, classifying, and attacking whole families of targets with relative autonomy once they have been set in motion. During the Vietnam war, U.S. forces successfully pioneered the use of reconnaissance drones; their utility for very high threat environments was reconfirmed during Israel's 1982 campaign in Lebanon (albeit in well known, nearby areas). Looking ahead, advances in sensor technology combined with progress in areas like automatic target recognition and expert reasoning will eventually make possible families of robot-like vehicles able to provide robust complements to manned systems. Possibilities range from remote battlefield fire units and more intelligent submunitions to mine-like aerial drones that can be seeded over enemy airbases and attack aircraft during peak launch and recovery periods.

Cruise missiles represent the leading edge of **standoff, very high accuracy weapons**. While there are scenarios in which the judicious use of very long-range cruise missiles like the Navy's SLCM (sea-launched cruise missile) or the Air Force's ALCM (air-launched cruise missile) could have great impact, they have been deployed primarily as nuclear systems and are probably too expensive for extensive employment with conventional warheads against traditional interdiction targets (bridges, follow-on forces, etc.). Because much of their high cost stems from the extreme reliability desired for nuclear systems, however, it seems certain that much cheaper, conventional only, long-range, high accuracy systems could be built--particularly if something like the Global Positioning System could be used. (Very recently, the Department of Defense has begun examining the potential of a new, long-range, conventional cruise missile.) Such systems could be useful in holding at risk with conventional munitions targets deep in the theater or deep within the Soviet Union. Even in the near term, cheap cruise missiles, whether launched from aircraft, ships, or army systems like multiple rocket launchers, should be able to achieve almost pinpoint accuracy against any targets whose positions can be precisely located, regardless of time of day or weather conditions. Most of the more lucrative interdiction and FOFA (follow-on forces attack) targets that could be covered with long-range, high accuracy weapons have long been assigned to land-based aircraft. Many of these targets could be covered by conventional cruise missiles, thus freeing up manned aircraft for other important missions. New warheads (e.g., effective fuel-air explosives) may make cruise missiles even more attractive delivery platforms for certain missions by reducing the need for expensive cruise missile accuracy.

Advanced strategic defense systems of some kind appear technologically feasible, but their scope and mission are uncertain, given technological, budgetary, and policy issues that remain undecided. If strategic defenses deployed by both sides make offensive systems more survivable but less effective, those offensive systems will be unattractive targets for the kind of counterforce attacks that are central in today's scenarios. Effective ballistic missile defenses could provoke peacetime measures to enhance, or a wartime "defense suppression" campaign to restore, the offensive ballistic missile threat; or divert military efforts toward air-breathing offensive systems or toward very short-range, battlefield systems. Although Soviet defensive measures even today make the traditional quantitative comparisons of offensive forces misleading, the future strategic balance will probably depend even more on the interaction between particular characteristics of offensive and defensive systems.

The technological advances anticipated for the next generation of launch vehicles may make **space-based** systems much cheaper than in the past; and the

military imperatives to control or occupy positions in space seem likely to increase. For one thing, the Soviets are making massive investments in space infrastructure, and in the long run the U.S. probably would find Soviet dominance of space politically and militarily unacceptable. Moreover, as soon as either the U.S. or the U.S.S.R. begins to deploy space-based ballistic missile defenses, both nations would have a compelling incentive to seek control over near-earth space.

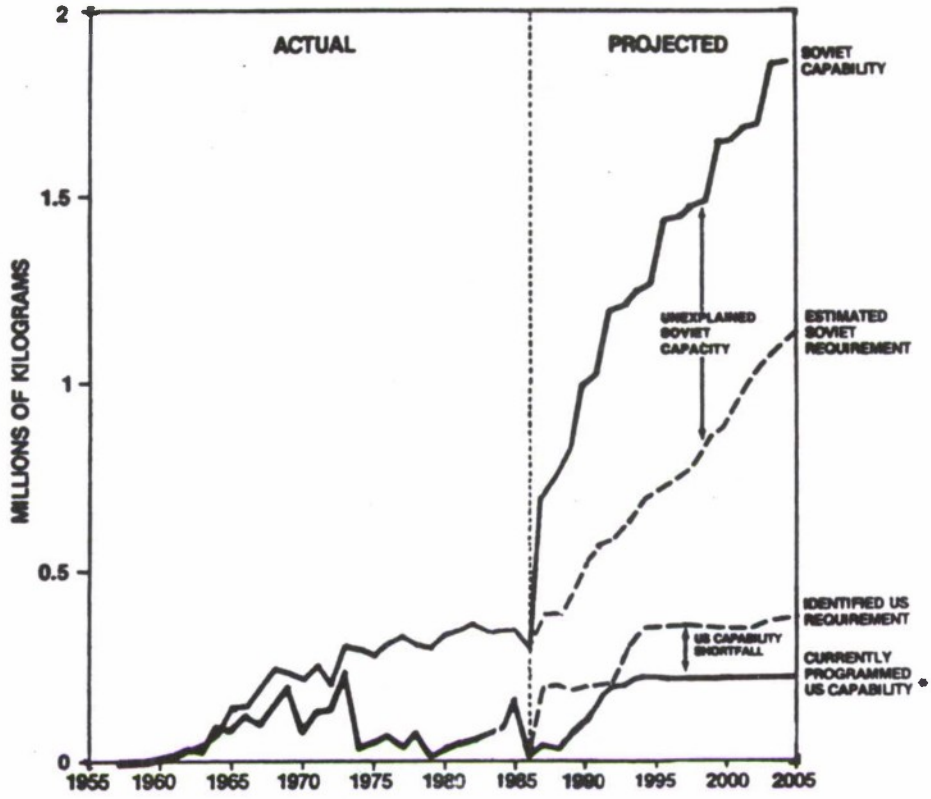
Since the 1960s, space has become the location of choice for surveillance platforms. Over the last decade, dependence upon space for communications and navigation has increased, particularly for the U.S. The appearance of precision location systems like the Global Positioning System (GPS) or the Soviet GLONASS, and the possible development of new capabilities to track and acquire military targets from space, will probably make space assets more vital to the success of strategic and tactical operations, and more lucrative targets for enemy attack.

Individual U.S. satellites will maintain their technological superiority, but defenses against or deterrents to Soviet anti-satellite (ASAT) capabilities will determine their wartime usefulness. The Soviet Union's much larger launch capacity (see Figure 10) will support a continued expansion of the Soviet satellite network and the Soviet permanent manned space presence, as well as the potential deployment of ASAT, satellite-defense, and ballistic missile defense (BMD) systems. Their advantages in launch capacity and manned presence in space also permit them to gain experience in exploiting space systems, possibly developing military missions and capabilities that we have not yet envisioned. The large number of Soviet launch pads gives them the advantage in wartime of replacing satellites within hours or days. To the extent that lengthier conventional war scenarios come to appear more plausible (as Soviet writings suggest--see section I.E.2), satellite vulnerability and replacement will become a more salient issue.

Other nations with space programs--China, India, and Japan--may develop military space applications. These nations can use space capabilities to enhance their military forces (communication, reconnaissance, surveillance, weather, etc.) or may use them to influence the outcome of regional conflicts (e.g., by providing intelligence information).

Another broad area in which technological advances could dramatically affect existing systems is that of **sensors and processing**. Improvements in synthetic aperture radar and infrared focal plane array performance will be at least on the order of factors of 5 to 10. One certain application of such advances will be improvements in the ability of satellite systems to support land and sea

FIGURE 10: SOVIET VS. U.S. WEIGHT TO ORBIT



* Does not include U.S. Advanced Launch System

campaigns. But improved sensors combined with very large-scale integrated circuits (VLSIC), expert-reasoning software, and advances in pattern recognition may eventually provide automatic target recognition that enables systems like guided missiles to be employed in fire-and-forget modes at well beyond visual ranges.

Microelectronics technology, an area where the U.S. now has substantial advantages over the Soviets, will also permit important improvements in the ability to design, operate, and train in the use of modern weapons. **Computer-aided design** may be crucial in resolving the increasingly complex design trade-off issues posed by the combinations of possibilities for exploiting future technologies. For example, stealth systems will presumably need to be optimized for immunity to visual, infrared, acoustic, and electro-magnetic detection systems; integrated with appropriately stealthy sensors and weapons-delivery suites; and have their stealthy characteristics balanced against aerodynamic and maneuvering performance, reliability and maintainability, and cost--to mention only a few of the design issues involved. **Improved man-machine interfaces** promise to

improve radically the ability of human operators to cope with dynamic, rapidly changing combat environments. Virtual-image displays (meaning images generated from non-human sensors and displayed in ways attuned to human sensory capabilities), "R2D2"-like pilot's "associates," and automated campaign-planning tools are some of the more prominent candidates. Similarly, the growing proliferation of many-on-many flight simulators and instrumented practice ranges like the National Training Center at Fort Irwin illustrate the potential of advanced microelectronics to allow Western airmen and soldiers to experience during peacetime some of the confusion, stress, fog, and friction of actual combat, building on traditional U.S. and Western advantages over the Soviets in tactical flexibility and individual initiative.

Another new weapon possibility is **biotechnology** weapons that attack other weapons rather than people. For example, it may prove feasible to devise gas-borne agents that, when ingested by a diesel tank engine, will cause the paraffin in diesel fuel to coagulate, fouling the engine to the point that it cannot run until it has been flushed. Such weapons would negate the effectiveness of existing systems by exploiting some aspect of the technology on which they rely. In this sense biotechnic agents can be viewed as antitechnology weapons, and agents non-lethal to humans would not depart from U.S. policies against chemical and biological warfare. But if these agents are to be used in a surprise-defense mode, they would have to be developed in secret.

Directed energy and radio frequency weapons can also attack the subcomponents of weapon systems, in particular their microelectronics. Given U.S. superiority in microelectronics, and the reliance we place on that superiority, such antielectronics weapons represent an important potential threat. As Soviet weapons become increasingly "smart," antielectronic weapons will be an important U.S. countermeasure. These systems are likely to be particularly important for point defenses. Finding ways to exploit and defend against directed energy and radio frequency weapons will be important tasks for military planners.

For several reasons, the main impact of this abundance of emerging technologies and system concepts is likely to center on non-nuclear warfare. Whether or not effective BMD can be fielded in this period, the risks of catastrophic escalation associated with nuclear use will prompt both the U.S. and Soviets to seek non-nuclear means to their ends. The combination of stealth and high accuracy at long ranges may very well reopen the long dormant possibility of non-nuclear strategic attack. U.S. non-nuclear attacks could be used to attrit Soviet air defenses or perform deep interdiction missions against particular targets in the Soviet Union, and the flexibility of a capability to conduct such attacks would impose disproportionate costs by tying down Soviet assets to defend

against them. Moreover, the very high-speed computing capabilities, directed energy weapons, and advanced sensing-pointing-tracking technologies that are part of the Strategic Defense Initiative (SDI) effort are likely to have ancillary applications to terrestrial forces; and forces capable of offensive and defensive operations in space are likely to be capable of directly affecting combat outcomes within the earth's atmosphere.

A possibility that draws on several emerging technologies would be to exploit likely increases in survivability and accuracy to develop pre-planned, non-nuclear options against relatively deep targets that are essential to a Soviet campaign to overrun central Europe. One option would be a "push-button" capability to employ manned and unmanned weapons with high precision against a segment of the targets in Eastern Europe and the western Soviet Union that are now covered by NATO's intermediate nuclear forces. This sort of capability may prove especially attractive now that the Intermediate-Range Nuclear Force (INF) Treaty is a reality.

But the Soviets can exploit new technologies to place NATO at serious disadvantages, even as NATO attempts to do the same to the Warsaw Pact. Much has been made of the possibility of attacking reinforcing Soviet echelons on their way to the front in a European war. But if the Soviets depend on an orderly movement of these echelons to the front, the United States and its allies rely equally or more heavily on long, unimpeded road marches by their forces to the battlefield. Soviet deep strike weapons could make such movements chaotic by striking at bridges, key traffic junctions, and forces on the move. The Soviets often take a more integrated approach to the development of military technologies than does the United States and have in some cases deployed advanced systems in quantity sooner than the West; this makes us less than fully sanguine about our technological lead.

The example of attacks on reinforcing units indicates one of the most important aspects of the new technologies: their ability to extend the battlefield to unprecedented depths, in ways that even modern aviation has not achieved. In a world with thousands of ballistic and cruise missiles, air superiority--which, in earlier times, could keep friendly skies clean of enemy aircraft--may prove increasingly difficult or even impossible to achieve. The result may be what earlier theorists foresaw in the aerial revolution, that is, the ability for each side to strike repeatedly and accurately at the other's rear areas in the course of a long war. The expense and destructiveness of future weaponry may make protection of the industrial base more important, but the increased ranges and capabilities of conventional weapons may make that infrastructure more vulnerable.

Another probable effect of emerging technologies will be to make military operations extremely rapid and highly dependent on the successful exploitation of *information*. A rich, accurate, and prompt stream of usable information will be needed for practically all aspects of military operations, and is likely to be the object of information warfare, as the enemy tries to disrupt, distort, and exploit our information and we try to disrupt, distort, and exploit his. The fast pace and large scale of warfare will impose an overwhelming requirement for theaterwide integration and automation of command, control, communications, and intelligence (C3I) sufficient to support a very rapid tempo of operations.

Highly accurate and destructive weapons will probably tend to penalize concentration of assets and make dispersion of forces a cardinal virtue. The U.S.'s relatively capital-intensive approach to military systems (large tanks, large ships, and large facilities) results in assets not easy to hide or protect against smart and powerful missiles. Dispersion on the battlefield or in the sea-combat arena, or in undersea warfare, as well as information countermeasures, may deserve serious consideration in addressing the requirement to protect our assets against the enemy's smart weapons.

The increased range and destructiveness of new weapons may also make the initial period of war more important, or even decisive. Both sides will need to emphasize peacetime deception and intelligence capabilities in an effort to achieve surprise and keep from being surprised. Because it will be difficult in peacetime to assess the effectiveness of new systems, both sides will be more uncertain about the likely outcome of war.

The new technologies may require changes--perhaps radical surgery--in our current organizations, military doctrine, and philosophy of command. Old allocations of roles and missions may prove unsuited to the new technology. It is thus particularly important that the Department of Defense undertake a broad-gauged study of all of the many facets of the revolution in military affairs, and not just the narrow technical and tactical aspects. This transformation of war will affect our force structures and command practices as profoundly as--in some cases more profoundly than--the atomic bomb, and we must prepare accordingly.

2. Soviet View of the Military Impact of Emerging Technologies

Soviet sources identify roughly the same list of technologies described above as important for future war, but consider their implications more systematically. Rather than only identifying ways to improve specific systems or perform existing missions, Soviet writings suggest that the conduct of war will be broadly transformed by a "qualitative leap" in military technologies. Soviet writings tend not to focus on questions of feasibility, cost, and timing for specific innovations,

but rather to *assume* that families of new technologies will eventually be introduced, and to examine the tactical, operational, and strategic implications of technological trends. Besides identifying the combined effects of emerging technologies in extending the area and speed of battle and transforming the conduct of operations, the Soviets are already looking ahead to a more distant future featuring weapons based on "new physical principles." U.S. forecasting efforts tend to be more piecemeal and less ambitious, extrapolating forward from current capabilities rather than trying to anticipate qualitative leaps that can bring about what the Soviets call a "revolution in military affairs."

Soviet forecasts consider, among other things, how emerging technologies will be developed and used in war by their probable enemies. The Soviets see Western and especially U.S. interest in developing advanced conventional weapons technologies as confirming their estimate that over the next several decades nuclear weapons will become a decreasingly credible deterrent to non-nuclear attack. The Soviets are concerned that Western advances in military technologies could offset Soviet advantages in the conventional balance. For example, NATO could compensate for inadequate strategic depth by holding at risk Soviet forces at operational and strategic depth, and NATO might compensate for quantitative disparities by qualitative advances in weapons systems. The assessment that technology will result in revolutionary changes in military operations makes Soviet economic transformation crucial to future Soviet military capabilities. Even the achievement of a prolonged status quo condition in military-technological developments (achieved by a combination of public diplomacy, arms control, etc., designed to retard U.S. progress in these technologies) would still leave much cause for Soviet concern due to the basic weaknesses of their economy.

a. Emerging Capabilities. The Soviets seem to believe that conventional weapons systems will benefit most from technological advances. Development of long-range, highly accurate, and remotely guided combat systems, remotely piloted vehicles, and qualitatively new electronic control systems will permit "reconnaissance-destruction complexes" that link sensor, communications, and fire systems in real or near-real time in the execution of fire missions at depths up to 500-600 km and deeper, i.e., throughout the enemy tactical, operational, and even strategic rear. Consequently, the technologies of greatest interest to the Soviets over the next 10 to 15 years appear to be those associated with microelectronics, automated decision support systems, telecommunications, and enhanced munitions lethality.

The Soviets believe that a principal characteristic of new conventional technologies will be an extension in the depths to which future systems--both fire systems and sensors--will operate. New sensor technologies, for example, will

permit a five to six-fold increase in the depth of the "zone of reconnaissance." And the degree of precision in determination of target coordinates will experience a similar increase, as new technologies improve guidance systems and reconnaissance capabilities. Trends in microelectronics and optics, involving electro-optic, infrared, and millimeter wave systems for terminally guided munitions, are of particular interest. Soviet sources foresee order of magnitude ("hundreds of times over") increases in accuracy, and make frequent reference to single-shot probabilities of kill ranging from .6 to .9 against both fixed and mobile targets. Equally important are developments in information processing and communications technologies that could permit the entire detection-to-destruction cycle to be performed in real time. Consequently, the Soviets have identified improved reaction times as a key trend in future military technological developments.

The Soviets are also closely examining "explosive substances of enhanced power"--e.g., armor-piercing shells with uranium cores, munitions using plastic, gelatinous, and liquid explosive substances, and incendiary munitions. Of particular interest to the Soviets are developments in fuel-air explosives, thought to release almost 5 times more energy than high explosive bombs of the same weight. Thus the Soviets believe that when fuel-air munitions are delivered by air or multiple rocket launcher "the zone of destruction is measured not in hectares, as before, but in square kilometers."

The most intriguing facet of these new developments is the promise that conventional weapons may achieve results formerly possible only by means of nuclear weapons. Until recently, Soviet writings suggested they were examining substituting these new non-nuclear systems for low-yield nuclear systems, most likely nuclear-capable artillery. But now there are fragmentary indications that the Soviets compare these systems to "nuclear missile weapons" in terms of potential effects. Given the significance of "nuclear missile weapons" in the Soviet assessment process, it is possible that military analysts are considering employment of conventional weapons at depths or for target categories formerly reserved for nuclear weapons. Recent Warsaw Pact analyses portray the emergence of this conventional substitutability as "gradual."

Soviet military theoreticians believe that many of the new technologies have already begun to appear on the battlefield, although their full effect may not be recognized until the mid 1990s. Budgetary constraints, both in the West and in the Soviet Union, could even stretch this projection out to 2000 and beyond. During a transitional period, technologies will be phased in and operational concepts modified accordingly.

b. Longer-Term Forecasts. The long-term (15-30 years) Soviet estimate seems to envision global war waged with weapons based on "new physical principles" (as well as subsequent generations of the new conventional weapons). The new weapons would not be nuclear, nor would they be truly conventional in the sense that we now understand the term. Their range, accuracy, destructiveness, and speed of delivery would far exceed the capabilities of today's conventional weapons, making possible survivable basing in space, air, and at sea. Nuclear energy might be used less for destruction with heat and blast than for powering weapons that kill or disrupt using directed energy.

In this period, space-based weapons, guidance control, and reconnaissance are expected to participate in warfare on land, at sea, and in space itself. Even in the early 1960s, senior Soviet military strategists believed that large-scale military use of space would have a "revolutionary" effect on the nature of war—as great, perhaps, as the effect of the introduction of nuclear weapons. Effective use of space would be far more central to success in the global conventional war envisioned by Ogarkov and others in the long-term future than it would in a massive nuclear exchange. The Soviets seem to anticipate advanced variants of space-based "reconnaissance-strike complexes," combinations of high-resolution reconnaissance with global reach tied in real time to a responsive control system that could bring "space-strike weapons" to bear against any target on earth or in near space. (The Soviets would like to postpone such developments, at least on the U.S. side; a similar policy was evident in the late 1960s, including the initiatives that led to the ABM [antiballistic missile] Treaty.) Drastic reductions in ballistic missiles by opposing sides would not diminish the importance of space. Military superiority in space would be a major determinant of a state's ability to control its manned and unmanned weapons in the atmosphere, and to detect and destroy the enemy's. Moreover, the speed and precision of future space-based weapons could reduce the importance of ballistic missiles while at the same time increasing their vulnerability.

While Soviet sources anticipate the deployment of Stealth aircraft in limited numbers by the mid 1990s, their longer term forecasts probably anticipate a more widespread application of that technology, for example, to cruise missiles. Military applications for laser, particle beam, radio frequency, kinetic energy, and electro-magnetic pulse technologies figure prominently in Soviet long-term assessments. Laser technologies are already employed in guidance systems for later generations of terminally guided munitions. The Soviets anticipate that lasers may also find widespread use in suppression of enemy sensor systems; such systems may already be available for use against enemy electro-optic sensors. Successful applications of laser technologies for air defense are also considered imminent. Also of interest to the Soviets is the potential application

of electro-magnetic gun technologies to theater warfare, e.g., in an antitactical missile role or against armored targets.

The Soviets have identified a range of other potential longer term applications for space-based laser and electro-magnetic pulse weapons. Soviet non-military specialists profess to see a danger that, based in space, these weapons could play a role in "decapitation" attacks on the components of the national airborne command post system or be employed against strategic bombers operating on airborne alert or soon after takeoff. The Soviet military analytic community has devoted particular attention to the potential effectiveness of such weapons against a range of space- and ground-based targets, including satellites, military space stations, helicopters, aircraft, oil and gas storage tanks, and command, control, and communications systems.

Other long-term developments of interest to the Soviets include the creation of genetic, biological, and geophysical weapons, as well as "psychotron" weapons (apparently, weapons controlled by human thought processes).

c. The Nature of Future Warfare. Among the effects of new technologies on future warfare, Soviet assessments center on the potential impact of unprecedented attrition and disruption of control on the fulfillment of operational and strategic objectives, changes in the relative role of offensive and defensive military operations, and the increasing scale of future military operations. This, in turn, has led to a reevaluation of the factor of time, the role of surprise, and the initial period of war. Soviet military theoreticians have come to believe that past analyses of the dynamics and tempo of nuclear warfare are increasingly applicable to conventional operations.

Effects of Attrition and Disruption of Control. Soviet military planners have always attempted to compensate for anticipated attrition rates by emphasizing such factors as surprise, high tempo operations, and intensive fire support. But conventional weapons in the future may impose qualitatively different rates of attrition than in past experience. According to Soviet analyses, reconnaissance-strike complexes are capable of detecting and destroying in the course of 60 minutes 15 to 20 "group targets" (each group representing one tank company) with a .7 probability of kill. Another Soviet analysis reported that one cruise missile, armed with self-guided cassette munitions, is capable of achieving the same radius of destruction as a one kiloton neutron warhead.

Of equal importance in Soviet analyses is the fact that these rates may be inflicted at greater depths than in past military operations--not only tactical depths, but also operational and even strategic depths. According to one Soviet analysis, precision-guided munitions can attack truck columns, dumps and bases, railroad stock, transport aircraft located at airfields, large bridges,

communications assets, and other targets in the operational and strategic rear, disrupting the support of large formations.

Compounding this problem is the likelihood that troop control facilities will become a major target of many of the precision-guided weapons. Command and control posts, communications centers, radars, and weapons guidance facilities appear prominently on any Soviet target list for these weapons. Moreover, the Soviets see the future battlefield becoming increasingly complex as more and different kinds of forces participate. Complicating the troop control problem is the likelihood that warfare will take place in an increasingly intense radioelectronic environment. Events in Lebanon in 1982 reaffirmed the Soviet belief that radioelectronic combat has a significant "leveraging" effect on fire destruction. In fact, the application of "massive radioelectronic interference" has been cited as one of the most effective counters to an enemy reliant on "the massive use of automated systems of reconnaissance [and] self guided munitions." The requirement for coordination and timing of future military operations is such that even short disruptions of control could have a significant impact on operational effectiveness.

Because new systems may shatter the combat effectiveness of units quickly, at great depths, and at comparatively low expenditures of munitions, overcoming the effect that will have on offensive tempos has been elevated to the status of a "major problem in the theory of strategy." The Soviets have taken a number of measures, including the expansion of their fire support doctrine, and the development and application of reactive armor to protect tanks from top attack systems. They are also apparently examining alternative patterns of dispersal and deployment. According to a recent Warsaw Pact analysis, "reserves, second echelons, and forces approaching from the rear will have to be shifted and arranged in smaller formations over greater areas so as to make of themselves the greatest possible number of potential targets."

Soviet military planners continue to emphasize scenarios featuring high-tempo offensive operations that could breach enemy forward defenses in the first two days of combat and achieve strategic objectives in 25-30 days. Continuous and carefully coordinated fire and maneuver activities would be necessary to overcome attrition, retain the initiative, and keep the enemy off balance. The use of non-standard operational behaviors, formations, and methods of fire and maneuver in pursuit of these objectives is emphasized in recent Soviet analyses.

Evolving Offense-Defense Mix in Military Planning. Soviet military theoreticians are apparently reevaluating the mix of offensive and defensive activities in future operational planning. The introduction of high-accuracy weapons systems, and particularly the depths to which these systems are capable

of operating, "are leading to a complete reevaluation of the very essence of the defense on a future battlefield." For one thing, the defender's strikes will not be limited to the tactical zone, but may be carried out across the depth of the attacker's deployments. More important, the defender will no longer cede to the attacker the advantage of striking the first blow. The optimum time for the defender to strike would be "right at the time when the enemy is preparing to attack, or else when the enemy is moving up to the lines to go on to the attack."

A defender's successful execution of such strikes could produce rapid changes in the correlation of forces and in the overall situation. The Soviets have long believed that nuclear strikes could produce such changes, but have come to realize that future deep strike, precision-guided weapons would impart similar characteristics to non-nuclear operations, making nuclear and conventional operations increasingly similar.

A more integrated approach to offense and defense is probably one way to overcome the potential effects of attrition, particularly on critical axes of advance. Forces operating on adjacent, less critical axes, could actively defend to release forces for redeployment to more critical areas. In order to exploit the defensive potential of long-range fire systems, the Soviets have apparently devoted more attention to the elaboration of fire doctrine in defensive operations. In addition to defense at the tactical or operational level, the Soviets could also be examining the potential benefits from the conduct of strategic defense in one theater of military operations (TVD), in order to reallocate resources to another, more critical area. Given the potential impact of new systems, successful strategic defense operations could create more favorable conditions for a subsequent counteroffensive.

Increasing Scale of Military Operations. The Soviets have developed forces and concepts to extend the conventional phase of a war as long as possible. Indeed, Soviet military theoreticians have concluded that theater warfare could remain conventional throughout. Beyond this, Soviet strategic planners have been considering the potential dimensions of conventional warfare conducted on a *global* scale. Authoritative statements of Soviet military doctrine since at least 1979 clearly imply that while future warfare will be global in scale and decisive in nature, it will not necessarily escalate to the use of nuclear weapons. "The sharp increase in the combat range of conventional weapons makes it possible to immediately envelop not only the border regions but also the territory of an entire country with active combat operations, which was impossible in wars of the past." This prediction reflects a somewhat different set of planning assumptions than are commonly employed in the West.

Soviet planners are probably examining the feasibility of an upgraded capability to hold the U.S. homeland at risk of non-nuclear attack--including, perhaps, the feasibility of at least initial operations from locations in the Caribbean or in Latin America, as well as the role of naval forces in such missions. Trends in quieting of Soviet submarines might increase their survivability nearer the U.S. coasts. Beyond the increasing breadth and depth of strategic military operations, Soviet military analysts seem also to be examining scenarios of more protracted length and the implications of prolonged conventional warfare for the economic, industrial, and social mobilization of the country. In a prolonged war, interdiction of sea lines of communication (SLOCs) could become a much more important Soviet mission.

Time and Surprise. The Soviets appear to view the single most important impact of new technologies to be on the management and use of time. As a result of the better reaction times and greater accuracies of future weapons systems, the Soviets believe that far less time will be available to execute missions or even, in some cases, to complete the planning cycle. The Soviets estimate, for example, that future reconnaissance-strike complexes could have a "detection-destruction cycle" of 6-10 minutes, thus reducing by a factor of 10 to 15 the time required to execute a fire mission.

These developments are expected to increase opportunities for conventional attacks to achieve surprise. The Soviets appear to judge that a surprise nuclear strike by either side could not escape devastating retaliation, as better reconnaissance and force reaction capabilities have increased the capacity to launch on tactical warning. For conventional attack, surprise may be achieved in various ways, including not only the unanticipated initiation of operations but also unanticipated methods of employing both new weapons and force groupings. Soviet analyses seem relatively optimistic about the achievement of surprise at the operational level, but less so about strategic surprise.

d. Conclusions. Over the mid-term, the Soviets expect non-nuclear warfare to be the major beneficiary of developments in military technology. Nuclear weapons will continue to play an important role, at least as a peacetime backdrop for military power and influence and in wartime to inhibit enemy use of nuclear weapons. Some in the Soviet military see an unchanged role for nuclear forces and a need for continued emphasis on nuclear warfighting capabilities and conclude that, since nuclear systems will experience many of the same qualitative upgrades that conventional systems will, Soviet military theory should continue to explore "less than massive" options for the employment of these forces. For example, were NATO successful in slowing a Warsaw Pact advance by conventional means, very selective Soviet nuclear attacks could appear lucrative. But the increasing effectiveness of non-nuclear systems should permit their

assignment to an increasing set of targets and missions. As a result, conventional operations will continue to take on many of the characteristics of nuclear warfare, especially the simultaneity of destruction throughout the depths of deployment. In particular, the Soviets believe that the introduction of conventional deep strike systems could increasingly blur the distinction between offensive and defensive operations. With the deployment of these systems, the defender has the potential to completely disrupt an opponent's offensive preparations, bring about a rapid change in the correlation of forces, and create favorable conditions for a counteroffensive.

The full potential of these technologies may not be realized until late in the next decade or possibly even after the turn of the century. During this later period, the Soviets seem to anticipate full-scale deployment of not only the first, but also subsequent generations of high-accuracy conventional weapons. The period will also see expanding roles at the tactical level for weapons systems based on new physical principles, in particular for battlefield air and ballistic missile defense. The role of these weapons in future warfare is likely to increase gradually from tactical to strategic applications, especially as systems that assist in target identification and designation are deployed widely on space-based platforms from which homeland targets are accessible. Such acquisition of capabilities for the non-nuclear strategic warfare envisioned by Marshal Ogarkov could bring about truly revolutionary changes in the basic concepts of warfare and in the manner in which military power is evaluated.

II. THE CHANGING SECURITY ENVIRONMENT

A. GROWING POWERS IN ASIA

The economic growth projected for the Northeast Asian countries makes it likely that they will become even more important international powers. Japan has already become a formidable economic power, a major factor in international trade, a major source of capital investments, and a major donor of foreign aid; accordingly, Japan has already become a different kind of actor in international affairs. China's sheer size and recently accelerated growth portend an increased international role, although the per capita product of China will not approach that of the world's wealthier countries over the next 20 years. Even if these countries do not significantly change their current policies and international alignment, their actions will carry more weight. More far-reaching shifts are also possible.

Economic policies alone could have important consequences. For example, Japan's capital investments overseas could assist the development of pro-Western countries (e.g., Mexico, Turkey, the Philippines, or Egypt), or--if Japanese policies were reversed (perhaps in return for Soviet concessions on the status of the Northern Territories), such capital could flow to Siberian projects and assist Soviet economic development. Even without large increases in active military forces and direct defense spending, Japan could exert its economic power in the service of collective security by, for example, financing possible joint military-related R&D efforts or providing support for U.S. bases in the Philippines and elsewhere. The national security interests of Japan and the United States generally coincide in the region, and efforts to develop and expand the strategic cooperation between the two countries are likely to continue along with expansion in Japanese military capabilities.

China and North Korea are already important arms exporters, and South Korea could become one. The economic growth of China or Japan or both could also result in their sooner or later becoming major military powers. China has given military programs lower priority in recent years and reduced the defense burden, but military modernization remains the "Fourth Modernization" in Chinese planning and may well be undertaken in earnest before the end of the century. Chinese and Indian military capital stocks are projected to increase quite rapidly.

The Indian military was always numerically formidable, numbering as it does over 1.25 million men. Today it has acquired a large range of new technologies (including a nuclear submarine from the Soviet Union), first line aircraft, aircraft carriers, and the wherewithal for long-range power projection. Its intervention in

Sri Lanka bespeaks a willingness to use large forces in battle to secure its own interests. Moreover, India has, and continues to develop, a solid military industrial base of its own, which can manufacture not only tanks but also the ingredients for a serious space program. At the very least, we can expect India to play an increasingly assertive role in the Indian Ocean, its foreign policy drawing strength from the military means available to it.

Nations that greatly increase their military power may become less reluctant to apply military pressure directly against neighbors in long-standing border or other disputes. For example, India might seek to interdict a Pakistani nuclear program or again undertake military action against Pakistan for some other reason or in response to provocation. China might again decide to use force to resolve its recurring border problems with Vietnam or its long-standing disputes with India.

Changes in the balance of military power in Asia might bring about changes in political alignments. Key questions include the disposition of China and Japan toward one another, whether the smaller nations of Asia come to regard either as a security threat, and what role Asia's large and small powers may wish the United States to play in the region. For example, Japan and China may have a continued interest in a U.S. role as a counterweight to the Soviet Union (or to each other), but may look to us as a potential secondary coalition partner rather than as a dominant power that can ultimately guarantee regional security. On the other hand, there could be a significant degree of rapprochement between the Soviet Union and China. Such a rapprochement could alter the overall security balance in the region by increasing the threat to other nations and perhaps making them doubtful that cooperation with the U.S. offers them real security against that threat. Another scenario that would change the regional balance and affect U.S. and Soviet access would be the possible reunification of South and North Korea. This might be brought about by a combination of changes in political leadership in both Koreas and the substantial and continuing growth of economic and military power in the South.

It is not clear whether such developments will increase the requirement for U.S. capabilities in the area, or make such capabilities irrelevant by comparison to the forces of the countries in the region. For example, conflicts between China and India or China and Vietnam could lead to Soviet pressure or even limited attacks on China. At that point, the United States would have to decide what policy to pursue toward a major conflict that could redraw the maps of Northeast and Southeast Asia. The enormous size of the armed forces of China, Vietnam or India, and the Soviet Far Eastern and Trans-Baikal Military Districts would mean that "tilting" toward one of the parties, as was done in the 1971 Indo-Pakistani war, would be ineffective. Even shipments of military equipment on the scale of those completed during the 1973 Arab-Israeli war might not have

any noticeable impact, while carrying with it the risk of involvement in the war. Distances between key countries and facilities in this region are substantially longer than in the European theater. Thus, forces ashore are harder to bring to bear in support of naval forces; it is difficult to concentrate the total capability available in the theater; and the few, separated, key facilities are more vulnerable and less redundant than in Europe. U.S. tactical aircraft have in the past been designed with ranges better suited to the European theater than to the Pacific.

Twenty years hence, the world will be very different from now, and the next twenty years will be a period of probably uneven transition to this new situation. While the Soviet Union's military power is likely to remain a central problem for U.S. strategy, the emergence of additional major powers will pose unfamiliar challenges. In this more complex environment, the strategy and orientation of Japan and China is likely to be no less important to the development of U.S. strategy than is the stance of the Soviet Union or Western Europe. And possible conflicts (including some not necessarily related to the U.S./Soviet competition) may involve U.S. interests and require U.S. planners to judge whether and how we should attempt to affect their outcome.

B. UNCERTAINTIES ABOUT THE SOVIET FUTURE

The Soviet Union will remain the major military competitor of the U.S. because of the size of its past investments, the high priority it is likely to continue to devote to its military efforts, and the likelihood that the U.S. and the Soviet Union will be at the leading edge of many military technologies. But there is a new level of uncertainty about almost all estimates of future developments related to the Soviet Union. Continued slow absolute growth (and a relative decline) of the Soviet economy would raise questions about whether the Soviet Union will be able to maintain its current position in world affairs 20 or more years from now. Uncertainties about the current size of and allocation of resources within the Soviet economy are compounded by uncertainties about the scope and results of current reform efforts. The Soviet rulers themselves are seeking improved economic statistical reporting and better estimates of past economic growth and current resource allocations, but already diagnose their economy as in need of fundamental changes. The stagnant and relatively backward state of the Soviet economy poses difficult issues and choices for Soviet rulers and opens up a broad range of possible developments within the Soviet Union and in Eastern Europe that would be important to U.S. strategy.

Major Soviet economic acceleration, if it happens at all, will not happen quickly. Economic sluggishness, whether due to the disruptions of attempted reform, the ineffectuality of reforms, or a retreat from reform, gives the Soviet

rulers an incentive to restrain or cut military spending. Reductions in Soviet military spending would likely be associated with arms control proposals designed to limit the pace of technological development in the U.S. and the West generally, and with a political strategy directed at Western publics designed to encourage a dismantling of the institutional structures of Western defense. Alternatively, but probably less likely, sustained increases in Soviet military spending would require an ever increasing share of a stagnant GNP--which appears to be the current trend and the pattern of the last 10–15 years.

For the near future, military assets already accumulated and weapons production already under way make Soviet military capabilities fairly insensitive to the possible variations sketched above. Less clear is to what degree, and when, Soviet military power would eventually suffer from the economy's inadequacies. The Soviet Union, and before it the Russian Empire, has not found its technological lag an insurmountable problem, and continuing efforts to obtain Western technologies, work around technical limitations, rely on the steady application of the best Soviet resources, and discourage Western defense improvements by diplomacy and arms control could be an effective strategy for competition in the future. The diplomatic and propaganda skills of new leaders could make these tactics even more effective than in the past. Nonetheless, Soviet rulers already suggest that economic rejuvenation is a necessity, and they appear to believe that both Soviet military power and political stability are at stake.

Soviet economic prosperity is not likely soon, and (if it is achieved) its political consequences are unclear. There are plausible links between economic liberalization, political democratization, and a benign foreign policy, but these links are not certain enough for U.S. national security planners to rely on. The Soviet regime may not need a command economy in order to maintain strongly centralized and dictatorial political authority; it could retain or revive other instruments of control. While reforms might temporarily preempt some resources now assigned to the military (e.g., as a means of supplying consumer goods to stimulate workers' productivity), a later reallocation toward the military, from a much larger GNP, is plausible. Reform could also make the military and its supporting production sector more efficient.

It appears more likely, however, that reforms will fail to improve the Soviet economy over the next several years. Whatever its economic results, the reform effort itself fosters political tendencies and expectations that have profoundly unsettling effects. Within the Soviet Union, efforts to reform the system may open the door for agitation on behalf of claims of the different nationalities for a larger share of benefits or greater independence. For many Russians, despite the fact that they are the dominant national group, the price of the present system is

too high. They also may increasingly feel that it will be unable to assure their continued role as the dominant national group. Armenians, Azeris, and Latvians have recently been outspoken; other Baltic nationalities, the Western Ukrainians, and others have latent separatist tendencies; and the Moslems are gaining most rapidly in numbers. In Eastern Europe, Soviet reform introduces uncertainties about what limits on the policies and independence of governments there the Soviet regime will impose. Can Party authorities in Eastern Europe count on Soviet support against local "liberalizing" movements? At the same time, to the extent that the Soviet Union reduces the economic costs of supporting its empire, additional economic challenges will face East European governments.

Internal challenges to the authority and policies of current Soviet rulers could result from some combination of economic stagnation, ethnic divisions, and political openness; this makes Soviet foreign policy potentially unstable as well, but in directions impossible to predict. Economic limitations and a preoccupation with internal problems recommend policies that reassure the outside world and avoid costly overseas commitments and arms programs. But we cannot know that the Soviet rulers, or their successors, share that assessment, and more belligerent, risk-taking policies are possible. For example, upheavals in the Soviet empire might stimulate dangerous imperial exertions (as well as providing occasions for political disputes or unrest at home). Tensions with the West could be seen as politically useful to a Soviet regime that sought to "crack down" at home. Or opportunities could beckon, e.g., in the Third World, where a more assertive Soviet policy appeared to promise great strategic gain; a Soviet regime generally pessimistic about the future could gamble, and even a cautious, budget-conscious Soviet regime could calculate that the likely benefits exceeded the costs.

Western policymakers need to be prepared not only for a wide range of possibilities, but also for continued disagreement and uncertainty about their relative likelihoods.

C. CHANGES IN THE GLOBAL DISTRIBUTION OF MILITARY POWER

American strategic planning from 1945 through the 1960s was able to assume that hostile military power was concentrated in the hands of the Soviet Union and its peripheral allies. The need for U.S. military intervention in other areas of the world, such as Southeast Asia or South America, was assumed to be limited to "half" or "brushfire" wars that the United States could handle without the commitment of the heavy firepower necessary to fight the Soviet Union and its allies.

It was also assumed that the industrial capacity to support major hostile military operations was concentrated in the hands of the Soviet Union and China.

One corollary assumption was that the United States and the Soviet Union would have considerable influence on the resolution of wars fought between third parties who were dependent on the superpowers for heavy military equipment and support for that equipment.

Over the next 15 years, those assumptions are likely to become less valid as the result of two trends. The first is the continued proliferation of heavy and electronics industries to such countries as Mexico, Brazil, India, Turkey, and South Korea. The second is an increasing number of countries that can successfully operate and maintain high technology weapons and other military systems even if they cannot produce them. Numerous medium and smaller size powers will have ready access to weapon systems that embody 1970s and 1980s technology, including such weapons as highly accurate surface-to-surface missiles and precision-guided munitions. The result may be to increase the difficulty of military operations by either the United States or the Soviet Union, in peacetime, crisis, or war, in areas of the world in which we could previously operate at low cost.

At the same time, the organizational effectiveness of Third World militaries has improved steadily over the last three decades, and will probably continue to do so. This intangible improvement, every bit as important as the growth in Third World weapons' inventories, has diminished some of the traditional military edge possessed by the United States, the Soviet Union, and the European states over the former colonial nations. The Arab-Israeli and the Iran-Iraq wars offer particularly vivid examples of national military establishments that have gradually acquired the ability to move large forces, to conduct sustained ground and air operations, to innovate tactically and technically, and to endure defeats without disintegrating.

Another effect of the diffusion of weapons production capacity may be to reduce the influence of the U.S. and U.S.S.R. over friends and clients who engage in regional wars. Some of the major regional wars since 1945 have been relatively short, in part because the belligerents had limited independent sources for replacing weapons. In the future, protracted, large-scale regional wars may be supplied by indigenous industries or by foreign suppliers under the control of neither superpower. The longer such wars continue, the greater the likelihood that U.S. or Soviet interests will be affected, for example, through disruption of trade or the expansion of the war to threaten friends and allies in the region.

Rapid economic growth in Brazil, India, and South Korea and forced draft military industrial development in North Korea have already given those countries the ability to produce artillery, armored fighting vehicles, first generation surface-to-air missiles, and infantry weapons. The ability to produce ammunition for

TABLE 7: THIRD WORLD WEAPONS PRODUCERS

	1965	1975	1984
Fighter Aircraft	India	India South Africa Brazil Israel Taiwan North Korea Argentina	India Brazil Israel Taiwan Argentina South Korea Egypt Chile
Helicopters	India	India Taiwan Philippines Argentina	India Philippines Indonesia South Korea Brazil Egypt
Tactical Missiles	none	India Israel	India Israel South Africa Brazil Egypt Taiwan Argentina
Tanks	India	India North Korea	India North Korea Israel Argentina Brazil South Korea

these weapons has proliferated as well. This has already given Iran and Iraq the ability to purchase heavy weapons and key consumables to sustain their war even though major shipments from the United States and the Soviet Union have been interrupted or reduced. The trend toward more proliferated weapons production is clear (see Table 7), but it should be noted that many of the newer producers are relying on foreign licenses or are assembling imported subcomponents, and thus have not yet attained a truly independent production capability.

Even when a country cannot produce a complete high technology weapons system, it may be able to modify older systems to give them significant new capabilities. Just as Israel could modify older tanks to give them additional capabilities, and as Iraq could modify 1950's era ballistic missiles to increase their range, other countries will be able to add new electronics systems or weapons payloads, including chemical munitions, to older platforms. As the spread of weapons production capacity makes the arms trade more of a buyer's market, the technological leaders may feel obliged to offer their most advanced equipment to their favored allies. In general, the capacity of competing sellers and their customers to do mischief will grow.

The trends in economic development have been paralleled by several trends in technology that affect the global distribution of military power. Technology has developed in some areas in ways that permit new military powers to leapfrog some of the older, harder to maintain military technologies. This is particularly striking in the area of communications, where poorer countries are now able to buy satellite and fiber optical communications systems, and then operate them relatively cheaply, rather than laying copper cables or building microwave transmission towers. This may seriously increase the cost of collecting communications intelligence from these countries, particularly if the new communications technologies are allied with the commercially available encryption systems that the revolution in data processing has made inexpensive. The proliferation of commercially available satellite services now also includes high quality, multispectral digital imagery from the French SPOT satellite. The potential cost of concealing American or Soviet military movements may increase as the number of countries able to purchase timely satellite imagery increases.

Technology has already produced weapons systems that could be effective against major United States and Soviet weapons systems. The use of antiship cruise missiles by Argentina, Iraq, and Iran has made this clear, as has the use of short-range ballistic missiles by Iraq and Iran. (Iraq, indeed, modified the short-range, Soviet-built SCUD missile and at least doubled its 300-mile range.) In the future, technology is likely to produce highly effective missile systems that are storable indefinitely, reducing the requirement for periodic system checks and maintenance that were formerly necessary if the missile was to be used with confidence. These "wooden rounds" could proliferate to give countries the ability to deny sea or air space to American or Soviet patrols in crisis, and to raise the military "cost of entry" if either superpower wished to intervene against the state possessing them. Iran, for example, has been able to use Chinese antiship cruise missiles, without a massive support infrastructure, to increase the difficulty of naval intervention against Iran.

There will be two contrasting trends. One is the spread of relatively modern military industry to a number of additional countries, increasing the availability of high quality weaponry throughout the world. This trend is already exemplified by the proliferation of ballistic missiles produced by neither superpower (e.g., China's sale of CSS-2 to Saudi Arabia). The other trend is a narrowing of the countries with leading-edge weaponry to the United States and the Soviet Union (although a few additional countries may specialize in particular areas). The Soviets themselves may in some cases have difficulty in competing effectively in the military technical revolution they foresee. Development and production of the next generation of weaponry is likely to be high cost and require strong technological and manufacturing capabilities.

Production of equipment at the leading edge of the state of the art, therefore, may not proliferate. For example, the costs of producing advanced fighter aircraft appear so great that established manufacturers of warplanes, such as France, may find it hard to move on to the next generation without significant overseas sales of current generation fighter aircraft, which are being squeezed out by the F-16. Perhaps only the U.S. and U.S.S.R. will be able to afford or to manufacture systems like the Advanced Technology Bomber or the next generation of jet engines. Similarly, advanced weapons like AMRAAM and PATRIOT (and the generation beyond them) are not likely to be matched elsewhere.

The military use of space will be an area in which new industrial powers will be at a disadvantage relative to the U.S., Soviet Union, Japan, and Western Europe, though the new powers will have increasing indigenous space launch capabilities. Paradoxically, other high technology areas may become areas of greater advantage for new powers because the superpowers have denied themselves capabilities through arms control agreements. Less advanced ballistic missiles, and rudimentary ABM systems, may well be developed and deployed by countries such as Israel and India, while the U.S. denies itself any comparable or superior capabilities.

Effective U.S. action in a wider range of global contingencies may depend on being willing either to use against lesser powers the highest technology it has available or to employ large forces over a long period of time to exploit its superior economic power. For example, the U.S. currently has a significant edge in low-observable technologies, manned aircraft, advanced land-attack cruise missiles, and antisubmarine warfare. If today's practices continue, many of these weapons will be developed primarily for use in high intensity warfare against the Soviet Union. If the operational doctrines governing their use, the size of the stockpiles, and the policies to shield them from foreign military intelligence are formulated with principal reference to a major U.S.-Soviet war, these doctrines and practices may not be appropriate for interventions in regional wars. Effective use of new technologies will depend heavily on whether explicit attention is devoted to developing appropriate supporting policies geared to lower-intensity contingencies. For example, the use of some weapons in lower intensity conflicts may give technological intelligence to the U.S.S.R. This should be thought through and planned for so as to reveal that which we wish to reveal, and no more.

Nuclear weapons proliferation* may also be an obstacle to effective U.S. or

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* A separate discussion of the *use* of nuclear weapons appears in section III.D.

Soviet interventions against lesser powers. If, for example, Iran had nuclear weapons the U.S. might be more skittish about confronting that state in the Gulf.

The independent nuclear arsenals of France, Britain, and China are entering an era of low cost enhancement, as Multiple Independently Targetable Reentry Vehicles (MIRVs) are added to existing forces. These forces may be joined by others in the future and may present more formidable national deterrents to Soviet attack. The coercive weight of the Soviet nuclear arsenal and/or the improvement of Soviet strategic defenses could, however, mitigate that effect. U.S.–Soviet agreement to make major reductions in their strategic nuclear forces could quickly enhance the relative weight of third party nuclear arsenals and open the prospect that unconstrained growth in those arsenals would not be overmatched by the superpowers.

It is currently assumed that a number of Third World states (India, Israel, South Africa, Pakistan) either possess nuclear weapons or have come within range of developing them. Among the incentives to nuclear acquisition may be the difficulty of matching a rival's conventional force developments, due to economic weakness (North Korea) or demographic disadvantage (Pakistan).

In addition to affecting the U.S. and Soviet Union, nuclear weapons proliferation will have an impact on the countries who acquire nuclear–armed neighbors. The diffusion of this kind of power may destabilize certain military balances and stabilize others. To the extent, for example, that Egyptian calculations of the outcome of a war with Israel are based on the assumed presence of Israeli nuclear weapons, Egyptian acquisition of nuclear weapons might create a situation in which it was believed that nuclear weapons would deter each other, perhaps making the world safer for non–nuclear Middle East wars. In other areas, the diffusion of nuclear weapons might make the balance more stable, if the process of acquiring nuclear weapons did not itself lead to preventive war.

The nuclear balance among new nuclear powers will be affected by local strategic defenses. Countries with advanced surface–to–air missile defenses may try to give them antitactical ballistic missile capabilities when faced with an enemy with nuclear armed ballistic missiles. Countries other than the U.S. are already designing the next generation of surface–to–air missiles with dual capabilities against aircraft and tactical ballistic missiles. In an environment in which the number of ballistic missiles is small, active defenses against them could become a crucial part of the military balance.

Chemical weapons represent one case of proliferation of military technology that deserves special attention. The development of chemical industries for unexceptionable peacetime uses has already given many countries in the Third

World the ability to mass produce toxins usable in war. Pesticide factories, for example, can be converted to the production of nerve gases. The lessons military observers in the Third World may well be drawing from the Iran–Iraq war are that rudimentary chemical weapons can be effective on the battlefield, and that a country that does not have chemical weapons cannot deter chemical attacks by a country that does. The political and technological preconditions for the rapid proliferation of chemical warfare capabilities in the Third World now exist.

One other global shift deserves mention for its effect not on the power of other nations but for its effect on the U.S. That is the geographic migration of parts of the U.S. industrial base, resulting in an increasing dependence on foreign suppliers for components of U.S. weapon systems. According to a recent DoD report, "this issue has been studied extensively on an ad hoc basis, and anecdotal evidence abounds"; but "there are few, even moderately comprehensive studies of foreign–sourced components of key weapon systems." The extent and location of production capacity for weapons and their subsystems has important implications for U.S. mobilization capabilities and related policy issues, raising a requirement to protect sources of supply and means of transportation in the event of a protracted large–scale conventional war.

III. POSSIBLE SHOCKS OR DISCONTINUITIES

Strategic planners must consider important possible discontinuities even if they appear relatively unlikely, since it is unlikely that the future will be free of surprises. Attention to possible shocks can help planners make strategies more robust and identify actions that may reduce the likelihood of unfavorable shocks. The topics discussed above suggest the wide range of possibilities compatible with the trends discernible today. In addition, major discontinuities having relatively little to do with these trends may become of central concern to military planners.

A. HOW TO THINK ABOUT DISCONTINUITIES

Changes in a country's security situation can result not only from the gradual operation of long-term trends, but also from sudden shocks or discontinuities. The sections that follow will suggest several examples of such shocks, which can take several different forms.

Least likely is some radical change in the American polity itself. A serious threat to our political institutions--large-scale terrorism or insurrection--could in theory completely alter our conception of national security and the forces required to protect it. Even a less violent but major alteration such as a breakdown in the bipartisan consensus about the importance of Europe, for example, would change the range of options available to decision-makers.

A far more probable and familiar kind of discontinuity is a sudden, radical change brought about by events outside the United States--such as the rise of a uniquely powerful and aggressive leader (Hitler), a scientific discovery (such as that leading to the development of the atomic bomb), or a social upheaval (the Iranian revolution). By definition such shocks are difficult to predict. Future examples might be a social revolution in Mexico or the Philippines, a sudden collapse of the global banking system, or a Soviet breakthrough in some exotic weapons technology.

The combination of several separate discontinuities may have particular impact--for example, the collection of shocks from Soviet acquisition of nuclear weapons to the North Korean invasion of South Korea that produced in the early 1950s the American rearmament envisaged in NSC 68. A future example might be an American military setback in the Persian Gulf coupled with a crisis in NATO leading to a sharp increase in American isolationism.

Gradual changes that proceed past some break point that is not evident in advance, or that accelerate, may result in sudden discontinuities. An analogy

would be patterns of integration in housing: a slowly changing mix of population can reach a tipping point at which change becomes discontinuous. Though single external shocks are the most dramatic kind of discontinuity they are often those most susceptible to understanding and appropriate response. In the other cases, however, the seeming similarity of the present situation to that of the past may lead to slower perceptions of change and indecisive reactions to it. This is a particular danger for the United States, which operates with a set of national security policies, institutions, and assumptions over 30 years old.

For example, although the Soviet strategic defense program is a familiar fact of strategic life, its sudden acceleration could result in a very different balance than currently exists. Another example would be the question of U.S.–European relations, and the NATO/Warsaw Pact balance in the Central Front. It is easy to say, because it is so largely true, that the conventional balance in Europe has always been adverse, that U.S.–European relations have always experienced periods of mistrust and suspicion, that the nuclear guarantee has always had dubious elements. It is quite possible that these constants of our strategic posture in Europe will simply remain, neither worse nor better than they were 30 years ago. Yet a prudent planner will take into account the possibility that a steadily worsening conventional balance would, at some point, have radical consequences.

B. WESTERN HEMISPHERE CONTINGENCIES

The global military role played since 1945 by the United States has been facilitated by the absence of significant security threats close to home. This sanctuary has been eroded over the last 30 years, and may be seriously disrupted over the next 20 years. Although other Western Hemisphere contingencies could also be important and deserve study, developments in Mexico could have particularly far reaching effects on U.S. national security policies by creating an entirely new focus for U.S. efforts and resources. Political instability in Mexico could have substantial repercussions north of the border, while the establishment of a hostile regime in Mexico could introduce new military threats to the United States.

Conditions in Mexico make such upheavals conceivable, although the Working Group does not predict them. Interest payments on Mexico's huge international debt divert funds from economic growth. Since a 1982 financial crash, severe austerity measures have attracted public hostility. The ruling Revolutionary Institutional Party (PRI) has held power for the past 5 decades, but its severe domestic control policies and charges of political and financial corruption have damaged elite and public confidence in it, as the most recent presidential election indicates.

Various possible forms of internal Mexican disruption would pose problems for the United States. The PRI's attempt to maintain its rule against opposition from northern Mexico could result in civil war between North and South, or between right and left. Communist groups could capitalize on the unrest with disaffected peasants, unions, and students or even initiate a guerrilla war not unlike Nicaragua or El Salvador. Alternatively, a popular, Philippines-style uprising is not inconceivable.

Sustained violence or economic collapse in Mexico would flood the U.S. with refugees, creating a serious border control problem with delicate domestic political ramifications, and placing a major burden on U.S. law enforcement agencies. The pressing demand of the "Mexico problem" would consume a tremendous amount of Federal attention. Military forces might be required to seal the border, control violence in refugee camps, deter cross-border incursions, or otherwise guarantee American security.

C. ALLIANCE SHIFTS

What is most remarkable about the existing set of American and Soviet military alliances is their stability over the last 30 years. Since latent tensions within alliances can remain latent indefinitely, this report classifies major shifts in existing alliances as unpredictable discontinuities rather than as the likely result of broad trends.

The Soviet empire appears vulnerable to such shocks. Two important past cases were the break with China and the defection of Egypt. One possibility for the future is that one or more of the six anti-Communist resistance movements currently under way (in Afghanistan, Angola, Nicaragua, Cambodia, Ethiopia, and Mozambique) may be successful in displacing an existing Marxist-Leninist regime. Even more troublesome to the Soviet Union could be attempts by its Warsaw Pact allies to assert more independence. Political unrest in Eastern Europe has reappeared every decade or so, and has been contained by Soviet force or pressure. The same tendencies are likely in the future, with Eastern Europe's economic difficulties an increasing grounds for discontent. The Soviet Union's reformist rhetoric may foster some political uncertainty in Eastern Europe about what the Soviet Union will tolerate there, and may therefore encourage that region's interest in escaping Soviet hegemony. This effort may or may not be successful, but could pose new and perhaps controversial opportunities for Western policies. A Soviet crackdown could lead in Western Europe to a reassessment of Soviet intentions.

A Soviet rapprochement with China would be a far reaching alliance shift. Although such an event does not now appear very likely, the ideological disputes

of the past seem irrelevant now that both countries are promoting economic reform, and the two countries' territorial and foreign policy disputes are perhaps negotiable. But however unlikely a new Sino-Soviet alliance appears, its implications should be considered, given the widespread assumptions now made about China's role in balancing Soviet power.

The alliance structure the United States constructed at the end of World War II has proven extremely durable. Yet the very durability of these alliances, and most notably of our foremost alliance, NATO, may blind us to the possibility of changes that leave us suddenly disadvantaged. One can imagine, for example, the future success of West European political parties promoting either national neutralism between the U.S. and the Soviet Union, or a European, as distinguished from Atlantic, approach to security. The defection even of a small member could cause disruption to the alliance out of proportion to the country's own strategic importance. Disagreements over the seriousness of the threat or about defense spending or trade with the Soviet bloc, or ruptures between our allies (e.g., a Greco-Turkish war) could lead to such changes. One can also imagine a shift away from Japanese-U.S. security cooperation, provoked perhaps by Japan's increased relative power or by disagreements over economic issues or policy toward the Soviet Union or China. Rapid shifts in alignments are possible in the case of some smaller allies of the United States that may be subject to sudden changes in government--for example, departure from the Western camp of the Philippines, Egypt, Mexico, or Indonesia following communist or other (e.g., Muslim fundamentalist) rebellion. It is, finally, possible to imagine shifts in American alliances initiated not by our partners but by ourselves. As in the case of the Mansfield Amendment of 1971, it is conceivable that budgetary and international trade pressures, coupled with a vague sense that our allies are not carrying a fair share of the burdens of defense, would lead American politicians to advocate sharp reductions in American forces overseas.

Of course, favorable developments in U.S. alliance relations are also possible, resulting, for example, in the assumption of larger alliance burdens by the West Europeans or the Japanese while the common bonds of alliance relationships are maintained or even strengthened.

The chief task for strategic planners hoping to accommodate future shifts in coalition structure is to ask two kinds of questions. First, how dependent is our current strategy and force structure on the stability of our present alliances, and how easy or difficult will it be to adjust to the loss of key allies? Second, how might we exploit--and perhaps even facilitate--favorable changes in our opponent's coalition structure?

The existing military alliances are, of course, fundamentally structured by the threat posed to the industrial democracies by the Soviet Union. Whether or not some changes in these existing military alliances take place, the future security environment will probably become more complex as additional major powers emerge and play more independent roles. Whether new alliance relations will develop between those powers, and what their character would be, is unclear. It seems unlikely that a new alliance on the model of NATO would come into being among any of the major powers of the early 21st century. The major powers might be more inclined to deal with each other from a somewhat greater distance, finding areas of common interest for cooperation, uniting against possible common threats, but not unequivocally committing themselves to one another's defense. Whereas the United States has been accustomed to playing the lead role in its alliance relations, its participation in alliances or coalitions may take more varied forms in the future; for example, its role may be that of first among equals, rather than Chairman of the Board.

D. NUCLEAR USE

It is conceivable that the next 20 years will see the use of an atomic weapon in the course of a conflict; after all, a similar though lesser threshold has been crossed with respect to the large-scale use of chemical weapons. Nuclear proliferation will worsen the odds, and the process of proliferation itself could be dangerous; for example, states may attempt disarming attacks on new nuclear weapons facilities of their enemies, and the failure of such attacks could increase the possibility of limited nuclear weapons use. The proliferation of ballistic missile systems may increase the likelihood of some eventual nuclear use. In any case, the first use of nuclear weapons in combat since 1945 would represent a major discontinuity of an obvious kind.

Use of nuclear weapons would probably urgently reinforce the tendencies that result from proliferation of nuclear weapons possession: the contemplation of preemptive strikes against newly nuclear enemies; the cautionary effect on intervention against a nuclear power; the increased importance of strategic defenses; etc. New factors would begin to assume importance in the military calculations of regional powers. The side with the more efficient urban transportation network and the superior evacuation and civil defense capabilities may be rated as much more powerful than was the case in the pre-nuclear calculations, for example. The country that had managed to acquire or develop an air defense network might find that part of its force emerging as a much more important factor in its military calculations.

If nuclear weapons were used successfully in a regional war to win a major breakthrough or compel an enemy's surrender, that result could remove most of

the inhibitions that other states had about acquiring nuclear weapons, and a rapid, general proliferation of nuclear weapons could occur, perhaps along with urgent efforts to improve defenses against the delivery systems for those weapons. At the same time, efforts to curtail nuclear proliferation would be invigorated, as would the political strength of antinuclear views, at least in democratic countries. Nuclear weapon use that killed thousands of civilians but had little military impact--because of "fizzles" or poor accuracy or because the battlefield targets were dispersed and dug-in--could lead to a rapid, even if inaccurate, downward revision in estimates of the utility of nuclear weapons.

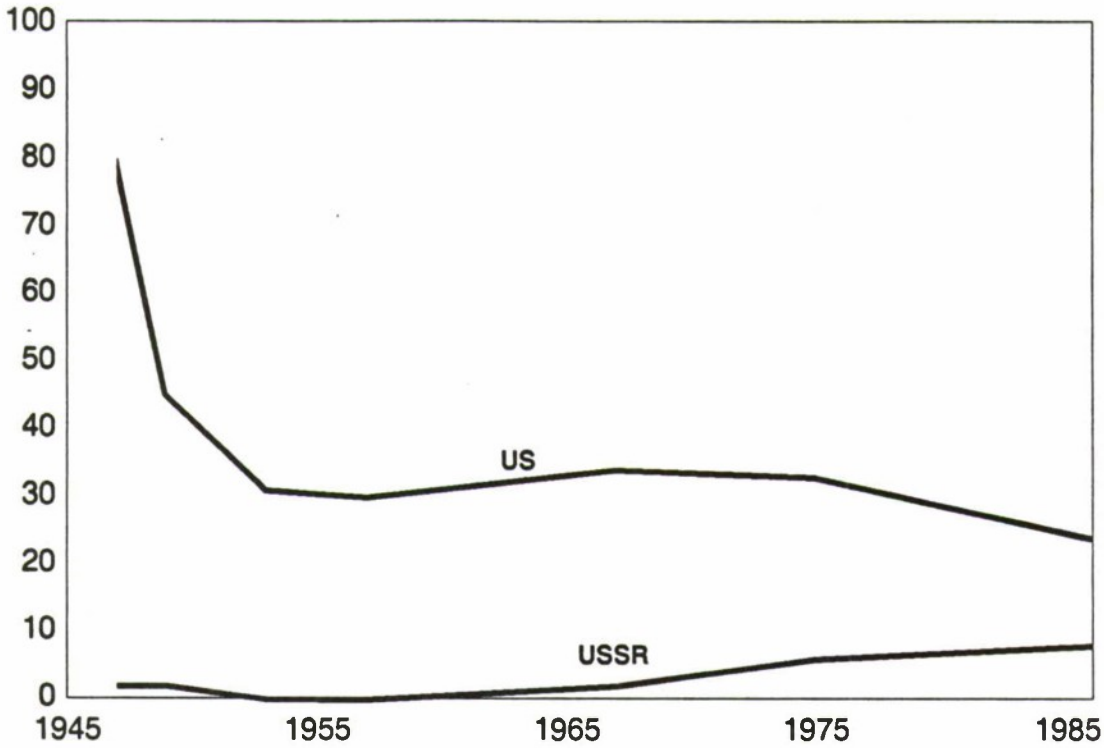
The most probable general effect could be an increase in the perceived level of difficulty of military intervention by the United States or the Soviet Union in regional conflicts once it had been proven that nuclear weapons could be used in a theater by local powers. The ability to coerce or act against a minor nuclear power might come to rest on the perceived willingness of the United States or the Soviet Union to intervene in some way against any state that used nuclear weapons. In that kind of world, the Soviet Union might enjoy an advantage over the United States.

E. U.S. LOSS OF BASES

There has been a general trend toward the reduction in the number of military bases and installations that the United States controls or to which it has access. The numerical decline is due in large part to a streamlining of our base system for the sake of efficiency, partly made possible by changes in our forces (see Figure 11). Political developments have deprived us of major bases or facilities in Libya, Ethiopia, Vietnam, Aden, and Iran. But the United States has retained access to major facilities and bases in Japan, Australia, South Korea, and the Philippines, as well as in Iceland, West Europe, and Southeast Europe. Our ability to use those bases for contingencies other than a major war with the Soviet Union has decreased somewhat because of host nation sensitivities. However, the ability of the United States to project power up to the borders of the Soviet Union has relied heavily on access to those bases. Bases are important to our ability to help protect the country in which they are located (as well as other countries in the region), and to perform strategic missions such as communication with reconnaissance satellites, prepositioning of rapidly deployable equipment, or recovery of strategic bombers.

Two changes may occur if we lose access to bases. First, more money for systems that can perform those missions without overseas bases may be required. Our forces' flexibility and mobility would become even more important, and technological innovation might create or enhance systems with those attributes.

FIGURE 11: OVERSEAS THIRD WORLD COUNTRIES
WHERE SOVIETS AND U.S. HAVE BASES OR FACILITIES



Excludes Soviets in Afghanistan, Mongolia

More communications relay satellites and more systems with ultra-long ranges may be necessary, which may force a restructuring of our Navy and Air Force.

Second, in the days before the United States possessed overseas bases, its military foresaw the need to seize and hold forward bases from the enemy or other powers in the event of war. This was the genesis of the modern amphibious mission of the Marine Corps. Loss of bases could lead to a resurgence of analogous forces. Once again, this could lead to the need to restructure our armed forces.

F. U.S. SETBACK OR DEFEAT

Another significant shock would be an American military defeat, such as the collapse of a defensive position or the dramatic failure of an expeditionary operation. Apart from the direct results of the defeat itself, such an event could have broader consequences. Other countries might reevaluate American power, creating new threats in areas where American power is now assumed to be a potent force. Increased tensions between civilian and military leaders in the United States could be another result. Another consequence might be a

reassessment of the utility of certain kinds of weapon systems or forces. For example, the tactical failure or destruction of any major national military asset might change our assessment of the effectiveness of our forces, with large implications for how we perceive the global balance of power.

The risk of U.S. military setbacks will be increased by relative improvements of some Third World forces. The diffusion of military technology, the proliferation of advanced hardware sold by many countries, and the inherent capacities of dictatorships for sudden action have made such states far more formidable than in the past. U.S. political sensitivities to the plight of prisoners of war and reluctance to pursue military operations that are domestically divisive or where victory appears remote may mean that a major setback would lead to disengagement, not redoubled efforts.

U.S. concern to avoid a military defeat or military involvement could result in a different sort of setback. A regional war in which the United States remained uninvolved could affect global perceptions of the ability of the United States to intervene successfully on behalf of major allies or major U.S. interests, and thus effect a major discontinuity in the security environment.

G. TECHNOLOGICAL SURPRISE

Another possibility is military-technological surprise. The risk continues to exist that the Soviet Union, while trailing the U.S. in many technologies, will achieve surprises in highly visible or influential areas because of the focus of their efforts. For example, their steady attention to space launch capabilities puts them in position to lift such large payload weights that they may be able to achieve some military space "spectaculars." They might achieve some major improvement in antisubmarine warfare. They may also surprise us by introducing new technology faster than we may have anticipated, or using technology in new and unexpected ways. The Soviets have been very astute in recognizing the value of using changes in military tactics or operational practices to enhance their own technological advantages or to offset those of the West.

The Soviets, however, are not the only source of surprises. Militarily valuable technology is becoming increasingly dispersed throughout the world. Ballistic and cruise missiles are being developed by several nations; various states are gaining experience in building the electronic components of communications, electronic warfare, intelligence, and smart systems; and nuclear, chemical, and biological technology is present in many countries, including radical ones. Our expectations about the restraints and deterrents that govern the use of these systems have been shaped by the record of a small number of countries during a relatively brief and peaceful period of history. Different ways of thinking about war and about

highly destructive weapons may well characterize at least some future possessors of such weapons, creating a potential for us to be surprised by their policies in acquiring and using these weapons.

H. ECONOMIC SHOCK

Another conceivable, although improbable, shock to the future security environment would be a severe and protracted disruption of the international economic and financial system. For example, a sharp increase in protectionism in the U.S. could provoke a massive liquidation of foreign holdings of U.S. Treasury bonds, corporate equities, and other assets. Interest rates could be driven once again to the double-digit levels of the 1979-81 period, and the resulting stock market "meltdown" might substantially exceed the 23 percent drop of October 19, 1987. In turn, higher interest rates might precipitate default on much of the outstanding trillion dollars-plus Third World debt. Such a chain of events could result in a sharp recession in the U.S. economy: high unemployment, declining GNP, and sharply reduced foreign trade. In the process, a global depression might ensue if and as foreign countries sought to protect their own markets, to freeze capital movements, and to pursue autarkical policies on a regional or bloc, if not national, basis.

This scenario is unlikely for several reasons: policies are available to forestall or reverse this progression; the major economic powers have strong mutual interests in avoiding such a collapse; and recent economic and financial trends seem to be moving in generally more favorable directions than those described above. But if there were a global economic depression as protracted as that of the 1929-1937 period, the future security environment could change drastically. The U.S. alliance might break, rather than shift, as alliance members engaged in various forms of retaliatory protectionism and capital controls. West Germany might become effectively neutralized, as well as increasingly oriented toward economic relations with the East. And the U.S. might become increasingly isolationist. Defense budgets and military research and development might be even more sharply constrained, while the possibilities of military conflict might increase: conflict in the Third World with or without resumption of Soviet expansionism; perhaps even military conflict with former allies; and possible conflict with the Soviet Union.

It goes without saying that we want to avoid such an environment. But if it came about, the task facing U.S. security planners would be one of trying to minimize losses: to consider which force structures are more and which are less compatible with such a "fortress America" environment; what longer distance deployment capabilities are necessary as access to forward bases declines and

feasible as standoff, longer range technologies evolve; and what forms of cooperative planning and operations can be developed with individual countries or groups of countries (e.g., the "Northern Tier" or "Southern Tier" of Europe, or with Pacific Rim countries, or others) with whom we have convergent interests, notwithstanding the absence of formal alliance relationships.

In sum, the future security environment--particularly 20 or more years from now--will probably be very different from that of the past. It is not easy to draw up a list of specific implications and issues, partly because many uncertainties remain even though some of the main characteristics of the next 20 years can be anticipated. In any event, changes toward the latter part of this period are likely to require the U.S. to revise its way of thinking about strategy, concepts of military operations, and force structure. New contingencies and problems will require the development of new frameworks of analysis and strategic paradigms, and place familiar issues in a different perspective.

For the next few years, familiar issues will predominate, but looming ahead lies a different security environment. For the next decade, the basic situation is a world with two dominant powers, and a larger number of medium size powers. Twenty years from now there will be three or four or possibly even five major powers. A more integrated, cohesive Europe could be one such power, although the prospects for such a development are unclear, notwithstanding the planned economic integration of Europe set for 1992. What is most needed in the next few years is more thinking about the nature of the multipower world that probably lies ahead, imaginative analysis of the likely behavior and strategies of the other major powers, and clearer formulation of the new, plausible scenarios and contingencies to be considered.

None of the countries for which above average economic growth is projected is an ally of the Soviet Union. Other things being equal, the relatively rapid growth of the East Asian countries (Japan, China, South Korea, Taiwan) and of some others (Turkey, Brazil) should make them more resilient against Soviet or Soviet-backed threats. China and Japan in particular are situated to become increasingly potent counterweights to Soviet power. Given a continuation of roughly their current policies and orientation, the growth of these countries is a favorable change in the U.S.'s security environment.

But this prospect is clouded in two respects. First, richer nations are likely to feel more independent and less susceptible to U.S. influence and may pursue policies less congruent with our own. China's arms sales activities are already an example of how a nation with which we have a substantial common strategic interest can nonetheless pursue policies that diverge from ours in other areas. Whether Japan's investments and technology transfer policies would accord with U.S. strategic objectives as Japan continues to grow economically is another important example. More generally, we can expect to have less influence even over powers with which we share common strategic interests as those powers

become stronger. A more politically united and therefore relatively more powerful Western Europe would also tend to act more independently.

More radical changes might also result from the rise of new powers. Shifts in economic and military stature may lead to changes in policy by the rising powers or provoke the hostility of other powers. A militarily more powerful China, for example, might become engaged in wars with traditional enemies (India, Vietnam). While such regional warfare might not directly affect U.S. security, it might well affect the calculations of other countries in the region and lead to shifts in the balance of power that could eventually affect U.S. security.

The Soviet Union is likely to remain in the near term the formidable military-technological competitor it has been for the past several decades, but its economic weaknesses make its long-term prospects a matter of great uncertainty. Restraints or cutbacks in Soviet military spending appear possible, but have not yet become manifest and are unlikely to be major except perhaps in conjunction with arms control agreements. Such spending is unlikely to grow substantially, if that counts as restraint. Soviet policies that promise openness and even "democratization" at home and more tolerance for diverse policies in Eastern Europe may prove unsettling to the Soviet empire. More fundamentally, can Soviet economic reforms prevent a protracted relative decline in Soviet economic and technological capacities? Do the failure in Afghanistan and the self-incrimination of a stagnant economic system manifest a decline in the regime's ideological and territorial drive? These uncertainties not only obstruct a confident description of the future security environment; the uncertainties are likely to persist and be an important feature of that environment.

Political stability is unlikely to characterize the Third World, as neither economic growth nor the passing of anticolonialism as a source of conflict appears to have exhausted the grounds for political unrest. Rapid population growth and urbanization, economic difficulties, ethnic and religious conflicts, AIDS, etc., remain potent sources of turmoil. Such instabilities have in the past appeared as opportunities for Soviet penetration, and may remain so in the future. But they may pose other problems as well, even where the outcome of a conflict between regional enemies appears to have no direct importance for the global balance of power or for U.S. interests. The wider proliferation of advanced weapons and particularly nuclear weapons will make most local wars matters of broader concern. The world's larger powers may find it impossible to stand aside from conflicts in which the use of nuclear weapons appears plausible. Intense and protracted conventional wars may also disrupt trade; terrorism may affect U.S. citizens; and some wars may involve the sympathies of the U.S. population (e.g., South Africa, the Middle East, Mexico).

Western Europe's defense programs are unlikely to show substantial increases, due to modest economic growth, constrained manpower pools, and the welfare costs associated with aging populations. Soviet intentions may be interpreted hopefully, and the pace of Western military innovations slowed.

For the United States, these trends may undermine the relative clarity of our current strategic situation. Our long-term military competition with the Soviet Union may enter a new technological era, as both sides become capable of innovations that may fundamentally alter the nature of warfare. But economic stringencies on both sides, and U.S. political uncertainty in assessing Soviet intentions and prospects, will (perhaps asymmetrically) constrain (but not prevent) the exploitation of these new technologies. The increasing power of countries traditionally opposed to the extension of Soviet power may prove a valuable counterweight to the Soviet Union, but the increasing self-sufficiency of those countries may make their cooperation with us somewhat more distant, and increase their opportunities to pursue new ambitions of their own. And there may be a variety of large and small regional conflicts where Soviet global expansion is not at issue. Our stake in these conflicts may be murky, even as our instruments for influencing them may be limited. But some of these conflicts could involve major powers possessing modern arsenals and chemical and nuclear warheads, and threaten major shifts in regional balances of power. Under such circumstances, it may become more difficult for the U.S. to assess its military requirements, as

- The power of potential coalition partners grows increasingly important, but their orientation increasingly uncertain
- The Soviet threat that has been our central preoccupation may diminish for some period (and perhaps reemerge, stronger, at a later date)
- Military contingencies we have not given much attention to in the past may require difficult judgments about what U.S. interests require and what U.S. capabilities would be effective.

Some key issues that deserve analysis and policy attention are described below.

A. ASIA AND OTHER NEW CONTINGENCIES

The favorable economic prospects of China, Japan, and other East Asian countries make improvements in their military capabilities likely (sooner or later),

a development generally favorable to the U.S. But the international orientation and policies of these countries will be of increasing concern to us. We will face questions of how to preserve favorable relations with them, what kind of military support to provide in peacetime, and what role to play in the event of war. For example, what would be the U.S. stake, and what role should we play, in a Soviet–Chinese war (or a war between China and Vietnam or China and India)?

In general, how should U.S. force development and budgets be allocated between preparation for the currently canonical European contingency and other, probably more likely, contingencies? What are our stakes, and what military and support capabilities would be most useful, in those other contingencies? For example, one implication of potential contingencies in Asia is the need for our forces, weapons, and command, control, communications, and intelligence to be versatile; in particular, they should be suited to the long ranges and relatively sparse base structure of the Pacific region.

Given likely constraints on U.S. military resources, should and can we shift the security burden in Europe, Asia, and elsewhere on to other parties? Can we design new approaches to burden–sharing to encourage Japan to assume responsibilities more commensurate with its economic and technological capabilities (by bearing some of the costs of SDI R&D, or of other militarily useful basic science and technology programs)? How can a redirection of U.S. military resources away from the European theater be managed so as to encourage, or at least not discourage, enhanced West European defense efforts?

B. THE STRATEGIC DISPOSITIONS OF THE RISING POWERS

A number of countries that will become increasingly important in the security environment are relatively neglected by U.S. analysts, certainly in comparison to the attention devoted to the Soviet Union. What is needed is not really the near–term execution of an ambitious study of these future powers, but the development of an intellectual infrastructure capable of interpreting this new world as it emerges. Programs are needed to recruit young analysts and provide them with language training and the opportunity to develop knowledge of Japan, China, Brazil, India, and other future regional powers. We need to understand the strategic culture of these countries, how their political and military elites view their nations' place in the world, the history of their military organizations and traditions, and their characteristic approaches to the use of force. We should also try to understand how trends in economics, demography, ideology, and technology will affect these countries and their military and alliance policies.

The economic integration of Western Europe planned for 1992 could also lead to the creation of a new major power, with political dynamics and a strategy

unlike the Europe of today; this, too, would become an important subject of study.

C. POLITICAL AND ECONOMIC RELATIONS WITH THE SOVIETS

Widely different developments are possible for the Soviet Union--ranging from major reductions in Soviet active forces to free resources for economic revival, to persistent economic stagnation that constrains military modernization, to successful economic reform that positions the Soviets to compete effectively with the United States in the military-technical revolution they anticipate. Moreover, different sets of Soviet circumstances might appear in succession, not simply as alternatives, making the development of U.S. strategy more difficult.

Soviet economic and technological difficulties make them eager to acquire Western capital, technology, and management skills. This interest, or the desire to restrain competition in military areas where they feel themselves at a disadvantage, may again be promoting a Soviet "peace offensive" that courts a favorable Western opinion of Soviet intentions. The announced Soviet withdrawal from Afghanistan, for example, may persuade many in the West that the Soviet Union has turned away from military imperialism in pursuit of domestic reform. Or, from a different line of reasoning, Western opinion may judge that Soviet economic shortcomings make them a less formidable military competitor than we have assumed. Such assessments may have an influence both on Western military budgets and on Western policies regarding trade, credits, and technology control.

One issue for the U.S. is whether Soviet economic problems are seen by them as requiring substantial arms reductions or arms control, either by formal treaty or by mutual restraint. This is an important issue regardless of whether it is a real possibility, or only seems so to hopeful segments of Western opinion. Second, assuming the fundamentally competitive character of our relations with the Soviets continues, how should and can the U.S. control the flow of capital, technology, and management skills to the Soviet Union, given the potential importance of such flows to the future Soviet competitive posture, and given the incentives of Western countries to sell these goods to the Eastern bloc?

While it is not clear whether Soviet policy in the near term will pursue new opportunities to project power to the Third World, the activities still under way supporting initiatives undertaken in the 1970s and the possibility of further undertakings at some later date make it important that the U.S. develop an improved strategy for countering this Soviet effort.

The Soviets may see power projection using a variety of instruments as a low-cost means of maintaining international influence and ideological credibility,

particularly if economic and technological limitations affect their overall military stature. The U.S. strategy for countering Soviet power projection relies on security assistance programs, aid to anticommunist insurgencies, and the implicit threat of U.S. force deployments in case of dire necessity. But Congressional limitations on these approaches, and the likelihood that we are already extremely reluctant to commit our own forces, make the success of our strategy questionable over the long term. Some shock where the U.S. is revealed to be unable or unwilling to thwart Soviet or Soviet-backed advances could have broad effects not only on the dispositions of Third World regimes but on the cohesion of U.S. alliances.

How can the U.S. counter Soviet power projection activities? Can we devise ways of sharing the costs and responsibilities of this task with some cooperating Third World countries? Can new technologies be exploited for U.S. employment or to aid local or cooperative forces in such contingencies?

D. NEW MILITARY TECHNOLOGIES

New technologies that make possible weapons of great range, penetration, precision, and effectiveness pose both an opportunity for the U.S. to gain competitive advantage, and a necessity of devising operational and technical solutions to our own vulnerability to such weapons.

A first task is to try to understand the broad implications of emerging military technologies. Soviet military writings reflect an effort to assess the nature of an impending "revolution in military affairs." The United States must undertake its own such analysis, in order to make appropriate changes in our operational plans and doctrine, organization, and command structure. We should try to understand how new technologies will affect the pace of war, the requirements for industrial support, the strategic value of different geographical areas, the best distribution of roles and missions among the services, and many other issues. Typically, the United States assesses the impact of particular technologies on a system-by-system basis. What is needed is a far broader analysis.

In addition to this intellectual task, new technologies will pose major strategic choices for the U.S. Western advantages in key technologies should permit U.S. competitive strategies that pose problems for Soviet military planners--a prospect that Soviet writings already express concern about. At the same time, the U.S. and its allies may find it politically difficult to sustain technological competition against a competitor who comes to be regarded as peaceable or in decline. The prospect of tightly constrained defense budgets in the U.S. and Western Europe, and the normal tendency to protect funding for ongoing projects and postpone funding for systems not yet begun, may limit the degree to which the U.S.

deploys advanced systems. Budget constraints also make more urgent U.S. exploitation of its competitive advantages in this area.

Moreover, because enemy precision attack systems may make the survivability of concentrations of forces highly problematic, technical or operational innovations (e.g., active defenses, deception, or employment of very dispersed or long-range forces) will be necessary even to sustain current capabilities. We may also need to preserve a technological edge for power projection in Third World areas where the military technology of the 1970s and 1980s has spread to a much wider range of countries.

The emphasis to be given to advanced weapons, the timing and scale of their development and deployment, and the organizational and operational changes to make best use of them form a key set of strategic choices for the U.S.

Development of advanced strategic defenses exemplifies these issues. The United States must think through not only the budgetary consequences of moving to a balance of offensive and defensive strategic nuclear systems, but the organizational and doctrinal aspects of this problem as well. SDI will require a sizable wedge of the U.S. budget, and a serious effort to build defenses against air-breathing threats and to harden key installations will mean additional costs. Given that the defense budget is unlikely to grow in the near term, or to grow sharply in the medium-to-long term, we must face the hard decision of how much to fund such efforts, what other military activities to cut, and how.

E. U.S. MOBILIZATION BASE

What policies should be pursued to preserve or improve the U.S. military-industrial base and mobilization potential? Our neglect of these subjects has been guided by the assumption that a major war would be relatively short, and feature nuclear attacks on homelands that would make new military production largely infeasible. But Soviet planning now appears to focus increasingly on scenarios where conventional war would be global in scope and very protracted. The U.S. is unlikely to try to stockpile what would be needed for a war lasting a year or more, so the wartime capacity of our industrial base would become much more important.

Moreover, our practice of building military systems using many components produced overseas, particularly in Asia, needs to be considered in light of longer war scenarios. Should the U.S. make efforts to retain domestic suppliers of the subcomponents of our military systems or rely on our ability to secure sea lanes in wartime? How can we preserve the vital elements of our military industrial base without fostering protectionism and uncompetitive domestic industries?

Greater reliance on components manufactured abroad will also have to be considered in development of our war plans, since protection of access to these sources of supply early in a conflict may be an essential objective. We may need to protect sea and air lanes to secure vital imports as well as to permit force deployments.

Mobilization will also become a more salient issue if a period of reduced tensions results in smaller standing forces. Our relative ability in a peacetime mobilization race, such as took place between England and Germany in the late 1930s, would be important in preparing for war, or even preventing it, in a period of renewed tension.

F. MILITARY USES OF SPACE

What is the U.S. strategy regarding the military uses of space? This requires planning not only for the requisite lift capacity, but for the missions we want our space systems to perform. The Soviets appear to have thought more broadly about the military use of space and, in particular, have not neglected its potential for offensive military systems, a subject the U.S. has shied away from.

G. U.S. BASING STRUCTURE

If the U.S. loses, or chooses to leave, bases in the Philippines, Spain, Greece, or Japan, what geographic or technological options do we have to replace these facilities or to do without them? A comprehensive audit of America's basing infrastructure is needed, with a view not merely to economy, but to strategic demands and the politics of basing issues, abroad and even at home. Our tendency has been to look at bases on a case-by-case basis: what is needed now is a more comprehensive look, global in geographic outlook, and looking ahead several decades.

One key issue is how new military technologies will tend to change (or could be exploited deliberately to change) the number, size, location, and function of the bases we need. Possible changes include constructing new overseas bases, expanding or modernizing existing ones, building larger bases in the continental U.S. for the projection of intercontinental conventional forces, mobile basing at sea, and increased use of space.

APPENDIX A: ECONOMIC AND MILITARY PROJECTIONS

This appendix describes the methods used in estimating economic and military trends for the period 1950 through 2010 for 15 key countries: United States, Soviet Union, Japan, China, United Kingdom, France, Federal Republic of Germany, Turkey, India, South Korea, Taiwan, Egypt, Brazil, Mexico, and Argentina. The initial discussion is confined to the general theoretical framework applied to all of the countries. In some cases, further adjustments were made because of data limitations or for other reasons. More detailed explanations of these adjustments, and of the specific data sources used for each country, are presented in the individual country sections of this appendix.

METHODOLOGY

Economic Trends

In order to depict the gross magnitude of impending economic changes, GNP estimates for the 15 countries have been derived from data and judgments concerning recent and pending changes in rates of capital formation, employment, and productivity. No single indicator suffices to convey the trend of an economy over time, still less to compare and size the performance of a large number of economies at any given point in time. Growth in real national product is clearly one salient indicator, but other ones are important and relevant, depending on the purposes for which the comparisons are intended. Other relevant indicators include capital flows, exports and imports, per capita income, domestic capital formation, resource allocations for research and development and science and technology, international holdings of assets and liabilities, and demographic changes.

The Working Group's initial evaluation of major economic trends focuses on gross national product because GNP is probably the most useful single indicator of economic size for making comparisons for a large number of countries over long periods of time.

The estimates from the present to 2010 employ the same methodology used in reestimating the actual GNP figures for the 1950–86 period; thus, the backward-looking and forward-looking series are intended to be consistent with one another.

The 15 countries covered currently account for more than two-thirds of the global economic product, as well as the overwhelming preponderance of global

military power. While none of these estimates is intended as a precise forecast, there are additional uncertainties surrounding estimates for the Soviet Union and China. Because the uncertainties relating to the Soviet situation are especially large, several alternative Soviet estimates have been made.

The basic model used in the estimates makes the simplifying assumption that output (Gross National Product or Gross Domestic Product) can be represented as a Cobb–Douglas production function. The function specifically assumes constant returns to scale, two factors of production – capital and labor, and Hicks–neutral technological change. Equation (1) shows the functional form of the model:

$$GNP = C * (EXP(a*t)) * (K)^{b} * (L)^{1-b} \qquad (1)$$

where

C	is a constant
a	is the rate of technological change
t	is years elapsed since the base year (1950)
b	is the share of capital in GNP
K	is the index of capital input in a given year
L	is the index of labor input in a given year.

The indices of capital input (K) and labor input (L) were estimated for each country. Measurement of both indices involves certain conceptual issues that are not addressed in the study.*

The Working Group used these simple measures because its aim is to compare differences among nations, rather than to make precise forecasts of their individual GNPs; the simplified measures are less likely to affect relative GNP differences than they are to affect the GNP estimate of any individual country.

The capital stock in a given year is calculated by adding the depreciated sum of all previous investments and the new investment in the given year, as shown

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* Capital services are difficult to estimate. Gross capital stock is the present value of future services that the capital stock will provide. If the lifetime of the capital stock is long, and the depreciation rate is constant among its various components, then the market value or the "net capital" measure serves as an appropriate proxy for capital service input. Or, if the lifetime and depreciation rate are constant among the various components of the capital stock, the "gross" measure is an appropriate proxy. However, uncertain equipment lifetimes and technological obsolescence make the assessment of input of capital services difficult. To keep the analysis simple, we use the gross capital stock as a proxy for the capital service input. Similar problems are encountered in calculating a labor input index. Labor can differ by hours worked, individual worker efficiency, educational level, and so on. These differences exist at each point in time, over periods of time, and across countries. In any event, for most countries such detailed data are not available, so gross numbers of persons employed were used.

by equation (2). New investment in a given year is a function of the GNP in that year, as indicated in equation (3).

$$K_t = (1-d) * K_{t-1} + I_t \qquad (2)$$

where

K_t is capital stock at time t

K_{t-1} is capital stock at time t–1

d is the depreciation rate

I_t is new investment in year t

$$I_t = s * GNP_t \qquad (3)$$

where

s is the share of GNP devoted to investment in year t.

In this formulation, the capital stock must be known for at least a single year to provide a benchmark value from which the whole stream of capital stock numbers can be generated. Except for the United States and the Soviet Union, total capital stock figures for a specific year were not generally available. To resolve this problem, a ratio of capital stock to GNP in 1950 of about 2.5 was assumed for each of the fifteen countries, based on the general experience of the United States and other countries, with modifications based on country-specific data.

The index of labor input was calculated as the ratio of total employed persons in a given year and employment in the base year, i.e., 1950. The parameters *a* and *b* in equation (1), representing technological change and the capital share in GNP respectively, were estimated from the country-specific data for several of the countries, while in other instances these parameters were drawn from other sources and from prior development research.*

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* In general, it appears that the share of capital in GNP declines as nations industrialize. For most developing countries the capital share is around 0.45, while for the industrialized nations it is generally 0.35, but may be as low as 0.25. In the present analysis to retain consistency, it is assumed that the share of capital in GNP for the developing nations is 0.45, while for the developed nations it is 0.35. For a good overview, see R.M. Solow, "Technical Change and

Military Trends

Two gross indices were selected to provide a simple and reasonably comparable basis for assessing the aggregate military status of each country: total annual military spending and military capital stock for each year of the 1950–2010 period. Although these indicators are important and useful, they ignore numerous other major influences on military capabilities, including leadership, training, morale, logistics, communications, and so on.

To estimate military spending, explicit and documented assumptions were made for each country regarding the fraction of GNP devoted to defense spending in the past, at present, and in the future. Prior and current spending shares accord with actual experience. The future spending share was either assumed to replicate this pattern or was adjusted to accord with intended or anticipated changes in particular countries.

Measurement of the military capital stock presents more complex and difficult theoretical and empirical problems. Among these difficulties are the following: first, the services provided by military equipment are difficult to define and quantify; and second, the same piece of equipment can provide varying levels of effective service depending on the type of conflict, terrain, adversaries, allies, and other contingency-specific circumstances. Our methodology measures the value of the military capital based on procurement cost. This implicitly represents the value of services that a particular piece of equipment will provide, relative to other procurements, averaged over the possible (but unexamined) scenarios in which it is expected to be used.

A further difficulty in measuring military capital relates to the possibility of accelerated obsolescence resulting from the technology embodied in an adversary's military capital.

Additional empirical problems arise in determining what to count towards the military capital stock. Part of military capital budgets is devoted to construction and procurement of civil-type items like office equipment, appliances, and amenities. Whether to include or exclude such items depends on the question being asked.

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the Aggregate Productivity Function." *Review of Economics and Statistics* 39, no. 3 (1957): 312–20; E. Domar et al., "Economic Growth and Productivity in the United States, Canada, United Kingdom, Germany and Japan in the Post War Period." *Review of Economics and Statistics* 46, no.1 (1964): 33–40; and J.W. Kendrick and B.N. Vaccara, ed., *New Developments in Productivity Measurement and Analysis*. The University of Chicago Press, 1980.

Generally in this analysis, the military capital stocks of the respective countries were calculated using gross currency outlays for military procurement (principally weapons procurement where it could be separated from total procurements) and construction (covering barracks, airfields, communication facilities, and other structures). The methodology is similar to that applied to civilian capital stock described previously in equations (2) and (3).

As with the civilian capital estimates, the military capital estimation requires a benchmark estimate for at least a single year to enable the entire series to be generated. In the absence of this benchmark figure, two approaches were taken. For some countries, a starting value for the military capital stock in 1950 was estimated based on the amount of defense spending devoted to military investment in that year, and building up the subsequent years' estimates by adding new investment and depreciating the accumulated military capital stock. For other countries, the military capital stock in 1985 was estimated from the countries' inventories of military equipment scaled to those of other countries in the sample; in this case, estimates for the earlier years were built up by subtracting each prior year's new military investment and adding depreciation from that year's existing capital stock.

Looking backward from 1985, the trend in military capital can be estimated by assuming the estimate for 1985 to be accurate, and generating backward the capital stock figures for the earlier years from the corresponding military investments in those years and a different depreciation rate.

To determine suitable depreciation rates for the forward and backward directions, this method was applied to the capital stock data for the United States, which is available for all prior years. An annual depreciation rate of 3.5 percent in the forward direction, and 4.5 percent in the backward direction, gives a good approximation in the U.S. case. These rates, or close approximations, were applied to other countries as well.*

For most countries, data were not available concerning the exact proportion of the defense budget devoted to military investment. In these cases, assumptions

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* Two exceptions are China and India for the 1985–2010 period. The rate used for China was 7.5 percent because military modernization now is the last of China's four "modernizations." By the 1990s and into the next century, it is expected that substantial replacement of the Chinese military capital stock will begin and that the rate of retirement will accelerate. For India, a 3.5 percent rate was used for 1985–2010. This lower rate was believed justified because, while the Indian military is modernizing its equipment, available sources suggest a markedly low rate of retirement is likely to be maintained. The military capital stock figures generated by the process described in the text were judged subjectively for their reasonableness based on data and experience pertaining to the various countries.

were made based on their similarity with other nations whose corresponding figures were known, e.g., the proportion of defense spending devoted to military investment in South Korea was assumed to apply to Taiwan, as well.

In making the estimates for the 1987–2010 period, we used military investment shares in total defense spending, and depreciation rates based on prior experience, or on adjustments of prior experience based on judgments relating to the individual countries. For the 1987 through 2010 estimates, this analysis also assumes that each country's military spending decisions are independent of those of other nations, i.e., reactive effects were not modeled.

Currency Conversion

Most of the trend analysis was initially conducted in the separate national currencies of the countries in the sample, and subsequently converted to constant price dollars, generally at the 1980 purchasing power parity rates. There are some exceptions to this procedure (e.g., Argentina, Brazil and China) for which some of the available historical data were already in dollars. In some other cases (e.g., South Korea), exchange rates were used for the conversions. The procedure used for each country is described in more detail in the following sections of this Appendix.

The currency conversion raises another question concerning the appropriate rate to use, as between the prevailing exchange rate or a suitable purchasing power parity (PPP) index. The PPP index was generally regarded as preferable.*

In general, the PPP index is more appropriate for converting GNP in national currencies to dollars, because it better reflects the real resource parities among currencies unaffected by short term changes in capital movements and financial expectations. Purchasing power parities thus provide a better basis for comparisons to be made among the economies of different countries than do foreign exchange rates. However, in the case of military capital stocks, the appropriate rate could differ from both the exchange rate and the PPP index because some military capital is procured at costs reflecting domestic prices (construction, indigenously manufactured equipment, etc.), while other military capital is procured at prevailing dollar exchange rates. Moreover, some military capital may be procured at prices that involve commodity offsets and associated transactions, which further obscure the actual conversion rate implicit in the acquisition.

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* The PPP rates are taken from R. Summers and A. Heston, "Improved International Comparisons of Real Product and its Composition: 1950–1980." *Review of Income and Wealth* (June 1984): 207–262.

The currency conversion process thus warrants further caution in interpreting the results.

ARGENTINA

Data Sources

For the years 1950–79, the GNP data were taken from the *Statistical Abstract of Latin America* (SALA), Volume 24, Table 3324. Real growth rates for GNP, for the period 1980–85, were also taken from SALA, Table 3301. Gross capital formation (civilian investment) as a percent of GDP was taken from the same source, Table 3366, for the years 1962, 1965, 1970, and 1975–82. For the period 1950–61, 20 percent of GNP was assumed to be devoted to gross capital formation (probably an optimistic estimate), while for 1971–74 the estimate was derived by interpolation. For the period 1983–85, gross capital formation was assumed to be 17 percent of GNP and 17.5 percent thereafter, based on the experience of recent years.

Labor force projections were taken from *Labor Force 1950–2000*, published by the International Labor Office (ILO) in 1977. The growth rate for the period 1995–2000 was assumed to apply thereafter until 2010.

Data for annual defense spending as a proportion of GNP were from the annual Stockholm International Peace Research Institute (SIPRI) volumes; for years after 1985, defense spending was assumed to be 2.5 percent based on a weighted average of the recent years' experience. Military capital investment was assumed to average 25 percent of total defense expenditures based on the experience of most non-U.S. NATO countries. The exceptions are 1982, when it was assumed to be 10 percent, and 1983, when it was assumed to be 40 percent because of the Falklands war.

Estimation

GNP for years beyond 1985 was estimated using the production function method described above. The share of capital in GNP was assumed to be 0.35 and the annual rate of technological change was assumed to be 0.5 percent. To obtain the annual civilian capital stock numbers, the ratio of the capital stock to the GNP was assumed to be 2.5 in 1950, a moderate size for this parameter based on the historical experience of the U.S. and other countries. The annual rate of depreciation for civilian capital was assumed to be 5 percent.

The military capital stock was derived by the forward and backward approach described earlier in this appendix. The depreciation rate for computing in the

forward direction was assumed to be 3.5 percent and in the backward direction, 5 percent. Once having estimated the 1985 figure via the forward method, the imputed figures for the earlier years were derived and used based on backward calculations employing the 5 percent depreciation rate.

The data reported in SALA are already given in dollars, so no conversion is necessary. It is not clear, however, whether these data were originally converted using the exchange rate or a PPP index.

BRAZIL

Data Sources

As with Argentina, GNP data were taken from SALA, Table 3324, for the period 1950–80. The annual GNP growth rates for the years 1981–85 are available from the same source, and were used to derive the actual GNP figures for those years. Data for the gross fixed capital formation, for the years 1962, 1965, 1970, and 1975–83 are from SALA, Table 3366. Gross fixed capital formation was assumed to be 20 percent of GNP for the period 1950–61, 21.25 percent for the years 1983–85, and 21 percent subsequently. The latter two figures are based on the weighted average of the most recent years for which gross capital formation data were available. Implicit compound growth rates were computed for the intervals 1966–69 and 1971–74, and figures applicable for the various years in those intervals were interpolated.

The labor data are taken from the ILO publication, *Labor Force 1950–2000*, cited earlier. The growth rate for the period 1995–2000 was assumed to hold for subsequent years until 2010.

Defense spending as a proportion of GNP is taken from the *SIPRI* volumes; for the years after 1985, it is assumed to be 0.7 percent, based on the experience of recent years. It is also assumed that 25 percent of the defense budget is devoted to capital expenditures for all years, based on the general experience of the non–U.S. NATO countries.

Estimation

The GNP forecasts are based on the production function model described earlier. Capital's share in GNP was assumed to be 0.35 for all years, and the annual rate of technological change was assumed to be 1.5 percent for years beyond 1985, reflecting a belief in the continued progress of the Brazilian economy. The civilian capital stock series was constructed on the assumption

that the ratio of the capital stock to GNP in 1950 was equal to 2.5, again reflecting the historical experience of the United States and other countries. The annual depreciation rate for civilian capital was assumed to be 5 percent.

The military capital stock series was derived using the forward and backward approach described earlier. The depreciation rates used in the forward and backward direction were 3.5 and 5 percent, respectively.

No currency conversion is necessary as the data reported in SALA is already reported in dollars. Once again, it is not clear whether the data were originally converted using the exchange rate or a PPP index.

CHINA

Data Sources

GDP (in 1980 dollars) for the years 1950 through 1980 were taken from Herbert Block, *The Planetary Product in 1980*, Washington: U.S. Department of State, 1981, pp. 42–43. These estimates are believed to be more reliable than the official Chinese figures. Estimates of GDP for the years 1981 through 1985 were obtained by applying a growth rate derived from the Chinese estimates for that period to Block's estimate for 1980. This official Chinese growth rate was judged to be more reliable than the GDP estimates themselves. The Chinese GNP estimate for 1980 in yuan was taken from Liu Guoguan, "On the Strategic Objectives of China's Economic Development", *Caimou jingji* (Economics of Finance and Trade), no.1 (1983): 5, and the GNP estimate for 1985 in yuan was taken from *Zhongguo tongji nianjian 1986* (China Statistical Yearbook 1986).

Labor force data were from State Statistical Bureau, *Guanghui di san-shi-wu nian* (The Glorious Thirty Five Years), Beijing: China Statistics Publishing House, 1984, p. 152. In the above data series, the labor force figures for 1950 and 1951 were missing; these were interpolated on the assumption that the growth rate of the labor force was constant between 1949 and 1952. For the 1990s and beyond, labor input was estimated to grow at an annual rate of 1.5 percent. This low figure reflects assumptions of a successful family planning program and the increasing aging of the Chinese population.

Defense spending data were derived indirectly. For 1980, the defense spending figure was an average of high and low estimates from *World Military Expenditures and Arms Transfers, 1971–80,* U.S. Arms Control and Disarmament Agency. Defense spending figures in yuan, for the period 1950–85, were also taken from the China Statistical Yearbook 1986. First, these figures were

converted into 1980 constant prices, and then an index was created with defense spending in 1980 being equal to one. Based on this index created from the yuan estimates and the mean 1980 figure in dollars, the full stream of defense spending figures in dollars was derived. This approach was adopted because the yuan estimates published by the Chinese government are likely to have been inflated. The mean proportion of GDP devoted to defense was 3.1 percent in 1985 according to the above figures.

The amount of defense spending devoted to military capital was estimated through several steps. Yuan estimates in 1974 constant prices were available for the years 1967 through 1983 from the Defense Intelligence Agency (DIA), *Chinese Estimated Defense Expenditures, 1967–83*, Washington: 1984, p. 13. The figure for 1966 was again a DIA estimate taken from *Defense and Economy*, Washington: 1980, pp. 3–4. Estimates for the years 1950 through 1965 were based on a regression of military investment on the gross value of output of the machine building sector (excluding farm machinery) for the period 1965–71.

The amount of defense spending devoted to military capital was then converted into 1986 dollars in two different ways. A high estimate resulted from converting 1974 yuan into 1974 dollars using a purchasing power parity index for the conversion, and then inflating 1974 dollars to 1986 dollars using the U.S. GNP deflator. The only PPP index available for China is for 1957 and is taken from Central Intelligence Agency, *Yuan–Dollar Price Ratios for Communist China & the U.S. in 1957*, April 1964. This PPP index was used to convert 1974 yuan into 1974 dollars, which were then inflated into 1986 dollars as noted above. The assumption underlying this procedure is that the PPP index in 1974 was the same as in 1957. The low estimate was derived in the same fashion, except that a lower proportion of defense spending in GNP was assumed.

The actual figures for military capital investments are not shown; what is shown, however, is their depreciated sum, which was used to arrive at the military capital stock estimates. As there are two sets of estimates of the amount of defense spending devoted to military capital in each year, high and low estimates of the military capital stock were obtained. These two estimates served as bounds, from which midpoints were calculated, as shown in Table 5 and Figure 10. The technique by which the military capital investment estimates were converted into military capital stock figures is described below.

Estimation

The GNP forecasts are based on the production function model described earlier. The only difference is that the capital stock is not calculated explicitly. Instead, it is assumed that the capital stock grows at an average annual rate of

8.0 percent between 1985–1995 and 7.0 percent between 1995–2010. This reflects an averaging of the experiences of countries like Japan and South Korea that had annual capital stock growth rates of 10 percent or more in past years, and India whose capital stock annual growth was about 5 or 6 percent on average. The average annual rate of technological change, estimated to be zero in the years prior to 1985, was assumed to be 0.50 percent between 1985–1995 and 1.0 percent between 1995–2010 based on the historical experience of other countries considered applicable to China. The share of capital in GNP was assumed to be 0.4.

Defense spending is forecasted to rise from 3.1 percent of GNP in 1985 to 3.5 percent of GNP between 1986–1990, 4.3 percent between 1991–1995, 5.0 percent between 1996–2000, and 6.0 percent between 2001–2010. The proportion of defense spending devoted to military capital is adopted from the high estimate, described earlier: 30 percent between 1986–1995, 35 percent between 1996–2000, and 40 percent between 2001–2010. The corresponding figure in all years for the low estimate is 66 percent, a figure rejected as implausible. The relatively high proportions of defense spending assumed to be devoted to military capital reflect the force modernization programs of the Chinese military establishment.

The military capital stock for the historical period is calculated using the forward and backward approach. The annual depreciation rates used are 3.5 percent in the forward direction and 5.0 percent in the backward direction. For the forecast years the annual depreciation rate applicable to military capital is expected to be higher in the Chinese case because of the force modernization and equipment retirement programs that the Chinese military establishment is likely to implement in the future. Accordingly, the annual depreciation rate for military capital is assumed to be 7.5 percent between 1985–2010.

EGYPT

Data Sources

National accounts data for Egypt were taken from *International Financial Statistics, 1986*, published by the International Monetary Fund (IMF). These include the historical estimates of GNP and gross capital formation. For the forecast period 1985–2010, it is assumed that 20 percent of the GNP will be devoted to gross capital formation, based on the experience of recent years.

Labor force data and projections for the future were taken from the ILO publication, *Labor Force 1950–2000*. The labor force projections were modified,

however, to allow for a probable rise in the level of unemployment and underemployment. With this in mind, it was assumed that the employed labor force would grow at only 80 percent of the growth rate implied by the ILO projections.

Defense spending data were taken from the annual *SIPRI* volumes. For the forecast period 1985–2010, it is assumed to be 7.5 percent of GNP, based on the experience of recent years. Due to lack of data regarding the proportion of defense spending devoted to military capital, it is assumed that 25 percent of defense spending was devoted to military capital for all the years based on the general experience of the non-U.S. NATO countries.

Estimation

GNP was estimated by the method described above. The share of capital in GNP was assumed to be 0.35, and the annual rate of technological change was assumed to be 0.2 percent. The ratio of the civilian capital stock to GNP in 1950 was assumed to be 2.5, and capital stock estimates for the later years were calculated based on that assumption. The annual depreciation rate used for civilian capital was 5 percent.

The military capital stock was derived by the forward and backward estimation method described earlier. The annual depreciation rates used were 3.5 percent and 5 percent in the forward and backward direction, respectively.

All calculations were performed in the national currency and then converted into dollars using the appropriate PPP index.

FEDERAL REPUBLIC OF GERMANY

Data Sources

GNP and civilian gross investment from 1950 through 1985 were obtained from the *International Financial Statistics, 1985* published by the International Monetary Fund. Analysis of these data indicates that the share of civilian investment in GNP in 1985 was about 20 percent, and this was assumed to hold for the entire forecast period.

Labor data for the period 1960–80 were from *Historical Statistics: 1960–1980*, Paris, Organization for Economic Cooperation and Development (OECD): 1982. For years after 1980, the data were from the U.S. Bureau of the Census forecasts.

Historical defense spending for the period 1950–85 was from data published by the Office of Program Analysis and Evaluation in the Office of the Secretary of Defense. Based on historical experience, it was assumed that Germany will devote roughly 3.2 percent of its GNP to defense. Using the *Report on Allied Contributions to the Common Defense*, A Report to the United States Congress by Caspar W. Weinberger, Secretary of Defense, April 1987, the Working Group estimates that roughly 25 percent of defense spending was devoted to military capital. This figure is assumed to apply for the subsequent years, as well.

Estimation

GNP was estimated according to the standard model described earlier. The share of capital in GNP was assumed to be 0.35, and annual technological change was 1.5 percent. The civilian capital stock was calculated by assuming that the ratio of the capital stock to GNP in 1950 was 2.5. The annual depreciation rate used for civilian capital was 5 percent.

The military capital stock was forecasted using the forward and backward approach, with depreciation rates of 3.5 percent and 4.5 percent, respectively.

Estimates in marks were converted to dollars using the PPP index.

FRANCE

Data Sources

GNP and civilian gross investment from 1950 through 1985 were obtained from *International Financial Statistics, 1985*. Analysis of these data indicates that the share of civilian investment in GNP in 1985 was approximately 19 percent. This figure was assumed for the entire forecast period.

Labor data for the period 1960–80 were taken from *Historical Statistics: 1960–1980*, Paris, OECD: 1982. For years after 1980, the data were from the U.S. Bureau of the Census forecasts.

Historical defense spending figures for the period 1950–85 were taken from the data published by the Office of the Secretary of Defense. Based on historical experience, it was assumed that France will devote about 3.3 percent of its GNP to defense. Based on the *Report on Allied Contributions to the Common Defense*, A Report to the United States Congress by Caspar W. Weinberger, Secretary of Defense, April 1987, the Working Group estimates that roughly 25 percent of French defense spending is devoted to military capital. This was assumed to apply in the future, as well.

Estimation

GNP was estimated in the usual way, as described above. The share of capital in GNP was assumed to be 0.35, and the annual rate of technological change, 1.5 percent. The civilian capital stock was calculated by assuming that the ratio of the capital stock to GNP in 1950 was equal to 2.5. The annual depreciation rate used for civilian capital is 5 percent.

The military capital stock is forecasted using the forward and backward approach, with corresponding depreciation rates of 3.5 percent and 4.5 percent, respectively.

Estimates in francs were converted to dollars using the PPP index.

INDIA

Data Sources

The national accounts data for the period 1950–84, including estimates of GNP, gross fixed capital formation (annual investment), inflation (GDP deflator) and total population, are from *International Financial Statistics* published by the International Monetary Fund. For the forecast years, it was assumed that gross capital formation increases linearly from 21 percent in 1984 to 25 percent in 2010 reflecting the general trend observed in other Asian countries.

For the years after 1984, labor supply figures were derived from United Nations' forecasts. It was assumed that the labor force grows with the cohort of all those between ages 15 and 64.

The share of GNP devoted to defense for the various years is taken from the *SIPRI Yearbook, 1974* and *World Military Expenditures and Arms Transfers, 1965–74 & 1985*, published by the Arms Control and Disarmament Agency (ACDA). For the future, it was assumed that 4 percent of GNP is devoted to defense spending. This figure is slightly higher than the 3.5 percent experience of recent years, reflecting India's force modernization programs and the expansion of the Indian navy.

The above sources do not indicate the percentage of defense expenditures devoted to military capital, but the fraction of the defense budget devoted to military capital expenditures, for certain years, is available in the *Statistical Outline of India*, published by Tata Industries, Bombay. (Figures for the missing years were obtained by interpolation.) These statistics are presumably compiled from various government documents. It is, however, not clear what types of

outlays are covered by military capital expenditures. For the 1990–2010 period, it was assumed that 20 percent of defense spending is devoted to military capital.

The proportion of defense spending devoted to military capital reflects the general historical trend, but is expected to be maintained at a level somewhat below that of the NATO countries because of the labor–intensive structure of India's forces and the mountainous terrain characterizing its vast border with China.

Estimation

GNP is forecasted according to the standard method. The share of capital in GNP was estimated to be 0.45. The parameter *a*, for the rate of change of technological productivity, was estimated to be not significantly different from zero.

To obtain the civilian and military capital stock values, assumptions were made regarding their reasonable values in 1950. These served as the starting values. The civilian capital stock was estimated as 1.3 times the GNP based on assumptions concerning investment, GNP levels and growth, and depreciation rates (5 percent) in the period prior to 1950.

For the military capital stock in 1950, it was assumed that the share of defense expenditure devoted to capital was only for purposes of making up for depreciation, without net new investment. Under such an assumption, the capital stock is equal to the capital expenditure divided by the depreciation rate. The above assumption seems reasonable because, in 1950, just 3 years after Indian independence, the national focus was largely on development and not on defense. The annual 1985–2010 depreciation rate used for military capital is 3.5 percent; while the Indian military is engaged in a modernization program, retirement rates are expected to be low, in contrast to the Chinese case.

JAPAN

Data Sources

The principal data source for the Japanese economy is the *Annual Report on National Accounts, 1986*, and its earlier edition, the *Annual Report on National Income Statistics, 1970*, published by the Economic Planning Agency. An additional source is the *Japan Statistical Yearbook* (1960–1983), compiled by the Statistics Bureau of the Management and Coordination Agency. For the forecast period, gross capital formation (civilian investment) was assumed to be 28 percent of GNP, based on the average of previous years.

The labor input into the Japanese economy was assumed to be the total number of persons employed.

Military expenditure data were from *Boei Nenkan* (Defense Yearbook) (1953–1974), *Yearbook of the Self-Defense Forces* (1963–1974), and *Defense of Japan* (1976–1986), published by the Defense Agency. There is an unexplained discrepancy of about 7 to 10 percent between the figures for the military budget and the actual expenditures. However, budget figures are preferred because they provide a breakdown of total planned outlays, which is required for computing the military capital stock.

For the forecast period, it was assumed, as the base case, that 1 percent of the GNP is devoted to defense spending, based on the experience of the last decade or so. Another case where Japan devotes 3 percent of its GNP to defense spending was also estimated, to bound the forecasts. The proportion of defense spending devoted to military capital was assumed to be 25 percent for the future years based on the historical average.

Estimation

The economic trends are forecasted using the familiar production function method. The capital share in GNP was estimated to be 0.37, and the annual rate of technological change 1.3 percent, for the period 1980–84; both figures are assumed to hold for the forecast period also. The results of this direct estimation corroborate the general results of research in economic development, and increase the credibility of the Working Group's assumptions for countries where direct estimates of these parameters were not made. The annual rate of depreciation for civilian capital was assumed to be 6 percent, based on historical data.

For the military capital stock, data are available for the years since 1950. The full stream is built from 1950 onwards using an annual depreciation rate of 5 percent.

Note that all calculations are performed in the national currency and then converted to dollars using the PPP index. For Japan, however, the exchange rate and the PPP index differ only slightly in 1980.

MEXICO

Data Sources

National accounts data for Mexico, including estimates of GNP and gross capital formation, are from the *International Financial Statistics, 1986* published by

the IMF. For the forecast period, it was assumed that 20 percent of GNP would be devoted to gross capital formation.

Labor force data were from the ILO publication, *Labor Force 1950–2000.* These projections were modified to take account of a rising level of unemployment and underemployment. It was assumed that employment growth would be 80 percent of the total labor force growth rate implied by the ILO projections.

Defense spending data were taken from the *SIPRI* volumes. For the forecast period, annual defense spending was assumed to be 0.6 percent of GNP, based on recent experience. The proportion of annual defense spending devoted to military capital was assumed to be 25 percent, based on the general experience of other countries.

Estimation

GNP was forecasted using the standard production function model. The share of capital in GNP was assumed to be 0.35, and the annual rate of technological change, 0.2 percent, reflecting Mexico's experience in the last decade, as well as the recent downturn in the Mexican economy. The ratio of civilian capital stock to GNP in 1950 was assumed to be 2.5. The civilian capital stock estimates were made on the assumption of a 5 percent annual depreciation rate.

Military capital stock estimates were based on the forward and backward approach, described earlier. Annual depreciation rates for military capital were 3.5 percent and 5 percent, for the forward and backward directions respectively.

Calculations were made in national currency and then converted to dollars using the PPP index.

SOUTH KOREA

Data Sources

South Korea's GDP and civilian investment figures for the period 1953–84 were taken from the IMF's *International Financial Statistics* (IFS). For the later years, it was assumed that 30 percent of GDP would be devoted to civilian capital investment, based on South Korea's experience over the past decade.

The population cohort between ages 15 and 64 was used as a proxy for the labor input. For the years previous to 1985, this cohort was estimated by multiplying the IFS population data by the percent of working age, derived from

the *World Bank World Development Reports* (WDR). For the forecast years, labor supply is based on the U.S. Bureau of the Census population forecasts by age category, with interpolation for missing years.

The estimates of military spending and military capital are based on data from the Korea Institute for Defense Analysis in Seoul. These data were available only for 1961 through 1982. For the future years, the share of GDP devoted to defense and the share of defense spending devoted to military capital were assumed to be the same as in 1982; namely, these are 5.8 percent and 31.8 percent, respectively.

Estimation

GDP is forecasted using the production function approach. The capital share of GDP was assumed to be 0.45 and the annual rate of technological change, 1.5 percent, representing the average rate of technological change observed for 1975–84. The civilian capital stock was calculated iteratively so that the ratio of investment to the capital stock in the base year is equal to the average level for the entire period. The annual depreciation rate for the above calculation is assumed to be 5 percent.

The military capital stock was also derived iteratively, using an annual depreciation rate of 5 percent.

National currency values were converted to dollars using the exchange rates published in *International Financial Statistics*. Because Korea's economy is a relatively open one, whose currency is pegged to the dollar, this conversion procedure was adopted rather than the PPP one.

TAIWAN

Data Sources

GDP (1980 constant dollars) for the years 1950 through 1980 were from Herbert Block, *The Planetary Product in 1980*, Washington: U.S. Department of State, pp. 36–37. For the years 1981 through 1985, GDP is based on a GDP index in 1981 constant prices derived from data in *Industry of Free China*, January 1987, p. 50.

Labor force data are from the *Taiwan Statistical Data Book 1985*, Taiwan: Council for Economic Planning and Development, 1985. For the forecast period, the labor force is expected to grow at roughly 2 percent annually.

Defense spending data for 1961 through 1983 were from *World Military Expenditures and Arms Transfers* (various issues) published by ACDA. Estimates of defense spending for 1954 through 1960 were derived by regressing defense spending on total government expenditures for the period 1961–70. Data on government expenditures and defense spending for 1961–70 were taken from the previously cited *Taiwan Statistical Data Book 1985*. For the years prior to 1953, defense spending was derived on the assumption that the defense burden as a fraction of GNP was the same as in 1954. For 1984–85, defense spending was based on the 1983 figure and an index of defense spending in the *Statistical Yearbook of the Republic of China 1986*, Taipei, Taiwan, p. 179.

Military investment as a proportion of defense expenditure was assumed to be the same as that for South Korea, see Charles Wolf, et al., *The Changing Balance: South and North Korea Capabilities for Long-Term Military Competition*, The RAND Corporation, 1985, R-3305/1-NA, p. 47.

Estimation

GDP was estimated in the usual way. As in the case of China, the civilian capital stock was not explicitly derived. Instead, it was assumed to grow at an annual rate of 4 percent. The capital stock growth rate is based on data contained in Wu Hui-lin, *The Estimation and Application of Capacity and Capital Utilization Rates in Taiwan,* Taipei: Chung-Hua Institution for Economic Research, 1983, pp. 67–69. The annual rate of technological change was assumed to be 3 percent based on Taiwan's experience in the 1970s. The share of capital in GDP is assumed to be 0.4.

Annual defense spending as a fraction of GDP was assumed to be 6 percent, based on recent experience, and the proportion of defense spending devoted to military capital was assumed to be 29 percent, the same as that for South Korea. Annual depreciation for military capital was assumed to be 8 percent. Military capital stocks were estimated employing the general methodology described earlier.

TURKEY

Data Sources

GDP figures from 1950 through 1984, are from the Office of Program Analysis and Evaluation (PA&E) in the Office of the Secretary of Defense. For the future years, it was assumed that the proportion of GDP devoted to civilian

capital investment would rise from 25 percent in 1981 to 30 percent in 2010, based on recent historical experience and the trend in gross capital formation in other rapidly developing countries.

Labor input is estimated as the population between ages 15 and 64. For the years prior to 1985, the Working Group used the IFS population data multiplied by the percent population of working age, according to the *World Bank World Development Reports*. For the forecast years, the labor figures are based on the U.S. Bureau of the Census population forecasts by age category. Both, series required interpolation for the missing years, based on an exponential function for the population series, and linear interpolation for the working age group.

The defense spending estimates were based on PA&E estimates. For the forecast years, the proportion of GDP devoted to defense was assumed to be 4.5 percent, the same as for 1985. The proportion of defense spending devoted to military capital was assumed to be 25 percent.

Estimation

GDP was forecasted using the production function approach. The capital share of GDP was assumed to be 0.45 and the rate of technological change, zero, reflecting past experience. The civilian capital stock is calculated iteratively so that the ratio of investment to the capital stock in the base year is equal to the average level for the entire period. The annual depreciation rate for the above calculation is assumed to be 5 percent.

The military capital stock was derived as described above, using an annual depreciation rate of 5 percent.

National currency values were converted to dollars using the PPP index.

UNITED KINGDOM

Data Sources

GNP and civilian gross investment figures from 1950 through 1985 were from the IMF's *International Financial Statistics, 1985*. The data indicate a share of civilian investment in GNP in 1985 of about 17 percent, and this was assumed to hold for the subsequent years as well.

Labor data for the period 1960–80 were from *Historical Statistics: 1960–1980*, Paris: OECD, 1982, and for subsequent years from U.S. Bureau of the Census forecasts.

Defense spending for 1950–85, are from PA&E, Office of the Secretary of Defense. For the forecast period, it was assumed the U.K. will devote roughly 5.3 percent of its GNP to defense. Based on the *Report on Allied Contributions to the Common Defense*, A Report to the United States Congress by Caspar W. Weinberger, Secretary of Defense, April 1987, the Working Group estimates that roughly 25 percent of defense spending has been and will be devoted to military capital.

Estimation

GNP is forecasted using the production function approach, assuming a capital share in GNP of 0.35, and an annual rate of technological change of 1 percent. The civilian capital stock was calculated on the assumption that the ratio of the capital stock to GNP in 1950 was equal to 2.5, and using an annual depreciation rate of 5 percent.

The military capital stock was forecasted using the forward and backward approach described earlier, with depreciation rates of 3.5 percent and 4.5, respectively.

Estimates in sterling were converted to dollars using the PPP index.

U.S.S.R.

Data Sources and Estimation

Historical GNP, civilian investment, and defense spending data in 1970 rubles were from *USSR: Measures of Economic Growth and Development, 1950–1980*, Joint Economic Committee, Congress of the United States, 8 December 1982. GNP and defense spending data have been updated to 1985 as the base forecast year, using *Gorbachev's Modernization Program: A Status Report*, prepared by the Central Intelligence Agency (CIA) for the Subcommittee on National Security Economics of the Joint Economic Committee, Congress of the United States, 19 March 1987. Information contained in Vasiliy Selyunin and G. Khanin, "Cunning Figures," *Novy Mir*, February 1987, pp. 181–201, indicates that economic growth from 1980–1985 was considerably lower than estimated by the U.S. intelligence community. The Selyunin–Khanin data were used to construct the base–case estimates.

Using the Working Group's update of *Gorbachev's Modernization Program*, civilian investment was estimated at about 33 percent of GNP in 1985, while Selyunin–Khanin material indicates civilian investment of about 29 percent of GNP in that year.

Civilian capital stock data through 1980 are contained in *Soviet Statistics on Capital Formation*, Central Intelligence Agency, SOV 82-10093, August 1982. The capital stock data can be updated though 1985 using *Gorbachev's Modernization Program* or using Soviet data combined with Selyunin-Khanin's conclusion that annual inflation in the Soviet investment data was 5 percent. This latter updating approach was used in constructing the base-case estimates. The Working Group's analysis of the historical civilian capital stock data indicates that the Soviet civilian capital stock depreciates at about 3.5 percent per year, and this rate has also been used for the forecast period.

Labor force data are contained in Stephen Rapawy and W. Ward Kingkade, *Estimates and Projections of the Labor Force and Civilian Employment in the U.S.S.R.: 1950 to 2000*. These data have been updated to 2010 using population data from Ward Kingkade, *Estimates and Projections of the Population of the USSR by Major Nationality: 1979 to 2050*, Bureau of the Census, December 1986.

When the data since the mid 1970s are updated based on *Gorbachev's Modernization Program*, a labor share of .65 with no growth in total factor productivity can be inferred. However, using Selyunin-Khanin, the update results in a labor share of .85 with no growth in total factor productivity over the 1974/5-1985 period.

The historical share of defense spending allocated to military investment is contained in *Estimated Soviet Defense Spending: Trends and Prospects*, CIA, SR 78-10121, June 1978. A military capital series was constructed for 1950-1985 using the forward and backward approach described earlier, with depreciation rates of 3.5 percent and 4.5 percent, respectively.

To convert GNP from 1970 rubles to 1985 dollars, data in *Gorbachev's Modernization Program* was employed. To convert defense spending and military capital to 1985 dollars, the Working Group used the *Annual Report to the Congress, Fiscal Year 1987*, by Caspar W. Weinberger, Secretary of Defense, and *The FY 1987 Department of Defense Program for Research and Development*, Statement by the Under Secretary of Defense, Research and Engineering to the 99th Congress, Second Session 1986.

Soviet Base Case

Based on the previously cited report prepared for the U.S. Congress, the ratio of Soviet GNP in dollars to U.S. GNP was roughly 0.53 in 1980. Data from Selyunin and Khanin, indicating very slow growth between 1980 and 1985, were used to update the 1980 GNP and civilian capital figures to 1985. Using the CIA estimate of Soviet defense spending in 1970 rubles, one obtains a defense burden

of 15 percent in 1985. Also as indicated above, labor's distributive share was assumed to equal .85 in the base case, and the capital share, 15 percent.

In the base case, zero growth of total factor productivity through 1990, and 0.5 percent annual growth for the remainder of the forecast period, were assumed.

Alternative A: Perestroika Succeeds, Low Military Burden

The 1980 GNP estimate obtained from *USSR: Measures of Economic Growth and Development* was updated using *Gorbachev's Modernization Program*. As in the base case, the ratio of Soviet GNP to U.S. GNP was assumed to be 0.53 in 1980. Using CIA data on Soviet defense spending in 1970 rubles implied a burden of 14 percent.

Civilian capital stock data contained in *Soviet Statistics on Capital Formation* were updated using *Gorbachev's Modernization Program*. Based on the previous labor series, forecasts were made assuming that labor's share of GNP is .65, and total factor productivity was unchanged through 1990 and grew at an annual rate of 1.5 percent thereafter.

Alternative B: Perestroika Fails, High Military Burden

In this case, Soviet GNP in dollars was assumed to be only 40 percent that of the U.S. in 1980, reflecting a judgment by various analysts that the 53 percent used in the base case is unrealistically high. The 1980 GNP figure was updated to 1985 using the slow-growth estimates of Selyunin-Khanin for the intervening years. The military burden in 1985 was assumed, in this case, to be 20 percent. Using the specified labor series, forecasts were made under the assumption that labor's distributive share was .85, and that total factor productivity was unchanged through 1990 and grew at a 0.5 percent annual rate thereafter.

Alternative C: Perestroika Succeeds, High Military Burden

In this case the assumptions were the same as in Alternative B, except that total factor productivity growth was assumed to be 1.5 percent after 1990. By using a more conservative estimate of Soviet GNP for 1980 compared to Alternative A, this scenario provides a lower bound to Soviet economic and military potential in the eventuality that perestroika succeeds.

Alternative D: Constant Military Spending

Soviet military spending was held constant at the 1990 base case level (299 billion 1986 dollars) throughout the 1990-2010 period. Using the base case

level and growth of GNP, defense spending's share of GNP would fall from 14.3 percent in 1990 to 10.4 percent by 2010.

UNITED STATES

Data Sources

Historical figures regarding GNP are taken from the *Economic Report to the President, 1987* (ERP). Data for the civilian capital stock are taken from John C. Musgrave, *Fixed Reproducible Tangible Wealth in the United States: Revised Estimates, Survey of Current Business*, January 1986. For the forecast period 1986–2010, the proportion of GNP invested in civilian capital was assumed to be 16.3 percent, representing the average for 1980–85.

Data for the labor input and gross civilian investment are also from the ERP. For the forecast period, labor is expected to grow at the 1980–85 annual rate of 1.0 percent.

Data for defense spending are also from the ERP. The proportion of defense spending devoted to military capital was drawn from U.S. Department of Commerce (DOC) data, which will be published soon. The Commerce data break military capital into procurement and construction. While procurement is probably more representative of military potential in a narrow sense, both components were combined to obtain the U.S. military capital stock estimates, for reasons of comparability with other countries.

The base case estimate assumes that U.S. defense spending grows, in real terms, at a rate of only 1 percent per annum from 1988 to 2010, compared to the estimated GNP growth rate of about 2.6 percent. The share of the defense budget devoted to procurement was assumed to be 29 percent and that to construction 2 percent, representing averages for 1962–86. The annual depreciation rates assumed for the above two components of the military capital stock were 5.8 percent (1950–85 average), and 1.7 percent (1980–85 average), respectively. For the depreciation rate applicable to military equipment the 5.8 percent average over the full historical period was used because the 1980–85 average (0.039 percent), was considered unrepresentative because it reflects the rapid equipment build-up of the last few years.

Two other U.S. estimates were also made, as described in the text above: Alternative 1 assumes that defense spending remains fixed in constant 1986 dollars; and Alternative 2 assumes that the share of GNP devoted to defense remains at 6.2 percent (1980–85 average) for the entire 1986–2010 period.

Estimation

GNP is forecasted using the standard production function approach employed for all the countries in the samples. It was assumed that the capital share in GNP is 0.35 and that the annual rate of technological change is 1.0 percent (1980–85 average). The civilian capital stock series for the forecast period was constructed using an annual depreciation rate of 2.3 percent (1980–85 average).

The military capital stock was constructed in a similar manner, based on the data for defense spending, military capital investment, and the appropriate depreciation rates for the two components.

APPENDIX B: EMERGING TECHNOLOGIES AND FUTURE WAR: A SOVIET VIEW

by Notra Trulock, III

INTRODUCTION

Until the early 1980s, Soviet military spokesmen seemed generally confident of the Soviet Union's ability both to control the peacetime military competition with the West and to prevail in the event of a major war. This confidence, although carefully measured and guardedly expressed, has nevertheless been grounded on the successes of both Soviet force development efforts and Soviet diplomatic initiatives since the late 1960s. The combination of these efforts permitted senior Soviet military authorities, such as Marshal N. V. Ogarkov, to conclude in the late 1970s that the threat of aggression from the West had been significantly curtailed. An increased willingness to use military force in the pursuit of limited foreign policy objectives testified to an increasing Soviet confidence in their military power. By 1982, Soviet military spokesmen believed that, as a result of their force development efforts, "a well proportioned military organization has been created which would permit the accomplishment of missions of any scale in any conditions."

Trends in the development of military affairs over the last 10 years have created considerable ferment within the Soviet military analytic community, however. Although Soviet military analysts continue to express satisfaction with the ability of the Soviet Armed Forces to fulfill current and near-term (about 5 years hence) requirements, these analysts have become increasingly uncertain about this ability over the next 10 to 20 years of military developments. Consequently, in recent years Soviet military analysts have initiated a major reassessment of their views and conclusions regarding the potential nature of future warfare and a reevaluation of the implications of such forecasts for future Soviet force requirements and the further development of Soviet military art.

Motivation for Soviet concern stems, in part, from a perception that the West has found a renewed willingness to compete militarily with the Soviet Union and desires to exploit its potential technological capacity to gain advantages in this competition. Complicating attempts to estimate the capacity of Soviet defense planning to meet future needs is the possibility that Soviet economic performance may constrain the range of options available to resolve mid- and long-term military requirements. The most critical factor compelling the Soviets to reconsider many of their previous views is the potential impact of emerging

military technologies on the future battlefield as well as efforts by both sides to develop new operational strategies for the employment of these technologies.

This appendix provides a discussion of Soviet military perceptions of mid- and long-term military technological developments, the implications of these developments for the nature of future warfare, and the potential benefits the Soviet military anticipates from the perestroika of the Soviet economy and the society at large.

SOVIET MILITARY TECHNOLOGY FORECASTS

Soviet military sources generally agree on four primary trends in the development of military technologies, which provide the basis for their forecast of a "qualitative leap in the modernization of the means of armed conflict." These have been characterized as

- The accumulation, further development, and qualitative modernization of nuclear weapons
- The rapid development of military electronics
- The significant qualitative modernization of conventional weapons
- The development of weapon systems based on new physical principles.

The Soviets have generally divided their assessments of the development of these technologies and their implications for future war into two distinct periods. The first encompasses a mid-term projection covering developments Soviet military planners anticipate to be fielded between the 1990s and the year 2000. Soviet mid-term forecasts generally incorporate projections of continuing modernization of the traditional types of conventional weapons (tanks, armored fighting vehicles, aircraft, etc.) but seem focused more upon the first and early variants of the second generation of a new family of highly accurate, precision-guided delivery systems for non-nuclear munitions.[1]* These forecasts also encompass completion of the ongoing modernization of strategic offense and defense systems and perhaps the initial appearance of early variants of weapons based on new physical principles. The Soviets anticipate initial deployments of the B-2 stealth bomber to occur in the mid 1990s. Also included in these forecasts are technologies that could dramatically increase the controllability of both weapon systems and force operations.

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* Sources are cited in numbered endnotes collected on pages 153-163.

Long-term forecasts, on the other hand, appear to concentrate on subsequent generations of conventional weaponry, the widespread application of low-observable technologies, and, in particular, an increasing range of tactical applications for weapons based on new physical principles and other technologies under development in the U.S. Strategic Defense Initiative. Such a forecast would probably cover the period from the year 2000 through possibly 2010 or 2015. Beyond this, while the Soviets have identified a number of potential military technologies, it appears that they believe it is difficult to determine in a systematic fashion their potential impact on warfare.

It should be pointed out, however, that Soviet military theoreticians, unlike their Western counterparts, seem to devote little energy to quibbling over the feasibility of each and every new technology. Instead, they seem to assume the integration of new families of technologies into military forces as an objective reality. This, in turn, allows them to move on to the more critical questions of the nature of the key attributes that these technologies would impart to weapons and control systems and, in turn, to analyses of the impact of these attributes on the conduct of military operations. The following sections devote more attention, therefore, to Soviet perceptions of these key attributes with less space devoted to, for example, such topics as Soviet investigations of the applicability of gallium arsenide to future control systems.

Soviet Mid-Term Assessments

Soviet assessments of the mid-term developments of nuclear weapons have taken as a starting point the quantitative growth of nuclear arsenals over the last 20 years and the manner in which this unanticipated growth has affected both the conditions and methods for the employment of these weapons.[2] The Soviets do not appear to envision the dynamism in the future development of strategic nuclear forces that they associate with the development of non-nuclear or strategic defensive systems. Instead, Soviet characterizations of strategic nuclear force development seem to anticipate essentially a continuation of current trends in the modernization of these forces. One recent Soviet analysis characterized these trends as providing improvements in reliability, combat readiness, and effectiveness, increases in accuracy and survivability, and a more extensive integration of automated control systems into the forces.[3]

It is evident that Soviet thinking on the role and function of these forces in future warfare has undergone considerable modification in recent years. Beginning in the early 1960s, Soviet statements of this role focused on the contribution of these "decisive means" for the achievement of a wide range of strategic objectives--both intercontinental and theater--in future war. More

recently, however, the Soviets have introduced a carefully drawn formulation of this role as a mission statement for the strategic nuclear forces. Many of these mission statements are similar to that employed in 1984 by General M. A. Gareyev, then chief of the General Staff's Military Science Directorate. Gareyev described these forces as a "reliable means for restraining (in Russian, *sderzhivaniya*) imperialist aggressors, always ready for a crushing retaliatory strike on the aggressor."[4] Obviously, this formulation is sufficiently broad to support any of the various employment options open to Soviet decision-makers: preemption, launch-on-tactical-warning, launch-under-attack, or retaliation. Evolving Soviet perceptions on the role and function of these forces are discussed in more detail below. Soviet attention to future strategic nuclear force requirements, however, likely centers upon improving the efficiency and effectiveness of the use of these forces in less-than-mass employment scenarios.[5] Technological trends in the development of these forces would appear to support the provision of such a capability. In particular, future nuclear systems should exhibit improved reaction times and greater accuracies in comparison with previous generations. The objective possibility of achieving dramatic improvements in circular error probables (CEPs) should, in the Soviet view, enable both sides to consider more discriminating use of these weapons.

Marshal Ogarkov and others have argued that both sides have achieved sufficient nuclear potential and that further accumulation of these systems is pointless. According to Ogarkov, the arsenals of both sides have reached such dimensions that "it is not necessary to be a military man or a scientist to know that the further accumulation of these weapons has become senseless."[6] Consequently, Soviet military planners may have had little difficulty accepting the 50 percent reductions in strategic nuclear forces by the mid 1990s envisioned in General Secretary Gorbachev's January 1986 proposals.[7] The one component of the Soviet strategic nuclear forces likely to experience quantitative expansion, however, could be the Strategic Aviation forces. The rationale for this expansion, however, may be due as much to the potential contribution of strategic aviation to global conventional warfare as to efforts to achieve a true "triad" of strategic nuclear forces.[8]

This may be especially true in light of recent indications that Soviet perceptions of future strategic nuclear force requirements, and perhaps even the design scenarios for these forces in general, are undergoing reevaluation. For some time, the scenario of primary interest in Soviet military discussions has centered upon the provision of a capability to respond to nuclear attacks under a set of worst-case assumptions. The new Minister of Defense, General Yazov, for example, identified the "essence of sufficiency" for the strategic nuclear forces as

"being determined by the necessity of the inadmissibility of an unanswered nuclear attack in any, even the most unfavorable circumstances."[9]

These worst-case assumptions have increasingly come to be associated with the requirements for the control and sustainability of these forces during a prolonged phase of conventional operations in any future war. With regard to the issue of control, there have been frequent references to the exercise of tighter control over these forces since at least 1982. These references have been associated with the task of preventing "unauthorized launches." Then Minister of Defense Marshal D. F. Ustinov, for example, identified a requirement to "organize still tighter control to ensure that an unauthorized launch of nuclear weapons, from the tactical to the strategic level, is ruled out."[10] Obviously, the provision of these capabilities would also ensure positive control and better connectivity to these forces. The Soviets anticipate that the current transition from analogue to digital communications technologies would provide direct links from the "higher military-political leadership to the strategic carriers (i.e., strategic weapons platforms/units) and operational-tactical nuclear forces."[11] The Soviets have also discussed Western investigations of the employment of laser technologies for communications, especially with ballistic missile submarines (SSBNs).[12] According to these accounts, such technologies would provide better transmission security, better resistance to interference, and higher data transmission rates.[13] It is likely, therefore, that the Soviets are examining a number of different attack assumptions, including those associated with non-nuclear attempts to disrupt control of these forces during the conventional phase of a future war.[14] The Soviets appear to be particularly concerned by the requirements associated with the sustainability of these forces over a prolonged period. These requirements become particularly critical as the Soviet Union seeks to attain greater survivability by relying more on mobile systems, including mobile land-based missiles.

For the most part, however, the Soviets believe that it is the development of conventional weapons that will benefit most from technological advancements.

> If, in the recent past, strategic nuclear-missile weapons were the main area in which the newest scientific ideas were used, then at the present time these ideas are being actively used in the formulation and creation of conventional types of armament, increasing to a significant degree the combat effectiveness, reliability, and other characteristics of these weapons.[15]

One clear consequence of the general skepticism over nuclear warfare has been the growing incentives for both sides to pursue these technological developments aggressively. According to Soviet observers, these trends portend

across-the-board improvements in conventional weapon systems, particularly in the development of long-range, highly accurate, and remotely guided combat systems, remotely piloted vehicles, and qualitatively new electronic control systems.[16] Beyond improvements in range, the Soviets also anticipate that future weapons systems will feature greatly accelerated rates of fire and operation, which would make possible a sharply compressed detection-to-destruction cycle.

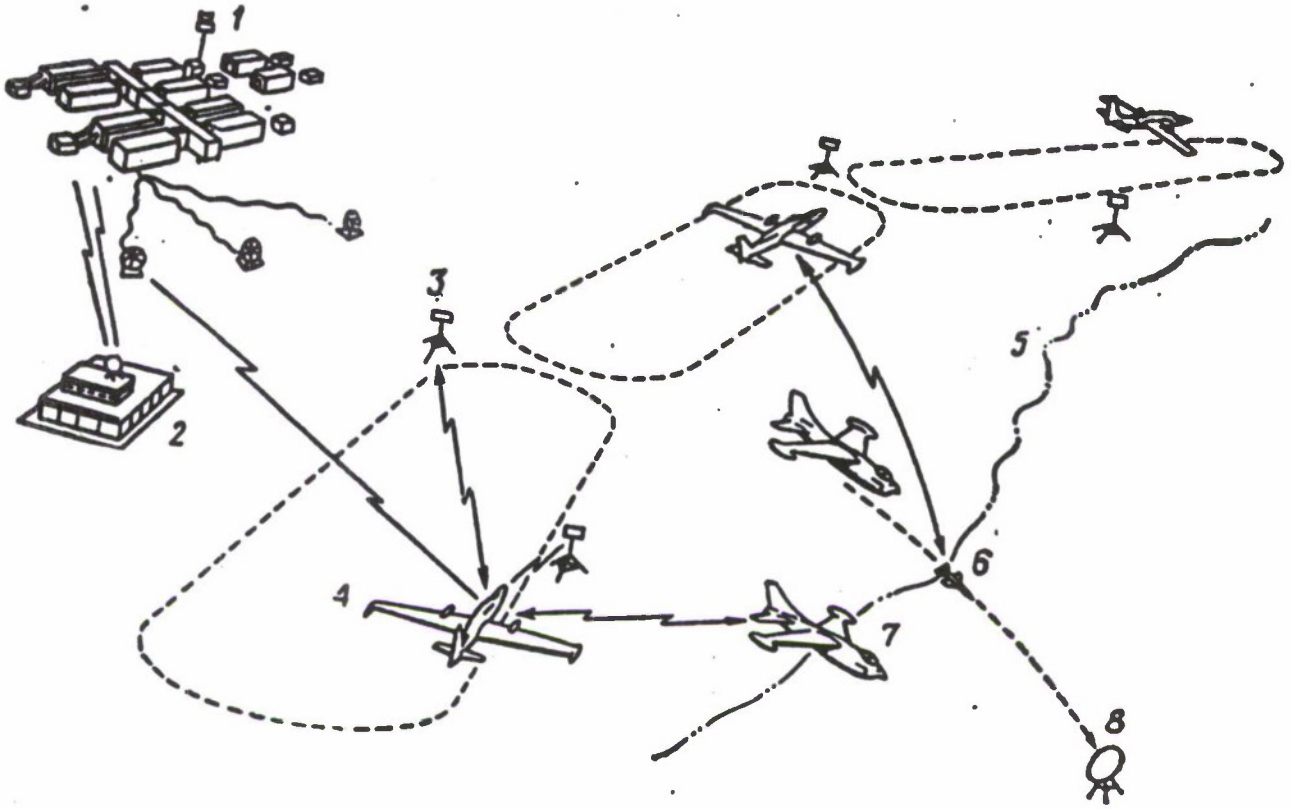
The Soviets have cited the development of "high-accuracy weapons" as the main trend in the contemporary development of conventional weapons. The Soviets have recently upgraded their assessments and definitions associated with such weapons. Earlier definitions classified such systems as simply those capable of achieving at least a .5 single-shot probability of kill (SSPK).[17] In contrast, the Soviets now define such systems as those

> in which the precision of determination of target coordinates, the time for reaction of the weapons, and the quality of the guidance permits the destruction of a target on the first shot or launch with a probability not less than .6 in real time.[18]

Beyond the change in the SSPK, the significant aspect of this new definition is the stipulation that these functions are to be performed in real time.[19] Reconnaissance strike complexes (RUK), which link sensor, communications, and fire systems in real- or near-real time in the execution of fire missions at depths up to 500-600 km and deeper throughout the enemy tactical, operational, and even strategic rear are the most commonly cited example of this trend. In effect, the means of detection, destruction, and control would be combined into a single system. For Soviet depictions of two such Western RUKs, the precision-location-strike system (PLSS) and assault breaker, see Figures B-1 and B-2.

The technologies of greatest interest to the Soviets for application over the next 10 years appear to be those associated with microelectronics, automated decision-support systems, and telecommunications. The Soviets have identified, for example, developments in radioelectronics, laser technologies, and computers as key to the successful introduction of RUKs.[20] While the contribution of military electronics is generally recognized, the Soviets also seem to believe that near-revolutionary developments are under way in explosive technologies. The Soviets also anticipate that the United States will begin the deployment of Stealth aircraft by the mid 1990s and, over the longer term, are surely watching closely the development of low-observable technologies for application to other weapon delivery platforms.[21] Soviet military scientists anticipate a qualitative transformation in conventional weapon systems to result from the combination of these technologies. According to Major General I. N. Vorob'yev, the leading

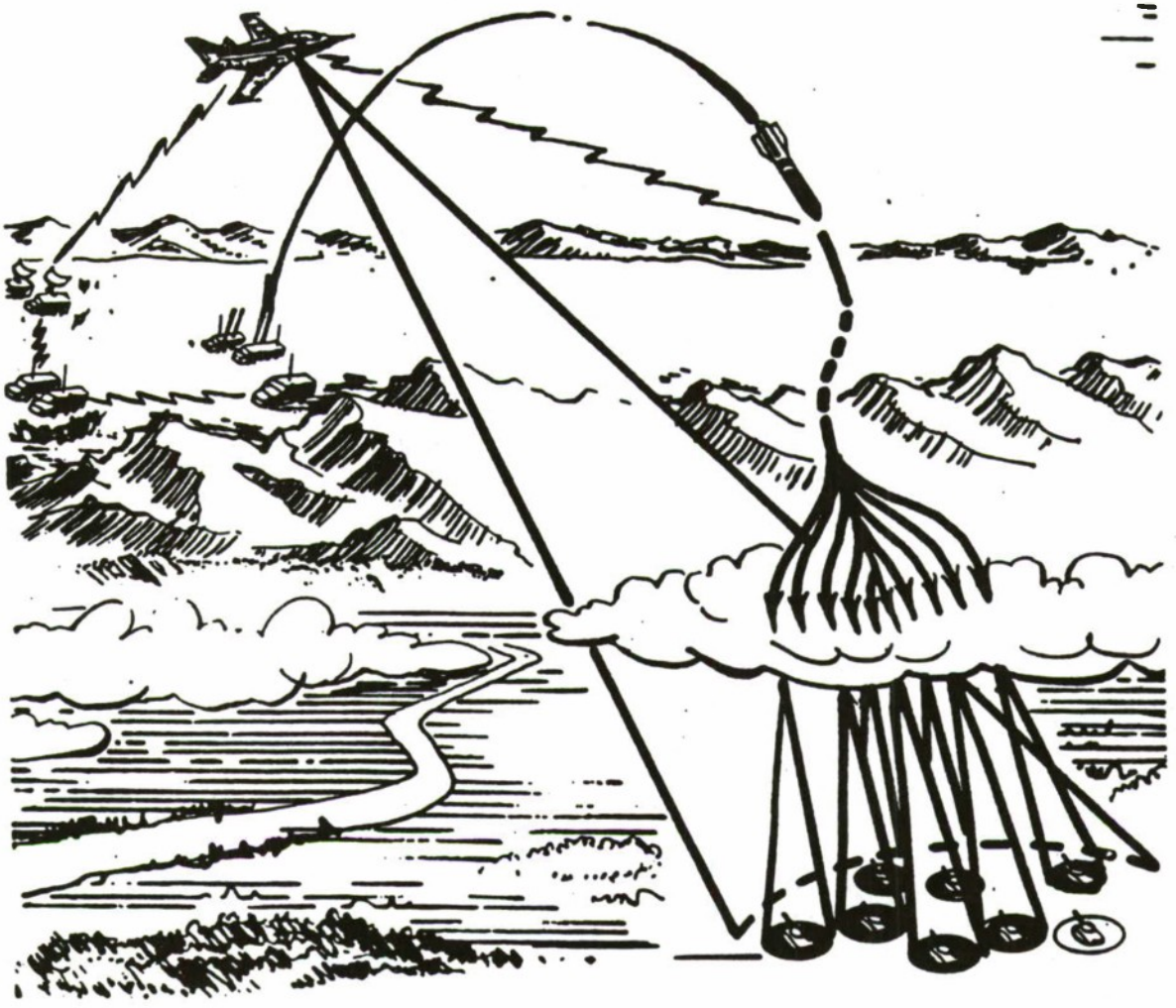
FIGURE B-1: EARLY SOVIET DEPICTION OF PLSS RUK



KEY:
1. Ground Control / Fusion Center
2. Tactical Aviation Control Center
3. Ground Navigation Point
4. Reconnaissance and Signal-Relay Aircraft
5. Forward Line of Own Troops (FLOT)
6. "Air-Surface" Guided Weapons with Rapid-Command DME-Guidance
7. Aircraft, Directing the PLSS System in Calculation of the Bombing Aim Point
8. Enemy Radioelectronic Means

SOURCE: V. Chernukin, "Tactics of NATO Aviation to Overcome PVO Systems," *Vestnik PVO* No. 8 (August 1981).

FIGURE B-2: SOVIET DEPICTION OF ASSAULT BREAKER RUK



SOURCE: Colonel A. Sergeyev, "Reconnaissance-Strike Complexes," *Krasnaya Zvezda* [Red Star] (14 February 1985).

Soviet military expert on the impact of modern firepower on tactics, under the influence of these technologies,

> The new generation of armaments will exceed those of their predecessors by several times over in range, by dozens times over in destructiveness, and by hundreds of times over in accuracy.[22]

Soviet assessments of the nature of these trends was probably well under way by the late 1970s, although it is also evident that the process was accelerated considerably in the early 1980s. While much of the discussion of these trends is presented in terms of "developments abroad," the actual assessment process is probably more objective in nature and developed in terms of both the challenges and opportunities presented by these technologies. Thus far, the Soviets have concluded that the combination of these technologies is sure to provide the following set of attributes, or tactical-technical characteristics, to future weapon systems.

With regard to the increasing range of new systems, the Soviets believe that both reconnaissance capabilities and fire influence will extend much deeper into the enemy's rear than previously possible. Since the 1930s, Soviet military planning has had as a primary objective the exercise of simultaneous fire influence over the entire depth of the enemy's deployment. Although the introduction of nuclear missile systems seemed to provide such a capability in the 1960s, Soviet military fascination with deep nuclear strikes was short-lived.[23] Because of their estimate of the capabilities of conventional fire systems of the time, during the mid 1970s the Soviets believed that fire destruction of the enemy could only be achieved "successively (not simultaneously)".[24]

The introduction of new fire systems would enable planners on either side to extend the depth of fires. To illustrate this point, Soviet analysts have argued that with the introduction of these systems the "depth of destruction of the 'contemporary battlefield' will increase by 10 times in comparison with the Great Patriotic War."[25] The Soviets believe the introduction of such systems into NATO inventories, for example, would extend the depth of division level fire missions to approximately 100 km. The potential introduction of newer conventional systems has changed the basic content of fire destruction; according to a recent Soviet definition it now includes, in addition to artillery fires, "strikes by the rocket-troops and aviation with the use of munitions with conventional arming."[26] Consequently, the introduction of longer range systems seems to hold out the possibility that simultaneous fire destruction throughout the enemy's depth is once again possible.

> When conducting combat with conventional means having a long range of operations, firepower throughout the depth of the

> formation of enemy large groupings can be prepared and used in a short period of time, and can have a decisive impact on the process of a campaign.[27]

NATO efforts to develop long-range fire systems and disperse these systems at greater depths in its operational deployment in order to improve survivability are sure to increase the significance of the principle of simultaneous fire destruction across the depth of the enemy.

Soviet acceptance of the Intermediate-Range Nuclear Forces (INF) Treaty, however, would seem to close off further development of land-based ballistic or cruise missiles for attacks beyond about 500 km deep. For example, Soviet sources frequently depicted the use of long-range cruise missiles employing cratering munitions against Warsaw Pact airfields as an important component of the West's deep strike capability. The agreement means that while ballistic and cruise missiles will continue to execute fire missions out of the range limits of the agreement, both sides would be forced to resort once again to aviation for execution of such missions beyond a 500 km range. Consequently, the Soviets are clearly interested in development of long-range, standoff, air-delivered weapons.

Soviet consideration of the potential impact of enhanced range is not limited simply to theater applications, however. Instead, Soviet military scientists are examining scenarios for the employment of these systems not only throughout theater depths but also against the homelands of the belligerents. This theme will be developed in more detail below, but Soviet sources emphasize the increasing range of conventional systems as a starting point for this analysis. Of special interest in this regard are standoff systems, such as sea- and air-delivered cruise missiles that could prove especially effective against thinly protected targets.

The Soviets are not simply focusing their attention on deep-strike systems, however, but are equally interested in those systems capable of providing deeper coverage in support of the close-in battle. These would include longer range artillery, multiple-rocket launchers and, in particular, longer range antitank systems. The Soviets anticipate, for example, that artillery systems could exhibit increases in range up to 40 km over the near term and up to as much as 70 km over the mid term. Similarly, future antitank systems could increase in range by as much as 1.5 to 2 times. The Soviets seem particularly interested in the development of standoff mining capabilities out to ranges between 40 and 100 km in the depth of the enemy.[28]

The Soviets believe that this characteristic will not only apply to fire systems but also will permit sensors to operate much farther into the enemy's depths in

comparison with current capabilities. New sensor technologies will, for example, permit a five- to sixfold increase in the depth of the "zone of reconnaissance."[29] Such reconnaissance systems would enable an opponent to detect more readily "vulnerable spots" throughout the depth of deployment and complicate the task of concealing forces and the overall concept of operation.[30]

Beyond specific systems, the Soviets view exploitation of the "vertical dimension" as a major trend in the expansion of the spatial scope of the future combined-arms battle. The combination of air- and heli-delivered fires serves not only to increase the fire potential and mobility of the forces, but also "provides the opportunity for the use of different types of fire destruction of the enemy and new methods of conducting the battle."[31]

In the Soviet view, the second major manifestation of the impact of new technologies is in the area of improved guidance systems and more precise reconnaissance capabilities. Trends in microelectronics and optronics, including electro-optic (EO), infrared, millimeter-wave, and laser guidance technologies, are of particular interest. Here too, technologies will contribute to the improvement of not only fire, but also sensor and target acquisition capabilities. The Soviets also believe that remotely piloted vehicles could play an expanding role in increasing the accuracy of not only fire systems, but also the means of reconnaissance.[32] The Soviets believe that just as the depth of reconnaissance will increase five to six times, so too will the degree of precision in determination of target coordinates experience a similar increase.[33] This is particularly true in light of the increasing contribution of space-based means of reconnaissance support to ground forces operations. Beyond the increasing precision of such means, the Soviets also believe that the time required for processing and transmitting space-based reconnaissance data to ground forces command posts is constantly being reduced.[34]

The promise of order-of-magnitude ("hundreds of times over") increases in accuracy represents potentially the most significant trend in the development of future weapon systems. According to a recent Warsaw Pact analysis, if a target can be detected, no matter at what depth it may be located, it can be destroyed.

> [U]p to now, the probability of hitting the target depended on the distance of the shooting: the greater the distance, the less the ability to strike. Precision weapons strike out this dependence, thanks to the guidance of missiles to the target. This accuracy is not dependent on distance, meteorological conditions, or time of day.[35]

In their discussions of accuracy, references to single-shot kill probabilities ranging from .6 to .9 for both fixed and mobile targets are common.[36] Similar

accuracies are predicted for air-delivered weapons. According to one Soviet account, laser- and EO-guided bombs can achieve CEPs ranging from 3 to 10 m at ranges of 5 to 65 km.[37] Air-delivered guided missiles are predicted to be capable of CEPs on the order of 5 to 30 m at ranges beyond 600 km.[38] Realization of these trends, in the view of this analysis, will produce "a revolutionary transformation in the means of combat, which must significantly influence the principles and methods of its conduct."[39] Obviously, such improvements in accuracy could significantly reduce rates of expenditure of munitions and lead the Soviets to modify, perhaps dramatically, planning norms.

While the contribution of military electronics is generally recognized, the Soviets seem to believe that near-revolutionary developments are also under way in the area of explosives technologies. Due in part to the exponential increases in the destructive power of these technologies, the Soviets are careful to portray these advances as occurring only in the West. Such developments, according to the Soviets, include armor-piercing shells with uranium cores, munitions utilizing plastic, gelatinous, and liquid explosive substances, and different forms of incendiary munitions. Of particular interest are developments in fuel-air explosives (FAEs). According to the Soviets, "when fuel-air bombs explode, the quantity of energy released is almost 5 times more than the blast of HE bombs of the same weight."[40] Another Soviet source reported that one U.S. air-delivered FAE, designated CBU-55, is capable of

> destroying a strong, reinforced-concrete structure. Its destructive action extends over dozens of meters, and the newer models up to 250 m, that is 4 to 6 times greater than an equivalent weight of HE munitions.[41]

As a consequence, the Soviets believe that when fuel-air munitions are delivered by air or multiple-rocket launcher "the zone of destruction is measured not in hectares, as before, but in square kilometers."[42]

Equal in importance to emerging fire and reconnaissance technologies are developments in communications and decision-support aids. The Soviets believe that military communications have also entered a "transitional stage of development" with the introduction and wide-scale replacement of analogue with digital systems.[43] Advances in communications technologies permit not only more effective vertical and lateral linkages between command echelons but provide an opportunity to exercise more positive control over subordinate forces. In this regard, Soviet commentators have also noted the enormous potential contribution of satellite communications.

> It is also necessary to remember the capabilities of satellite means for providing communications at all levels of command and control, even at the lowest level.[44]

According to a recent Soviet analysis,

> both strategic and tactical systems of military communications show the tendency toward an increased proportion of space means of communications (established up to divisions and brigades of ground forces), carrying capacity techniques for line and channel formation, and an increase in the mobility of the systems due to utilization of highly mobile, noise resistant, secure (encrypted), automated VHF radio communications systems with multi-station (time-sharing) terminal access.[45]

More significant are the potential communications trends supporting the real-time collection, processing, and transmission of fire commands to reconnaissance-strike complex operations. The Soviets believe that it is increasingly possible to automate the following critical processes in the detection-destruction cycle: target detection, data transmission, preparation of targeting data, transmission of the command for destruction. As a result of automation, the Soviets believe these processes can be performed in real time.[46] The consequent increase in reaction time ranks as one of the most important attributes of future systems.

Such a trend could not fail to increase the importance of time on the battlefield and has forced military planners to seek technologies that permit the further compression of the planning and decision-making cycle.

> Saturation of the troops with very sophisticated weapon and combat equipment systems and the high dynamism of combat actions under present day conditions make it necessary to automate many labor-intensive command and control processes.[47]

Technologies facilitating automated processing, fusion, and presentation of data to support decision-making have received particular attention.

> New technical means of the procurement, assembly, transmission, processing, display and documentation of information create the objective prerequisites for a sharp increase in the effectiveness of control.[48]

The combination of these trends, especially in improved accuracy and enhanced lethality, has clearly forced the Soviets to reevaluate the role of conventional weapons in future combat. As a result of the impending

introduction of precision-guided, long-range weapons, the Soviets appear to be reevaluating fire norms. In order to illustrate the potential of these systems, Soviet military sources provide numerous comparisons between the effectiveness of high-accuracy and more "traditional" weapons systems. With enhanced accuracy and lethality, the Soviets have argued that "just a few" such systems, in the place of "many hundreds of munitions," would be necessary in order to fulfill mission requirements.[49] In one such analysis, based on Western data but intended to demonstrate for junior commanders the effectiveness of these systems, a Soviet military author equated the destructiveness of not more than six high-accuracy conventional weapons against half a battalion deployed over a .2 square kilometer area to that achievable by the expenditure of 10 tons of artillery munitions.[50] Other examples equate the destructive potential of one guided artillery shell of the Copperhead type to that achieved by 100 traditional artillery shells.[51] Similarly, one T-16 or T-22 missile is portrayed as being capable of disabling up to eight tanks at ranges from 30 to 200 km. Air- delivered "containers with missiles" may destroy up to 12 armored targets at depths up to 300 km, while artillery-delivered munitions of the SADARM type can destroy as many as three tanks at ranges up to 70 km.[52]

More significant, however, is the clear implication the Soviets have drawn regarding the promise of levels of destruction achieved through conventional fires that were formerly possible only through nuclear employment. Particularly intriguing is the possibility of fulfilling damage criteria with a fairly high degree of confidence but without the collateral damage and operational complications inherent in nuclear strikes. Soviet discussions of this dimension have undergone a subtle transformation in recent years. Until recently, the Soviets have been careful to use language that suggests that they were examining some form of substitutability of these systems for low-yield nuclear systems such as nuclear-capable artillery. Such comparisons initially concluded that the potential destructiveness of these systems would "approach" that of tactical nuclear weapons. Subsequently, these evaluations came to be presented in terms of the "comparability" of conventional and nuclear effects. Low-yield tactical nuclear warheads continued to be the measure of comparison, however. In one specific 1984 example, the Soviets equated the kill radius of a conventionally armed cruise missile to that which could be achieved through employment of a 1 kt neutron warhead.[53] A more recent assessment has concluded that

> [h]igh-accuracy weapons systems such as RUKs and, in the future, hypersonic missiles and guided aviation cassette warheads, will approach tactical nuclear weapons (in effectiveness) and may sharply increase losses of personnel, weapons, and equipment, and

> may destroy with one missile an entire subunit of the type tank (motorized-rifle) company.[54]

The Soviets may have upgraded their assessment recently, however, as there are now indications that they believe these systems to be comparable to "nuclear-missile weapons."[55] Given the significance of "nuclear-missile weapons" in the Soviet assessment process, it is possible that military analysts are considering expanded employment roles for conventional weapons, either in terms of depth or of target categories formerly believed suitable only for nuclear attacks. Concern has recently emerged in Soviet military sources over the effectiveness of "hypersonic" (probably a reference to hypervelocity) missiles. The attribute of this system of greatest interest to the Soviets is not just its reaction time, but their assessment that "one such missile is able to reliably destroy armored targets over an area of 6 square kilometers.[56] The upgraded assessment may also be based upon the Soviet estimate of the enhanced destruction potential inherent in, for example, fuel-air munitions or other new explosives technologies. The assessment is probably based less upon a one-for-one comparison and more upon the shattering and decisive effect such high-accuracy weapons could have on combat operations. The time horizon for this assessment is unclear, however, as recent Warsaw Pact analyses portray the emergence of conventional substitutability as "gradual."[57] The Soviets clearly understand that the effectiveness of these systems is susceptible to meteorological conditions, smoke, etc., but nevertheless have concluded that the introduction and widespread deployment of such systems cannot fail to bring about major changes in the nature of combined-arms warfare.

B. Soviet Assessments of Long-Term Trends

It is in their longer term forecasts, however, that Soviet military theoreticians seem to envision truly revolutionary changes in the nature of warfare. Although their forecasts encompass subsequent generations of newer conventional systems and widespread applications for low-observable technologies, Soviet attention seems focused on efforts to develop weapon systems based on new physical principles. Although in its early stages, the Soviet forecast has progressed sufficiently to allow the Soviets to conclude that the creation of such weapons is a "reality of the near future" and that the potential impact on warfare could be enormous. In Marshal Ogarkov's view, for example,

> [w]ork on these new types of weapons is going on in a number of countries, for example in the USA. Not to take into account the creation of these weapons--a reality of the near future--would be a serious mistake. There cannot fail to be a change in the established

ideas about the methods and forms of armed combat and even about the military power of the state.[58]

That similar work has been under way in the Soviet Union for years is both indicated in Western sources and admitted in Warsaw Pact analyses. One such analysis recently revealed that the Soviets have been testing laser systems for the solution of battlefield air defense problems for at least 10 years.[59] To omit consideration of these systems in estimates of both the nature of future war and the potential course of the future long-term military competition with the West would constitute, in the view of Marshal Ogarkov, a "serious mistake."[60] Interestingly enough, in light of his strong position on this question as late as 1984, Ogarkov omitted mention of these weapons in his 1985 treatment of the important trends in military technologies.[61] One can only speculate that Ogarkov's omission may have resulted from internal reaction to the forcefulness of his implied criticism of the Party in earlier statements. On the other hand, the Soviets may hope to obviate or at least significantly delay the introduction of these systems through arms control negotiations. Whatever the case, other military analysts continue to discuss these weapons in much the same manner as Ogarkov. Moreover, a Soviet military ballistic missile defense expert, Major General Surikov, recently asserted that the Soviets would continue to conduct research and experimental design work to further upgrade the Moscow ABM system. Surikov implied that this research would include the use of "optical-electronic devices (including those operating in infrared and ultraviolet ranges)" for guidance systems.[62]

Military applications for laser, particle beam, radio frequency, kinetic energy, and electro-magnetic pulse technologies constitute the primary focus of Soviet long-term assessments.[63] The Soviets are also closely monitoring developments in robotics technologies, which they anticipate could lead to production of "crewless" aircraft, tanks, and self-propelled guns. Other long-term developments of interest to the Soviets include the creation of "psychotronic," genetic, biological, and geophysical weapons.[64] The Soviets have devoted particular attention to tactical applications for laser technologies. Soviet sources indicate that, for all practical purposes, these weapons are already in existence.[65] Laser technologies are already employed in guidance systems for later generations of terminally guided munitions. The Soviets anticipate that lasers may also find widespread use in suppression of enemy sensor systems; such systems may already be available for use against enemy electro-optic sensors.[66] Successful applications for laser technologies are also considered imminent in the solution of air defense problems.

The Soviets clearly anticipate that both sides will vigorously continue to exploit space for military communications, navigational, meteorological, and intelligence collection purposes. Although they realize that research and development in the area of space exploitation and weapons based on new physical principles has been under way in both the United States and Soviet Union for some time, the boost given these efforts by the U.S. Strategic Defense Initiative seems particularly worrisome to the Soviets. Soviet interest in the application of these weapons has extended beyond employment against ballistic missiles, however. The Soviets have devoted particular attention to the employment of such weapons against a range of space- and ground-based targets. One recent military analysis, for example, compared the characteristics and utility of laser, beam, kinetic energy, and electro-magnetic pulse weapons.[67] According to this account, laser weapons would have practically limitless range and would be particularly effective against "light-cased" military targets such as satellites, military space stations, helicopters, aircraft, missiles, and oil and gas storage tanks. Beam weapons, on the other hand, would be limited to targets in space, due to their inability to penetrate the atmosphere, and would be most useful against missiles during the ballistic portion of their flight. Electro-magnetic pulse weapons hold considerable potential for blinding command posts, disrupting communications systems, and destroying satellites and military space stations.

Soviet perceptions of other applications of these technologies is a bit murky. Non-military specialists have identified a range of other potential applications for laser and EMP space-based weapons over the longer term. These analysts profess to see a very real danger that these weapons could play a role in "decapitation" scenarios through space-based attacks on the components of national airborne command post systems.[68] Similarly, these weapons might be employed against strategic bombers operating on airborne alert or soon after takeoff.

Beyond the implications for space-based systems, however, the Soviets are concerned by the potential tactical applications of the new means by which to execute fire missions and the reconnaissance, target detection, and (in particular) information processing technologies sure to result from this initiative. For example, one trend of concern to the Soviets is the potential application of electro-magnetic gun technologies to theater warfare, not only in antitactical missile roles, but also against armored targets.[69] By way of illustration, a recent Soviet account provided the following assessment of the capabilities of this family of technologies.

> Electromagnetic guns are capable of creating at a range of 2000 km (at a speed of flight of inert munitions 10-20 km/sec) a higher

> density of energy in a unit area than other prospective types of weapons, including powerful lasers and nuclear munitions (with yields up to 25 KT.)[70]

Soviet forecasts for the conduct of warfare in the period after 2000 envision space-based reconnaissance directly linked to fire systems that can strike in real time deep into enemy defenses and even homelands. Numerous discussions of such space-based, reconnaissance-strike complexes have appeared in recent Soviet portrayals of U.S. military space programs. Two different variants have been identified in Soviet military analyses. One focuses upon the creation of a new generation of piloted space vehicles designed expressly for armed conflict from space. According to this variant, these vehicles would combine great speed, a "global zone of operations," and independent reconnaissance means with strike assets to provide a real-time RUK capability.[71] The second variant has focused upon the development of military space stations. According to this account, these would provide basing for "aerospace aircraft" which would be equipped with electro-magnetic guns and self-guided small-caliber missiles. This Soviet military analyst concluded that "this would represent nothing other than a reconnaissance- strike complex of space basing."[72] The appearance of such "aerospace aircraft" may have been included in a recent forecast of future aviation developments offered by the Commander in Chief of Soviet Air Forces, Marshal Yefimov.[73] According to Yefimov, three types of hypersonic vehicles are currently under consideration in "different countries in the world," and he predicted that "such machines may make their appearance in the form of surveillance aircraft and interceptors."

SOVIET MILITARY PERCEPTIONS OF ECONOMIC CONSTRAINTS ON FUTURE MILITARY PLANNING

Probably because of the issue's greater immediacy, Soviet military analysts have devoted more attention to the potential impact of mid-term technological changes on the nature of future war. In fact, Soviet consideration of these issues was probably well under way in the late 1970s but clearly assumed an accelerated pace in the early 1980s. The timing of this process was hardly coincidental, since the Soviets believe that "the basic systems of armament are renewed every 10 to 12 years."[74] One recent Soviet military assessment indicates that the Soviets have concluded that rearmament cycles may have undergone an even greater compression in recent years.

> Practice is showing that the period of development of new forms of weapons and equipping armies with these weapons is now reduced several times in comparison with the beginning of the century, and

> now comprises altogether about seven to eight years. Tendencies toward the shortening of this period are becoming all the more clear, despite the fact that technically the weapons are becoming more complicated and expenditures on their production are increasing.[75]

Soviet modernization programs already under way would be nearing completion by the late 1980s or early 1990s, and General Staff spokesmen in particular clearly believed that careful consideration of future requirements was overdue. This requirement became particularly acute in light of the Soviet view that the acceleration of the "military-technical revolution was bringing about qualitative changes in the structure of the military correlations of forces in the international arena."[76] As they conducted their analyses and identified their future requirements, however, Soviet military authorities apparently encountered a number of potentially critical shortfalls in the overall capacity of the Soviet system to respond to these defense requirements.

Perhaps the most critical shortfall concerned not only the degree of stagnation in the Soviet economy, which was becoming increasingly evident in the mid-to-late 1970s, but also the capacity of defense industries to develop the technologies required for mass production of the weapons systems of the future. Soviet military analysts, as a result of their Marxist-Leninist training, have always understood the importance of a strong economic base to support the fulfillment of defense requirements. Citations addressing the relationship between economics and military strength, particularly from the works of Engels, are common in Soviet military sources. One Soviet military analyst, for example, observed that

> [i]n pointing out the dependence of military strength on economic strength and capability, Engels wrote, "Nothing depends on economic conditions like the army and fleet themselves. Equipment, staffing, organization, tactics, and strategy depend first of all, on the level of production and means of communications." The most basic thing in violence, according to Engels, is "economic strength, is having the strong tool of large industry."[77]

In fact, the military has increasingly stressed economic potential as the key determinant of the outcome of the military competition with the West. Consequently, Soviet military commentators have progressively expanded the range of economic issues appropriate for military consideration.

> When solving the problems of building the military, the highest-ranking military organ of the nation must take into account the level of development of the nation's economy, the quantity and

quality of its industrial products, the capabilities for converting the economy from a peacetime to a wartime footing and the level of professional training of workers, engineers, and technicians.[78]

Beginning in the late 1970s, however, the depth of military concern over the status of the Soviet economy appeared to increase significantly. While military specialists were probably satisfied with the ability of the economy to fulfill current modernization requirements, it is also true that the technologies incorporated in these weapons were, for the most part, developed in the late 1960s and early 1970s. The sophistication of Soviet weapons systems also received an enormous boost from successful efforts to secure advanced Western technologies during the period of detente.[79] It seems evident, however, that by the late 1970s and early 1980s the Soviet military was becoming more skeptical about the ability of the economy to support what the military assessed to be its future needs. Soviet protestations aside, restricting access to Western technologies, such as those acquired from Toshiba and Kongsberg Vapanfabrik of Norway, can only serve to increase the pessimism of Soviet military planners over the capacity of their industrial base to produce the weapons systems of the future.

Beyond the systemic problem, the origins of the current dilemma lie in the Soviet political leadership's decision to reduce investment in industry as a whole, and particularly in machine building, in order to meet near-term commitments to both the military and agriculture.[80] Senior military spokesmen, however, were clearly aware of the potential impact of this decision on the ability of the civilian economy to support future military needs. Senior military authorities, such as Marshal Grechko, continued to emphasize the critical role played by the development of heavy industry for future military requirements.[81]

This problem was becoming increasingly acute as Soviet military analysts observed the West attempting to exploit its economic and especially its technological capacity in order to overturn Soviet force development advantages. In particular, the Soviets believed that the United States was seeking "to weaken the USSR economically, forcing it to spend vast resources on the creation of military equipment as a counter to American nuclear and conventional means."[82] The problem was not simply that the United States was attempting to exploit its economic potential, however, but that the Soviets were also becoming increasingly alarmed by "formation of a highly developed and more independent military-industrial base in Western Europe."[83] In fact, retrospective political and military analyses explicitly identify the stagnation of the Soviet economy in the mid to late 1970s as providing an impetus for the West to embark on its rearmament efforts. One such analysis, for example, after citing the economic achievements of the

Soviet Union as making possible the attainment of military–strategic parity and the introduction of detente, concluded that

> [t]hen, in the mid seventies the brief detente gave way to confrontation. Why did imperialism take this turn? There were various reasons, but one of them was that the economic difficulties in the socialist countries, including in the Soviet Union, were perceived in the West, and above all in the United States. And they thought: Now we can apply the "squeeze" and force the Communists to capitulate.[84]

General Secretary Gorbachev has offered a similar analysis when he cited "our internal state of affairs" as a key motivation for the "all–out offensive––economic, political, psychological, and militarist––launched by the forces of reaction at the end of the '70s and the beginning of the '80s."[85] Not surprisingly, by the mid 1980s the military increasingly stressed that

> [i]n contemporary conditions, the defensive capability of the state, the combat power of the army and navy more than ever before in the past depends on the condition of the economy, science and technology, and the defensive industries.[86]

Ironically, in marked contrast to earlier periods, by this time the military had increasingly come to view the economy as a "limiting factor" on force development.

Consequently, the Soviet military was not simply content to be a passive recipient of the output of Soviet industry. By the late 1970s, military specialists had apparently concluded that subsequent phases of modernization might require a somewhat different industrial base. Grechko had already identified a potential shortfall in the ability of the Soviet economy to produce future weapons. In 1975, he wrote that

> [t]he production of new weapons models and combat equipment is placing greater demands upon the country's economy. In order to manufacture these weapons and equipment it is not enough to make use of only the old branches of industry. It is necessary to develop new, long range branches, capable of producing qualitatively different materials, which would also include such unique materials as those possessing a high degree of mechanical strength, heat resistance, purity of composition, and other properties.[87]

As an indication that this concern was growing by 1980, for example, a military economist warned that

> [i]n conditions of the stormy and continuous development of military technology, the interdependence between the economy and military affairs is changing in many respects: the demands on the national economy are essentially different from those presented ten or even five years ago.[88]

This military economist, and others, argued that the Soviet economy must be able to fulfill not only current demands, but also the "long range requirements of defense" as well. Throughout this period, the military became increasingly assertive on its responsibilities with regard to the establishment of economic priorities. By 1985, military commentators were privately writing that

> the highest military organ must use suitable measures to affect the economy, issue proposals for preparing the economy early for war, increase the volume of production of truly important products, improve the quality of the economy to consolidate national defense, and set in a rational manner economic targets aimed to raising the economy's vitality all in time to defend against and counter the enemy's blows and also for use in the war.[89]

One clear item on the military's agenda was an increase in funding allocations for research and development. As early as 1976, Soviet military theoreticians were calling attention to the need for increased research efforts to meet the future demands of military affairs.[90] By 1978, Marshal Ogarkov had identified fundamental research to support "forecasting of the further development of military affairs in general" as "one of the most important tasks at the present time."[91] Increases in military research and development funding at about 4 percent yearly since the mid 1970s indicates that the Party, on at least this one point, has been responsive to the military's concerns.[92]

Equally important to the military, however, is the continued capacity of the Soviet industrial base to mass produce the weapons systems of the future. Military writers have increasingly emphasized the benefits for the military that are derived from a vigorous and efficient civilian sector of the economy.

> The creation of a new generation of computers, the production of machines with programmed controls or automation of loading and unloading work has for the armed forces sometimes no less significance than the development of a new form of weaponry. It must not be forgotten that contemporary military production is based on wide cooperation of dozens of branches, it depends, therefore, not just on the military sector alone.[93]

As early as 1980, Soviet military economists had publicly identified the creation of "unique materials, high-precision instrumentation, principally-new control

systems, and computer technologies" as critical to the further development of Soviet heavy industry.[94] Not surprisingly, by the late 1970s, Soviet acquisitions of Western technologies focused increasingly on manufacturing, instrumentation, and testing equipment.[95] The incorporation of the latest advances in science and technology into the machine building industry, in particular, was judged to be of critical importance to the military.

> Machine-building supports the increase of qualitative indicators in all material production and serves as the basis for the realization of scientific-technical achievements in the interests of the defense of the country.[96]

The military's concern at that time over the status of the machine building industry has been validated by subsequent Soviet analyses of the Party's failure to sustain investment in heavy industry.[97] In particular, these analyses indicate that failure to invest in machine building has created a significant technological lag in the overall sophistication of the Soviet economy.

Even General Secretary Brezhnev, in one of his last public appearances in 1982, was forced to at least imply that technological development necessitated by future military requirements might be beyond the current level of sophistication of the Soviet economy. Speaking to an assemblage of senior military command personnel in Moscow, Brezhnev admitted that

> [c]ompetition in military technology has sharply intensified, often acquiring a fundamentally new character. Lag in this competition is inadmissible. We expect our scientists, designers, engineers, and technicians will do everything possible to resolve successfully all tasks connected with this.[98]

This theme was amplified somewhat by another military economist shortly after Brezhnev's death. Major General A. Gurov echoed Brezhnev's acknowledgment that the Soviet Union must not lag behind in the military-technical competition.[99] The rapid renewal of the "most complex systems of armament" would require a highly developed and dynamic economy and advanced scientific-technical potential. Among the "broad range of problems" associated with meeting future Soviet defense needs, Gurov identified the further development and improvement of the "structure of our national economy as a whole and the defense industry in particular." According to Gurov, an "objective requirement" confronting the Soviet political leadership was to ensure that

> the utmost attention [be] devoted to the economic backup for the tasks being resolved by the Army and Navy in the interests of maintaining constant combat readiness, further enhancing it and,

> consequently, comprehensively strengthening the defense capability of our state and the entire socialist community.[100]

During the leadership transition period, some military theoreticians introduced a more rigorous standard by which to measure the potential effectiveness of the defense industries. These spokesmen focused on the qualitative dimensions of the military-technical competition and began to assert that Soviet weapons must be equivalent to those produced in the West. These assertions assumed various forms, with the most extreme being that Soviet weapons had to match Western systems in their precise tactical-technical characteristics.

> The lessons of the former war teach that the armed forces, in order not to be caught unawares, must always have the most modern types of weapons and military equipment provided by the achievements of science; in their tactical-technical characteristics these must not be less than the corresponding systems of the armed forces of the probable enemy.[101]

Others asserted simply that, as a first-order priority, attention must be devoted to the application of the country's scientific-technical potential to support the "reliable creation in short order of any type of weapons in the current or future arsenal of the enemy."[102] According to a recent Warsaw Pact analysis, this concern was generated by a growing realization that the future military competition could shift into completely new areas and that the traditional approach to ensuring that incremental modernizations would correspond to Western advances would no longer suffice. Continued competitiveness would depend, instead, upon

> the frequency of the appearance of prototypes of new weapons systems, and even on the tempo of coming up with new design concepts or daring scientific hypotheses concerning possibilities in the future of combat means.[103]

The Soviet military is fully aware of what is necessary for the development and production of these types of weapons.

> In the struggle for improvement in the technical equipping of the military it is difficult to over-estimate the basic trends of scientific-technical progress--the further priority development of machine building, especially machine-tool manufacturing, robotics, computer technology, instrument making, and microelectronics. It is exactly these trends which are today the basic catalysts of military-technical progress.[104]

According to recent Soviet analyses,

> [w]hat is demanded today for series production of modern weaponry, the newest combat technologies is not common or ordinary but the most modern, often unique equipment--fundamentally new instruments, numerically-controlled machine tools, robotics, the latest generation of computers, and flexible production systems.[105]

Moreover, the Soviet military recognizes that the economy will have to be able to produce such items as microprocessors, new composition and "special, pure materials" and laser and fiber technologies in order to compete in the future.[106] Such materials would be important not only for military space developments, but also for future land warfare systems. Survivability enhancements, for example, cannot be achieved without applications of such new materials, especially in light of Soviet design philosophy for such systems. Various military authorities have expressed confidence in the ability of the economic system to perform at this level, given proper management and exploitation of this system's full potential.[107] However, even the most optimistic Soviet assessments, such as one provided by L. N. Zaykov, then Central Committee Secretary for heavy industry, indicate that Soviet machine building will not begin to approach world levels of competition until the early 1990s.[108] Given the comparative levels of sophistication of Soviet and Western production processes, achieving a high degree of equivalence in tactical-technical characteristics of weapons systems would seem to be an inordinately difficult task.

THE TRANSITIONAL STAGE OF MILITARY DEVELOPMENTS

Without question, the military has concluded that the development of military affairs has entered a period of transition, as a result of both the objective factor of future technologies and also internal and external political developments. Although it has been asserted in the West that the Soviets believe military affairs have entered a third revolutionary stage of development, Soviet military analysts are more cautious in their judgment. Although Defense Minister Yazov has in fact made such a statement, this conclusion appears linked more to the ongoing effort to reform Soviet society through the Gorbachev restructuring programs.[109] Soviet military analysts, on the other hand, seem to believe that the requisite conditions for the introduction of a new stage of military affairs have not yet been met.

This is based on their application to military affairs of the dialectic law of the transformation of the quantitative into the qualitative. They apparently believe

that these technologies are simply not yet available in sufficient quantities to initiate a new stage of force development. According to Marshal N.V. Ogarkov,

> [u]ntil that time, as long as new weapons and military technology are used in limited quantities, they will most often simply be adapted to existing methods of armed combat or at best they will introduce only certain partial corrections.[110]

Soviet criteria for concluding that a new stage of military affairs is under way include the requirement for large-scale production and widespread deployment of these systems. Beyond this, however, the systems must produce a wide-ranging transformation in force structure and the entire system of armament which, in turn, will result in a "qualitative leap in the combat power of the state."[111] The last such transformation occurred as the result of the integration of nuclear weapons into the armed forces in large numbers.

It is evident that Soviet military theoreticians believe that a similar transformation is, in fact, "imminent" as a result of the impending introduction of a new generation of weapons. Full-scale deployment of these systems will indeed produce yet another qualitative leap in combat power and the necessary conditions for a new stage in military affairs. What is less clear is the Soviet view of the quantity of these systems which may be required to bring about this new stage. Given the Soviet evaluation of the potential characteristics of these systems, the numbers required will surely not be comparable to the number of tanks or aircraft, for example, required to change the nature of warfare during the interwar period of the 1920s and 1930s. It also seems possible that certain characteristics, such as "order of magnitude" improvements in accuracy combined with the greater lethality of munitions, may necessitate fewer deployments in comparison with the earlier transformation in warfare brought about by nuclear weapons. On the other hand, Soviet perceptions of such factors as attrition or the potential duration of future conflicts, discussed in more detail below, may also affect Soviet estimates of this relationship.

Nevertheless, Soviet military planners believe that the current transitional stage, which could extend well into the next decade, affords them considerable time to develop and test alternative approaches and solutions to the military dilemmas of the future battlefield. In many respects, the Soviets appear to believe the current stage is similar to the mid-to-late 1950s. As during that period, both sides are struggling to comprehend the potential impact of qualitatively new weapons on force structures, operational concepts, and command and control objectives.[112] In pursuit of this objective, the Soviet military has undertaken a number of tasks, which are discussed below.

First, the military has attempted to accommodate itself to the Party's role in the development of military doctrine and policy and has consistently sought to depict itself as understanding the economic realities of the contemporary period. General Gareyev, for example, has warned that

> military-theoretical thought must constantly strive for the rational use of the means allotted for military needs within the limits of strict necessity, so that defense will be reliable and at the same time not too burdensome for the state.[113]

Soviet military economists have explicitly reminded their readers that the economy can be a "limiting factor," that both material and human resources are "not unlimited," and that the economy is "not always able to simultaneously solve a large number of tasks of a military-technical and military-economic character."[114] Moreover, with considerable apparent reluctance, senior military command authorities, such as Marshals Akhromeyev and Kulikov, have begun to at least acknowledge the concept of sufficiency in their public statements, although they seem to prefer the term "defense sufficiency" to "reasonable sufficiency."

At the same time, the military has also continued to remind the party of its obligation to ensure national security and of the critical role of military strength in fulfilling that obligation. While Party and civilian spokesmen have consistently referred to Gorbachev's Party Congress statement that national security may be achieved only by political means, Marshal Akhromeyev, on the other hand, has been willing to admit only that the task of ensuring security "must be resolved primarily by political means."[115] According to the military, the "strategic balance" between the Soviet Union and the United States can be maintained only through the modernization and development of the armed forces. Diplomacy, arms control, and unilateral initiatives are simply no substitute for sustained efforts to "strengthen the defensive capability" of both the armed forces and the country as a whole. Military spokesmen have even reverted to quoting Lenin on the Party's obligation to fulfill 100 percent of the military needs.[116] Furthermore, the military has repeatedly reminded the Party that it was only the military buildup that forced the United States to rethink the premises of its defense policy and accept arms control. A particularly direct criticism of contemporary critics of the military was published in a *Krasnaya Zvezda* account of a writers' conference held at the Ministry of Defense in late 1987.[117] According to this account, one participant observed that it was solely through the efforts of the military that the Soviet Union was able to negotiate with the United States on an equal basis.

> It is a strange business, Alexsandr Prokhanov said, but we are going through a period when our culture, in the shape of some writers, is trying somehow to "run down" the Army and impute nonexistent sins to it. That despite the fact that the Army in the period of so-call stagnation was thriving, worked conscientiously, and achieved strategic parity. A pacifist, abstract peace-making mentality, after all, would not have allowed us to talk with the United States as equals or achieve the signing of a treaty on medium-range and shorter-range missiles.

Not surprisingly, therefore, a number of areas of contention exist between the analyses of civilian experts and the military's agenda. Differences have even emerged over the nature of a future war. On the one hand, civilians have argued that the Soviet military no longer needs to be prepared to fight everywhere in the event of a future war. The military, however, continues to assert that a future war will be global in nature and that it must be prepared to conduct worldwide military operations.[118] Other areas of contention include approaches to the measurement of sufficiency and symmetrical versus asymmetrical responses to Western arms developments.

Disputes between these civilian "experts" and military spokesmen are only thinly veiled in the Soviet Press. The military, in fact, has become increasingly direct in its response to civilian proposals and critiques of military requirements. It appears that the military's case against any unilateral measures in pursuit of reasonable sufficiency is being made primarily by the service Commanders in Chief (CINCs) who are also Deputy Ministers of Defense. Army General Tretyak, recently appointed CINC of the Air Defense Forces, has been especially prominent in promoting the military's case for continuation of resource allocations to ensure a reliable defense. In a 3 February 1988 interview in *Literaturnaya gazeta*, a Soviet economist illustrated the potential benefits of unilateral reductions in Soviet military manpower.[119] According to this account,

> In the late fifties, the Soviet Union unilaterally reduced its Armed Forces by 1.2 million men. This made it possible to build 100 major house building combines. In a comparatively short space of time, housing construction was doubled in the country and the old-age pension was doubled.

Treytak responded less than a month later. In an interview published in *Moscow News*, Treytak explicitly addressed this historical example, but his assessment differed dramatically from that of the Soviet economist.[120]

> On the surface, it looked rather convincing. But only on the surface. As a professional military man, I'll tell you that the step

> was a rash one. It dealt a terrible blow at our defense capacity and at our officer personnel.

Moreover, Treytak asserted that "we are still feeling" the effects of this unilateral move. Consequently, Treytak concluded that

> any changes in our army should be considered a thousand times over before they are decided upon. Temporary benefits are a great lure. But I repeat once again--the most important thing is to have a reliable defense. If we were not so strong, then imperialism would not have resisted an attempt to change the world of today. We must have as much force as is necessary to guarantee reliably the security of the USSR and our allies.

Fleet Admiral Chernavin, CINC Navy, has also referred to hopes for an end to the arms race and military expenditures as "dreams" and has explicitly reminded the Party that "dreams are dreams and reality dictates its own laws."[121]

Other military spokesmen have warned against an overemphasis on political means at the expense of requisite military measures. Lt. General V. Serebryannikov, for example, recently reminded his readers of the catastrophic consequences resulting from an overreliance on political measures at the expense of military vigilance prior to the outbreak of the Great Patriotic War.[122] Serebryannikov warned of the negative effect on military vigilance of the constant publications in the Soviet media of arms control proposals, optimistic estimates of the future threat environment, and favorable treatment of the potential enemies' policies and objectives. Particularly telling was Serebryannikov's references to the consequences of a similar campaign prior to June 1941. Similarly, General Yu. Lebedev, a deputy chief of the General Staff's Treaty and Arms Control Directorate, has sought to justify sustained military spending through reference to the Soviet Union's Great Patriotic War experience.[123] According to Lebedev,

> we Soviets cannot repeat what happened in 1941. The defeat occurred because of a lack of attention to the Army's need, and there are still countries that consider us their enemy and that threaten us.

What seems evident in this expression of military concern is that the Party has yet to strike the balance between political and military measures. It is too early to predict the final outcome of these policy debates, but the military seems concerned that its influence in the national security decision-making process may be in some jeopardy.

On the last point, in particular, the military may have found some support within the Party Central Committee. In its January 1987 Plenum resolutions, the

Party linked the necessity to maintain strategic parity with a demand for a "speedy build-up of the economic potential, comprehensive strengthening of the defenses of the country and maintenance of its defense capability at the proper level."[124] Not surprisingly, senior military authorities, such as Deputy Defense Minister Shabanov, moved quickly to link the 27th Party Congress formulation on strategic parity to the 1987 Plenum resolution.[125] Other military authorities, such as Marshal Akhromeyev, have continued to identify the "strengthening of the defensive capability" as one of the main goals of the Party's policy of restructuring. Moreover, the military has recently dropped all reference to Gorbachev's 27th Party Congress national security formula. The 1987 version of TAKTIKA, for example, refers only to those passages of Gorbachev's speech that support the task of strengthening the defensive capacity of the country and modernizing the armed forces.[126]

Consequently, there can be little doubt that the military fully appreciates the benefits it will derive from General Secretary Gorbachev's "restructuring" policies. Despite potential economic constraints, military economists have argued that the fulfillment of the key objective of the restructuring of Soviet industry, the introduction of new technological processes and equipment, would shorten the production time of military equipment and reduce the material and labor costs associated with such production.[127] According to Marshal Kulikov, successful restructuring will

> serve to consolidate the country's defense capability. Scientific-technological progress and economic development permit timely supplies of modern weapons and combat technology to the Soviet Armed Forces. These supplies are commensurate to the danger of any eventual aggression.[128]

Army General Lizichev, the Chief of the Main Political Administration, set forth the military's view of the anticipated benefits from the "acceleration of the country's socioeconomic development and the fundamental restructuring of all aspects of our life and work." According to General Lizichev,

> the country's success in the economic, social, and cultural spheres and in the development of science and technology have a decisive effect on the provision of the Army and Navy with the most modern combat equipment and weapons and on the supply of the necessary material resources, on their meeting with comprehensively trained military cadres and educated and spiritually and physically healthy personnel, and on the state of military science.[129]

The restructuring program, according to Soviet military analysts, would not only create new possibilities for resolving future defense tasks, but, most important,

"strengthen the position of socialism in the competition with capitalism and the overall defensive capability of the country."[130] Still other military spokesmen have written that the fulfillment of plans for the perestroika of all spheres of life and the acceleration of the social-economic development of society will play the critical role in the increase of the defense potential of the country.[131]

As an interim step, however, the military seems to have been willing to undertake a reassessment of its internal priorities. Two absolute requirements, from the military's perspective, are continuing support for the completion of current modernization programs and continued growth in research and development budgets. On both counts, the military seems successful thus far in protecting its programs from encroachments from outside, although it can probably expect few, if any, increases in current program resources. In particular, the military will resist any transfer of resources away from this effort to the consumer sector or social programs. Remarkably, and perhaps as a reflection of its concerns, the military has gone so far as to assert that "the people understand these needs and do not yearn for additional comforts" and that the "funding of the Army does not cause negative feelings on the people's part."[132]

The military does seem to recognize that it must evaluate trade-offs between service modernization programs. General Staff spokesmen seem to have identified certain Navy programs, surface combatants in particular, as an "excessive luxury" and have emphasized instead the role of SSBNs and Naval Aviation as the "basic force" of the Navy.[133] In contrast, the Soviet air forces seem to have received the highest priority for future modernization efforts. Only the air forces have been singled out as already undergoing a "qualitative leap" in their development in recent Soviet evaluations of the five services.

The most important task has been to understand and fully comprehend the dimensions and directions military affairs are likely to assume as a result of the advent of a new stage of development. For the time being, at least, the focus of Soviet military analysis is on comprehension of the potential course of developments in military affairs over the next few years, especially with regard to the impact of a "new qualitative leap in weapons systems and military technologies." The Soviets believe that both sides have entered an intense period of forecasting with the purpose of comprehending the impact of these developments on future warfare, which probably explains the references to the contemporary period as a transitional stage. Senior military authorities, such as Marshals Ogarkov and Akhromeyev and General Gareyev, have been particularly concerned that the Soviet assessment process begin to address these problems and develop forecasts of these developments. According to Gareyev,

> [t]his circumstance demands from Soviet military science the theoretical elaboration of many important problems of the development, preparation, and employment of the Armed Forces, and predetermines a shift of the center of gravity [in military affairs] to the realm of the struggle of military-scientific and scientific-technical ideas.[134]

A number of research agendas have appeared in Soviet sources in response to the tasks of the current transitional stage. Central to these agendas has been the requirement to investigate and comprehend the potential nature of future warfare and the main features and characteristics of future military operations. The reasons for this, according to Marshal Akhromeyev, are evident.

> History provides many examples of how the armies of a number of countries prepared for future war by relying on past experience and without taking into account the changes taking place in military affairs.[135]

The senior Soviet military leadership seems intent that the Soviet army not become one of these "examples" in the event of a future conflict.

SOVIET FORECASTS OF THE NATURE OF FUTURE WAR

The Soviets clearly anticipate the combined effect of future technological developments on the nature of warfare to be potentially enormous.

> The significant changes in the technical equipping of armies at the contemporary stage . . . will exert a deep influence on the character of battle and on military art as a whole.[136]

The introduction of such systems as RUKs and hypersonic missiles, for example, cannot fail in the Soviet view to introduce fundamental changes in the character of combined-arms warfare.[137] What have the Soviets concluded thus far with regard to the potential nature of this "deep influence"?

Generally, the Soviets believe that future theater warfare will continue to assume an increasing "land-air" character, as both sides expand capabilities and operations in the "vertical dimension." The contribution of aviation assets, not only to deep fire destruction but also to maneuver in depth, can hardly be overestimated, according to the Soviets. In this sense, it seems unlikely that the Soviets would forego their basic operational concept, which envisions the conduct of operations across the depth of enemy defenses, simultaneously if possible. Acquisition of the capabilities discussed in earlier sections could provide the Soviets with an opportunity to execute this concept fully without the risks

associated with a reliance on nuclear systems for deep targeting or to fulfill damage criteria. The Soviets seem to believe that this operational concept, which was validated in the Great Patriotic War and continued to retain its relevance through the revolution in military affairs, would continue to be the most appropriate concept for future war. This conclusion appears to apply not just to the mid-term Soviet forecast, but also to warfare well into the 20th century. What is likely to change and evolve is the character and complexity of future military operation and the methods by which the mission requirements of these operations would be fulfilled.

A number of themes have surfaced with regularity in Soviet assessments of the impact of new technologies on future warfare. Soviet military theoreticians have come to believe that many of the analytic conclusions regarding the dynamism and tempo of nuclear warfare are increasingly applicable to conventional military operations. Consequently, Soviet analyses have focused increasingly on the potential impact of unprecedented attrition and disruption of control on the fulfillment of operational and strategic objectives, the increased "blurring" of the distinction between offensive and defensive means and the consequent impact on the mix of offensive and defensive activities in military planning, and the increasing scale of future military operations. The Soviets have been reevaluating the factor of time and the role of surprise in modern warfare and are reconsidering many of their basic premises regarding the initial period of war. The starting point of much of this analysis, however, is the evolving perception of the potential escalation thresholds of any future war and the increasing unwillingness of both sides to rely on nuclear weapons to resolve tactical, operational, and perhaps even strategic tasks.

Soviet Perceptions of the Impact of New Technologies on Intrawar Thresholds

One of the major conclusions of the research conducted to date on the subject of Soviet views of future war is that the Soviets expect non-nuclear warfare to be the primary beneficiary of current and prospective developments in military technology. The Soviets seem to believe that the increasing effectiveness of non-nuclear systems should permit the use of these weapons for an increasing set of missions and targets. Although destruction of some military targets will continue to be possible only with the use of nuclear weapons, more and more missions, some formerly possible only with these weapons, will in the future be executed through use of non-nuclear systems. Consequently, the Soviets have concluded that future conventional operations will increasingly take on many of the attributes and characteristics commonly assumed to be associated with nuclear warfare.

Several issues that are inherent in the nature of future military technologies merit additional attention. In particular, these concern the potential impact of new technologies on intrawar thresholds or firebreaks. Some treatment of potential Soviet perspectives on these issues is important for consideration of alternative strategic environments and future Soviet efforts to manage the long-term military competition. This section will review what is known of Soviet perceptions on these issues.

The observation has been made in the West that many of the anticipated upgrades to conventional systems, especially those that will provide order-of-magnitude increases in the accuracy of these systems, are equally applicable to future nuclear systems. Increasingly, it is argued, either side should be able to execute selective, discriminating nuclear attacks that can achieve a high degree of military effectiveness with low (or practically no) collateral damage. Earth-penetrating weapons are often cited as an example of a system that would appear to meet these criteria. Some fear, however, that since the (self) deterring nature of the indiscriminate effects of current systems would be removed, either side might be tempted to resort to these new nuclear forces very early in order to raise confidence in achieving desired damage expectancies. Consequently, concern exists as to the manner in which potential intrawar firebreaks--conventional to nuclear, and within nuclear operations--might be affected by the introduction of these new technologies. In particular, how is the nature of the transition from conventional to nuclear operations likely to change, given Soviet perceptions of future war?

The Soviets clearly believe that nuclear weapons will continue to play an important but gradually diminishing role in the further development of military theory. Nuclear weapons are likely to continue to shape the operational context for military operations in the event of a future war. For example, the Deputy CINC for Combat Training of the Soviet Ground Forces, Colonel General Merimskiy, has noted that the presence of nuclear weapons will continue to impose unique requirements on military planning.[138] Soviet commanders will continue to address the dilemmas associated with the need, on the one hand, to disperse en route to commitment positions, so as not to present nuclear-suitable targets, and, at the same time, to concentrate forces at decisive places and times to ensure success. Obviously, denuclearization of NATO and Warsaw Pact force postures would alleviate these operational dilemmas somewhat. Not surprisingly, therefore, Defense Minister Yazov has graciously declared Soviet willingness to restructure Warsaw Pact forces along "nonnuclear principles."[139]

From this and other Soviet statements, some in the West have concluded that the Soviet military now sees little, if any, military utility for nuclear weapons. This observation seems to ignore several key conclusions of Soviet military

theory. First, as Merimskiy notes, the mere existence of nuclear weapons imposes certain constraints and requirements on military planning. More important, however, the Soviets believe that the existence of an effective and survivable nuclear force could potentially deter an opponent from employing his nuclear weapons to punish Soviet aggression through attacks on the Soviet homeland. The capability to deter such attacks by the threat of unacceptable retaliation represents a critically important function for Soviet strategic nuclear forces. Equally important, the existence of secure and effective theater nuclear forces, and especially the threat to use such a force in an irrational manner, could deter an opponent from using his nuclear forces to deny achievement of the objectives of Soviet aggression. Consequently, the continued existence of such nuclear forces has a very real military utility in the sense that the intrawar deterrent inherent in such a capability could enable the Soviets to execute their concepts of a non-nuclear strategic operation unimpeded by an opponent's nuclear attacks. The Soviets clearly believe, however, that in order to fulfill such a deterrent role, these forces must be both usable and effective; this conclusion was reached in the aftermath of the Khrushchev period and continues to represent Soviet military theory today.

Soviet conventional preferences in the event of a major war are now generally accepted by Western analysts. Beginning in the mid 1960s with the adoption of a "war-by-stages" approach, the Soviets sought to exploit the opportunities inherent in the NATO strategy of Flexible Response to achieve their strategic objectives without involvement in the enormously complicated environment of nuclear operations. At the same time, the Soviets were appropriately skeptical about their ability to prevent such a war from escalating to the use of nuclear weapons. This skepticism was repeatedly expressed in the General Staff journal *Military Thought* and in the General Staff Academy lecture materials.

Although the Soviets initially believed that NATO would be forced to resort to nuclear use early (3-5 days at best), this estimate came to be modified somewhat during the 1970s. On the one hand, the Soviets observed that NATO's nuclear threshold during this period, as evidenced in NATO exercises, was raised somewhat to 5-7 days and possibly even to 10 days and beyond.[140] This was probably due in part to increasing NATO military capabilities, and also to the perception on both sides of the disincentives for early nuclear use. On the other hand, the Soviets became increasingly confident of their conventional capability to sufficiently disrupt NATO's nuclear decision-making process so as to prevent NATO's effective use of these weapons. Nevertheless, they continued to anticipate that at some point in a conflict, NATO would be forced to resort to nuclear weapons. Consequently, although they had long expressed the preference for conventional operations and had postured themselves accordingly, Soviet

confidence in keeping a future war conventional was not really reflected in authoritative statements of military strategy or military doctrine until the late 1970s or early 1980s.

This conclusion was, however, subject to some reconsideration during the early and mid 1980s. This reconsideration was generated, in part, as one response to the Reagan Administration's strategic offensive forces modernization programs, published reports that the Administration's first set of Defense Guidances focused heavily on requirements for the conduct of a protracted nuclear war, and the apparent willingness of some Administration officials to speculate in public about the utility of nuclear weapons in future conflicts. References to the inevitability of escalation to nuclear weapons found their way back into articles by authoritative Soviet military spokesmen; some Soviet military publications seemed to reflect an increased awareness of the operational requirements inherent in a nuclear environment; and Soviet concerns over the form and content of the initial period of war once again included references to the destructiveness of a first massive nuclear strike.[141] It has been reported in the western media, moreover, that Soviet concern was sufficiently high to necessitate the declaration of a KGB alert in 1981.[142]

However compelling these "concerns" may have been, there are a number of equally plausible explanations for Soviet behavior during this period. First, it is evident that the "war scare" of the early 1980s was part of the internal political maneuvering in preparation for the coming leadership succession. This campaign was designed, in part, to discredit Brezhnev and, more likely, his probable choice for General Secretary, Chernenko, through denigration of their commitment to defense of the homeland. Second, it had become abundantly clear by 1982 that the economy was stagnating badly and that competition for future resources was likely to intensify. The military sought to exploit the war scare campaign to ensure at least a continued claim to its historical share of the allocation pie. Moreover, if done adroitly, the military might even be able to increase that share in response to its perception of the nature of future war requirements. Finally, Soviet political and military spokesmen were enlisted in a public diplomacy campaign not only to disrupt deployment of U.S. INF missiles in Europe, but also to dissuade NATO from carrying though the nonnuclear upgrades to its forces envisioned in the 1984 NATO Ministerials. In the context of this campaign, for example, Marshal Kulikov sought to dissuade NATO elites from undertaking conventional force improvements designed, in part, to raise the nuclear threshold by arguing that "by whatever means a new world war begins it will *inevitably* end in a nuclear catastrophe" (emphasis added). A key component of this campaign, which also sought to exploit the general level of concern over nuclear war prevalent at that time in the West, was to assert that such Western deployments

would inevitably increase the threat of war and of nuclear catastrophe. This campaign also featured Soviet assertions that the threshold between conventional and nuclear operations was becoming increasingly blurred by the impending introduction of newer conventional systems. Ironically, although it is often asserted in Soviet public diplomacy statements and by some Western observers that this could, in effect, lower the nuclear threshold, Soviet military analysts have concluded just the reverse. Since these systems are nearly comparable in effectiveness but not in terms of indiscriminate destruction and collateral damage, there should be little need to resort to nuclear weapons to execute any but a limited set of military missions.

Whatever the case, by 1985, Soviet confidence in the U.S. recognition of the futility of large-scale nuclear use was reflected in two authoritative statements of the contemporary views of Soviet military theory. In a February 1985 article in the authoritative Party journal *Kommunist*, the new Chief of the General Staff Marshal Akhromeyev concluded that

> [i]n recent years our probable enemies, recognizing the unavoidability of a retaliatory nuclear strike and its catastrophic consequences, are devoting special attention to the development of systems of conventional weapons with better destruction, range, and accuracy characteristics. Simultaneously, they are modernizing the methods of unleashing strategic military actions with the use of conventional means of destruction, primarily the new types of controlled and automated modes of high-accuracy weapons.[143]

The same year, General Gareyev, then Chief of the General Staff's Military Science Directorate, critiqued the conclusions of Soviet military theory of the 1960s and 1970s on the inevitability of escalation to mass nuclear employment.

> In the 1960s and 1970s the authors of this (*Military Strategy*) and many other works proceeded from the conclusion that war in all circumstances would be conducted with the use of nuclear weapons, and strategic military actions with the use of only conventional means of destruction were considered as a short episode at the beginning of the war.[144]

Gareyev asserted that these authors had failed to foresee that the "accumulation and modernization" of nuclear arsenals would reach such proportions that "a mass use of these weapons in a war could bring catastrophic consequences for both sides." This fact, coupled with Western (and Soviet) efforts to develop high-accuracy conventional systems, led the Soviets to conclude that the "possibility of a comparatively long war with use of conventional weapons is

increasing." In other words, despite the war scare and Soviet references to the increased threat of nuclear war in the early 1980s, the chief military scientist of the Soviet Union, by 1985, could argue that the Soviets believed that the nuclear threshold of a future conflict was likely to be very high, if it were even reached at all.

More significant for the issue under consideration, Gareyev based this conclusion not only on the mutual disincentives for mass nuclear employment, but also upon the impending introduction of "new types of high-accuracy weapons." Current evaluations of these new systems, consequently, are unlikely to reduce the Soviet confidence in this estimate. It is sufficient to point out that this evaluation has been progressively upgraded to the point that these weapons are apparently now considered "comparable to nuclear missile weapons on the battlefield." Consequently, the Soviets have devoted increasing attention to the effectiveness of these weapons against targets not only at tactical depths, but also at operational and even strategic depths. For example, Soviet rear services spokesmen have acknowledged that critical nodes within the rear services support structure are vulnerable to attacks with precision-guided conventional munitions at these extended depths. They have apparently recognized that the West may be closer to a solution to the technical problem associated with holding these targets at risk than to those problems associated with killing armored targets at extended ranges.

Marshal Ogarkov's estimate of both the range and destructive potential of future conventional systems would also seem to support the view that the Soviets believe that the advent of these new technologies should raise the nuclear threshold of a major war. Ogarkov essentially argued that the integration of new reconnaissance and guidance technologies into future conventional weapons systems should effectively remove any of the limitations currently restricting the application of these systems to a wider range of missions. Improvements in accuracy, when combined with these other developments, should open up new mission opportunities for these systems as well. In effect, these developments would provide conventional weapons with an effectiveness approaching that of nuclear weapons, make these systems "global in nature," and sharply increase the destructive potential of these systems "at a minimum by an order of magnitude." In short, Ogarkov appears to believe that, in the future, there will be few, if any, missions that would be inappropriate for non-nuclear systems. Consequently, both sides would likely be far less reliant on the use of nuclear weapons to perform tactical, operational and perhaps even some strategic missions. Authoritative Soviet spokesmen appear to believe that, assuming appropriate resource allocation and funding decisions are taken, neither side should be

tempted to resort to even precision-guided, low-yield nuclear weapons in an attempt to achieve a greater confidence of destruction.

Obviously, retention of such selective options would ease the potential decision dilemma for the Soviet leadership associated with a stalemated conventional war. Rather than being confronted with the stark choice between halting short of fulfillment of their strategic objectives and resorting to large-scale nuclear use, Soviet political leaders have probably insisted on the development of a set of nuclear options tailored to the requirements of military effectiveness, but designed to assure minimum collateral damage. Equally obvious is the fact that the Soviets understand clearly the dilemma such options would present NATO and the potential for dissension in the process of deciding how to respond, which could be created not only by attacks on NATO's periphery, but also by withholding strikes from selected countries within NATO's Central Region.

Resort to these options would not be taken lightly, however. It seems likely, given the clear perception of both the political and military leadership of the potential risks associated with any nuclear use, that such options would be of interest in only the most desperate circumstances. There is every indication that the Soviet political leadership has become progressively more, rather than less, pessimistic about the risks of nuclear use.[145] The progressive tightening of political control over nuclear use, referred to once again recently by the new Minister of Defense General Yazov, would seem to reflect the determination of the political leadership to prevent any unauthorized use on whatever scale. According to Yazov, the Soviets have undertaken "the organization of the most rigorous control aimed at the prevention of nonsanctioned use of nuclear weapons, ranging from tactical to strategic nuclear weapons." Soviet leaders appear determined not to let any future conflict slip from their control. This has become particularly clear in the aftermath of the Chernobyl nuclear power plant accident. Given the political leadership's seemingly real fears of the potential catastrophic consequences of general nuclear war, they are probably more intent than ever on limiting vertical escalation and preventing the further spread of nuclear conflict, once initiated. Whatever the case, political leadership decision-making is certain to be far less tolerant of ambiguity than in the past. It is doubtful, for example, that use-or-lose arguments would sway political decision-makers unless indications of a large-scale attack were unambiguous. Soviet leaders might have incentives to ride out small-scale attacks or those likely to be conventionally armed. Although it may be unintended, the thrust of much recent Soviet discussion about nuclear war seems to reflect a belief that, regardless of which side initiates nuclear use, both sides are equally at risk from any large-scale use of these weapons. Consequently, the Soviet leadership may discard some of the traditional factors, such as the requirement for massive

preemptive attacks, which would have determined potential Soviet responses in the past, in favor of a more cautious approach to escalation decision-making.

Beyond this, however, the military may prefer to prepare and posture for a prolonged conventional war, rather than rely on an "easy" resort to even precision-guided, low-yield nuclear attacks. This choice has been presented in stark terms in a number of recent authoritative statements by senior Soviet authorities. According to Marshal Akhromeyev's May 9, 1987 Victory Day article in *Red Star*,

> [n]uclear war may bring mankind to its grave. A world war with the use of conventional weapons, if it is unleashed by the aggressor, may also bring to mankind innumerable and even unforeseen disasters and suffering.[146]

So too did World War II, but mankind survived that experience. Presented with such a dilemma, it seems evident that Akhromeyev's choice would be clear.

In 1988, the Soviets modified this choice somewhat. They began to refer to non-nuclear attacks on nuclear power stations and chemical production facilities as having the potential for, in the words of Defense Minister Yazov, "catastrophic consequences comparable with a nuclear cataclysm."[147] Akhromeyev's discussion of the same issue was somewhat more temperate. He concludes only that

> the likelihood of the deliberate destruction of nuclear power facilities and chemically dangerous production units will give such a war a destructive character not only regarding armies and navies, but also to the peoples of all continents.[148]

The Soviets, of course, have very powerful incentives to deter enemy attacks against their own facilities. There also appears to be an interesting correlation between Soviet references to such attacks and the employment of similar arguments by West European opposition parties to justify removal of U.S. nuclear weapons from Europe. There is, however, nothing in these statements to indicate that such attacks are somehow tantamount to crossing the nuclear threshold. In fact, Akhromeyev makes explicit this view by going on to state that in a conventional war, "it must be also taken into account that such a war could at any moment turn into a nuclear war." It is only the inclusion of these targets, however, that threaten consequences even remotely comparable to general nuclear war.

This choice may also reflect the essence of Marshal Ogarkov's message to both his internal military critics and the Party leadership. Ogarkov clearly

believed it is far better to prepare for a prolonged, intensive and bitter but non-nuclear struggle than to count on a solution to be achieved through nuclear attacks. Soviet confidence, for example, in either side's capability to execute a disarming first strike has been waning for years and now seems at an all-time low. According to the Soviet analysis, both sides have sufficient diversity and protection for strategic nuclear forces to ensure the execution of a retaliatory strike which would, in Ogarkov's view,

> even with the limited number of nuclear weapons remaining to the defender, deprive the aggressor of the potential afterwards to conduct not only the war, but also any type of serious operations. . . .

Ogarkov's curious reference to "not only the war, but also . . . serious operations" apparently refers to retaliatory strikes against not only military forces in the field, but also the set of war-supporting targets in the homelands. Although ostensibly directed to a Western audience, there should be little doubt that the intended recipients of his message are key decision-makers within the Soviet elite. Better to expend precious resources on non-nuclear forces, especially those with the potential for military effectiveness approaching that of weapons of mass destruction, than to risk the catastrophic consequences inherent in reliance on nuclear forces.

Consequently, for both military and political reasons, there would appear to be little support for the proposition that new conventional weapons, at least in the Soviet perspective, would lower the nuclear threshold of a major conflict. Instead, the Soviets seem to believe that with less need to resort to these weapons to solve military problems, the threshold should be pushed progressively higher. Moreover, Soviet military leaders seem to prefer prolonging conventional operations rather than resorting to nuclear weapons in the event of a stalemated offensive. Obviously, such a conclusion also supports their claim for continued access to their traditional share of resources, but also probably reflects a genuine desire to avoid both the risks and complexities of operations in a nuclear environment.

Effects of Attrition and Disruption of Control

Soviet military planners have always attempted to compensate for anticipated attrition rates in their operational planning through emphasis on such factors as surprise, high tempo operations, and intensive fire support. Soviet military theoreticians, however, seem to believe that conventional effects in the future may impose qualitatively different rates of attrition in comparison with past experience.

The Soviets have devoted careful attention to the experience of local wars, especially in the Middle East, and have compiled an extensive data base on the effectiveness of contemporary conventional weapons systems. Soviet analyses often refer to this data base to illustrate the potential destructiveness of modern weapons. According to a recent Soviet analysis, for example, in the 1973 war the Israelis "destroyed 52 Arab tanks with 58 'Maverick' guided missiles," and in the Mitla Pass battle, "Israeli helicopters delivered a surprise strike that destroyed approximately 50 percent of an Egyptian brigade."[149] Estimates of the effectiveness of new conventional systems seem to have magnified Soviet concern over attrition. According to these analyses, reconnaissance-strike complexes are capable of detecting and destroying in the course of 60 minutes 15 to 20 "group targets" (each group representing one tank company) with a .7 probability of kill.[150] Another Soviet analysis reported that

> [t]he effectiveness of the use of these means of destruction is such that one T-22 (Lance-2) or T-16 (Patriot) missile can destroy up to 10 armored targets in an area with a radius of 120 m or in an ellipse with the large axis 400 to 800 m.[151]

Yet another Soviet analysis reported that one cruise missile, armed with self-guided cassette munitions, is capable of achieving a radius of destruction equivalent to a 1 kiloton neutron warhead.[152]

Of equal importance in Soviet analyses is that these rates may be inflicted at greater depths in comparison with past military operations[153]--not only tactical depths, but also operational and even strategic depths. According to one Soviet analysis of the potential impact of precision-guided munitions on rear service targets,

> [t]he destruction of truck columns with material means, dumps and bases, railroad stock, transport aircraft located at airfields, large bridges and other targets in the operational and strategic rear may result in the disruption of the support of entire formations [divisions, brigades] and large formations [fronts, armies, corps]. The situation is even more aggravated if the enemy succeeds in conducting a massive strike on communications and other targets. This, it goes without saying, would disrupt the planned receipt of reserves which are required by forces for the successful fulfillment of assigned missions. In other words, the entire system of rear support would suffer.[154]

Compounding this problem is the likelihood that troop control facilities will become a major target of many of the precision-guided weapons. Even the most

cursory examination of Soviet military theory indicates the importance the Soviets attach to the establishment of control over both their own forces and actions and, to the extent possible, the actions of their opponents. The Soviets clearly believe that the best approach to the fulfillment of wartime strategic objectives is to impose early and firm control over the course of a conflict. Most in the West are aware that the Soviets believe, further, that the course and outcome of a war are determined by the correlation of economic, moral–political, scientific–technical, and especially military potentials of the opposing sides. The Soviets have concluded, however, that the correlation of forces in wartime is determined not as much by potential as by *real* capabilities.[155] The critical factor, according to the Soviet analysis, is that the degree of transformation of potential into real capabilities is determined by the effectiveness of control. Moreover, one of the key principles of Soviet military art is that it is not enough simply to be strong in general, but that one must be able to achieve superiority at the decisive places and times in a conflict. Here again, the ability to concentrate the main efforts of the forces is directly determined by the effectiveness of the control systems. The Soviets have consistently portrayed the future battlefield as becoming increasingly more complex as more and different kinds of forces participate. Consequently, the principle of cooperation and coordination among these forces is assuming greater significance in comparison to military operations during the Great Patriotic War and has been characterized as "the most important condition of success in contemporary battle."[156]

Possibly the most disconcerting aspect of precision–guided weapons for the Soviets is the potential threat to the control of their forces in the event of war. The Soviets believe that the compression of the detection–to–destruction cycle and the increase in kill probability would have a major impact on the time available for commanders and staffs to react to rapid changes in the battlefield situation. In fact, Soviet military analysts, such as Major General Vorob'yev, have identified the disruption of cooperation among Soviet forces as having the potential for creating what Vorob'yev terms a "crisis situation" for Soviet commanders and staffs.[157] Such crisis situations could result not just from the destruction of command and control facilities, but also from the introduction of delay into the control process. It is obvious that the Soviets anticipate that command and control facilities will be one of the key targets for future precision–guided weapons systems. Command and control posts, communications centers, radars, and weapons guidance facilities appear prominently on any Soviet target list for these weapons. The Soviets have also concluded that destruction of certain command and control elements of RUKs, such as fusion centers, could be sufficient to eliminate the threat from these systems.[158] Complicating the troop control problem is the likelihood that warfare will take place in an increasingly

intense radioelectronic environment. Events in Lebanon in 1982 have reaffirmed the Soviet belief that radioelectronic combat has a significant "leveraging" effect and, when skillfully employed, can greatly complement fire destruction.[159] In fact, the application of "massive radioelectronic interference" has been cited as one of the most effective counters to an enemy reliant on the "massive use of automated systems of reconnaissance [and] self-guided munitions."[160] The requirement for coordination and timing of future military operations is such that even short disruption of control could have a major impact on operational effectiveness.

The characteristics of these new systems, therefore, can produce fires that can shatter the combat effectiveness of units quickly, at great depths, and at comparably low expenditures of munitions. Consequently, the task of developing methods to overcome the effects of these fires on offensive tempos has been elevated to the status of a "major problem in the theory of strategy." The Soviets have taken a number of measures, including the expansion of their fire support doctrine and the development and widespread application of applique and reactive armor to protect their tanks from top-attack and antitank systems. The Soviets will probably seek to increase their already enormous emphasis on the role of preemption in both fire support and maneuver. Recent Soviet targeting lists have elevated RUKs to a status equal to that traditionally accorded nuclear systems. The Soviets will strive to further compress the detection-to-destruction cycle to facilitate a high degree of probability for the rapid destruction of such systems. Soviet training patterns will probably also feature attempts to exploit warning of enemy attacks in order to maneuver away from such threats, much as the Soviets would attempt to maneuver away from enemy nuclear attacks. They are also apparently examining alternative patterns of dispersal and deployment.[161]

The Soviets are also seeking potential solutions in other areas as well. According to General Gareyev,

> [i]n connection with this there has emerged the necessity for the further perfection of the methods of the intensification of efforts, for bringing the forces up to prescribed strengths, the repair and reestablishment of weapons and military equipment, and the creation and use of reserves.[162]

Furthermore, Soviet analysis has been devoted to the value of continuous, uninterrupted, and carefully coordinated fire and maneuver activities in retaining the initiative and keeping the enemy continuously off balance.

Possibly from a perception that the West uses Soviet doctrinal prescriptions to predict Soviet behavior and expects Soviet forces to display little initiative or

originality in tactics and operational concepts, the Soviets have been devoting increasing attention to the employment of non-standard operational behaviors, formations, and methods of fire and maneuver. A number of other options may also be open to the Soviets to offset the impact of high rates of attrition. For some time, it has been evident that the Soviets are experimenting with their ground force structures. At least two Unified Army Corps in the Soviet Union have been publicly identified. The Soviets may be attempting to field smaller, more self-sufficient units that would be capable of operating independently of control of a higher echelon. While Soviet commanders would not willingly give up positive control, they probably have concluded that at least temporary disruptions are unavoidable. Self-sufficient small units, which could provide organic fire and air defense support, should be able to operate absent such control with little negative impact on the overall operational plan.

Obviously, the Soviets will seek to exploit the increasing degree of mobility inherent in current and future combat systems. In this regard, the Soviets appear intent on exploiting ongoing trends to the fullest in the expansion of the vertical dimension of future combat. One Warsaw Pact analysis recently concluded that, with the ongoing development of combat helicopters,

> [t]he formation of the theory and practice of air-land combat operations must be acknowledged as the most significant developmental tendency in modern tactics of ground forces.[163]

The introduction of army aviation, for example, would facilitate not only an extension of fire influence, but also the capability to exploit more rapidly the results of such fires. Exploitation of the vertical dimension, through heli-borne movement of forces, could enable the Soviets to overcome the impact of high-accuracy weapons on the mobility of ground-based forces. Similarly, the Soviets have identified the success of the air operation to be "essential to the success of the strategic operation in the TVD [theater of military operations]."[164] Although this is a combined-arms activity, for the foreseeable future, air power will continue to play the decisive role in such operations. The air force may also seek to expand its current missions, at the expense of the navy, by assuming a larger antisurface role.

Increasing Scale of Military Operations

By Soviet definition, the scale of military operations is determined by the breadth and depth, and also by the duration, of such operations.[165] By every indicator, Soviet military planners have concluded that the attributes of future non-nuclear systems might enable these forces to play an expanded role not only

at tactical, but also at operational and even strategic depths. Few in the West have considered the global implications of non-nuclear technologies until recently; investigations at this level of warfare have continued to focus primarily on global nuclear conflict.[166] Western specialists on Soviet military affairs have argued that Soviet interest in conventional warfare remains limited to peripheral TVDs and have tended to discount any Soviet consideration of the strategic implications of new technologies.

On the latter point, it is evident that the primary Soviet strategic objectives would be sought in the peripheral TVDs, since the central focus of any major East-West conflict is sure to be the Eurasian landmass. Consequently, the Soviets have long considered the potential strategic implications of a progressively longer phase of conventional warfare. The trend, in this regard, has clearly been to develop forces and concepts to achieve victory as quickly as possible but, in the event this proves impossible, to extend the conventional phase of a war as long as possible. As discussed above, it has become increasingly clear in recent years that Soviet military analysts have concluded that theater warfare could remain conventional throughout. By 1983, for example, the Soviets believed that

> [m]odern concepts of nonnuclear war envisage the achievement of strategic results with conventional means combined with the readiness to repulse nuclear attacks.[167]

Beyond this, however, Soviet strategic planners have been considering the potential dimensions of conventional warfare conducted on a global scale for some time. Descriptions of future war in authoritative statements of Soviet military doctrine and military strategy have clearly stated that while such a war would be global in scope and decisive in nature, it will not necessarily escalate to the use of nuclear weapons.[168] As early as 1980, the Soviets believed that the evolving nature of military technologies created the possibility that in conventional warfare

> offensive and defensive operations by the different sides, under certain conditions, could have the nature of being of a "global scale" and be conducted as strategic campaigns on continental and sea battlefields.[169]

A 1981 Soviet military textbook took a similar view.

> What could modern war be like? It is difficult to imagine its scope. Basically, the whole population of the earth will be drawn into it. The decisive importance of political and military objectives makes the threat of the use of nuclear-missile weapons very real. In such a war, conventional weapons will be used—conventional weapons

> that have qualitatively new tactical-technical characteristics. The destructive capabilities of these weapons have sharply increased as have their effective range.[170]

By 1984, the Soviet General Staff had apparently concluded that the promise of these new technologies required a reevaluation of defense planning scenarios. In his 1984 interview, then Chief of the General Staff Ogarkov predicted that developments in conventional weaponry would permit "order of magnitude" increases in their destructive potential.[171] More significant, however, as a result of the increasing range of these systems, the "zone of potential strategic military actions" would sharply increase as many of these systems become "global" in nature. This has led Ogarkov and the Soviets to conclude that

> [t]he sharp increase in the combat range of conventional weapons makes it possible to immediately envelop not only the border regions but also the territory of an entire country with active combat operations, which was impossible in wars of the past.[172]

Ogarkov's prediction, which has been subsequently repeated in other sources, seems based on a somewhat different set of planning assumptions than is commonly employed in the West.[173] As indicated above, Soviet rear services spokesmen, such as the Rear Services Chief of Staff Colonel General Golushko, have indicated particular concern over the potential vulnerability of rear services targets to precision-guided attacks at strategic depths. According to this analysis, such attacks could not only disrupt rear service functions, but also the overall capability to sustain Soviet operations and, through this, the achievement of strategic objectives. Although Soviet military scientists are probably doubtful of Soviet capability to execute this mode of warfare fully over the near term, a longer term perspective that envisions widespread deployment of space-based reconnaissance and target location systems directly linked in real-time to long-range strike systems might make consideration of such a scenario more feasible. The Soviets expect conventional fire destruction to be extended throughout the depth of the theater and, eventually, into the strategic rear of the homelands.

—Most, if not all, of the consideration given to this subject in the West focuses too narrowly on the utility of highly accurate, long-range systems for raising the nuclear threshold and enhancing conventional deterrence. The Soviets, on the other hand, do not assume that use of nuclear weapons would end the war. In their view, even after nuclear use, conventional weapons would play an important role in achieving the successful conclusion of the war.

This Western perception is based, in part, upon the view that the Soviets would only contemplate the mass use of these weapons and that only a mass use

could have decisive impact. This is obviously not the place to revisit the subject of Soviet incentives and planning for less-than-mass nuclear use. Acknowledgment that the Soviets would recognize such incentives in their nuclear employment planning, however, could open some new dimensions in the West's consideration of the potential utility of non-nuclear strategic systems. For example, in situations where both sides felt compelled to limit the size of their nuclear strikes or to conduct such strikes against a selected set of targets in each other's homeland, non-nuclear strategic systems might provide an effective capability against other homeland targets. The latter type of strike might prove effective against war support targets such as, for example, transportation networks, power grids, communications nets, and port facilities, without risk of widespread collateral damage inherent in nuclear attack against such populated areas. Consequently, there would be no need to resort to a full laydown of nuclear weapons such as envisioned (or assumed to be envisioned) in the war planning of both sides. Moreover, it would seem that the calculus of intrawar deterrence might be altered somewhat by the potential of an effective employment of such systems. The Soviets could execute a limited nuclear strike, then follow up with non-nuclear strikes on the remainder of the target set. Without an analogous capability, the U.S. would be forced to resort to large-scale nuclear use (despite the large Soviet reserve of nuclear weapons with which to retaliate) or to do nothing.

Such a capability could also become especially important in the context of a prolonged war. With regard to this dimension of the scale of future military operations, the Soviets believe that they need to prepare for a prolonged conflict, regardless of whether this conflict is fought with nuclear or conventional weapons. They have explicitly stated their conclusion that a "future nuclear war will not be concluded rapidly," and Soviet preparations for this eventuality are generally recognized in the West.[174] Although they hope to avoid protracted nuclear operations through a rapid and decisive non-nuclear victory, they also appreciate that the introduction of new conventional systems could reduce the likelihood of such an outcome and, therefore, seem to be preparing for a "comparatively long" conventional war.[175] Soviet military theoreticians appear to generally agree with this judgment. They believe that, regardless of whether the war is fought with nuclear weapons or conventional systems only, such wars would be protracted because of the huge military and economic potentials of the opposing coalitions.[176] The notion that the Soviets would only contemplate short war and quick victory scenarios also colors much of Western thinking on this subject. The Soviets would of course seek such an outcome, but they seem to believe that it is naive to think that such an outcome would be easily achievable. General Gareyev made this point very effectively in 1985.

> In contemporary conditions the outcome of war, to a significantly greater degree than before, depends on the quality and effectiveness of the efforts put forth at the very beginning of the war; however, the strategic principle of the *economy of force* has in general been preserved inasmuch as in a war between large coalitions with enormous potential capabilities it would be difficult to count on its swiftness (of conclusion). It is, therefore, necessary to be prepared for a long, stubborn, and bitter armed conflict. (Emphasis in original)

Soviet military scientists appear to see no contradiction between this conclusion and the likelihood that these systems would increase the tempo of conventional operations dramatically. They apparently have concluded that the combination of anticipated attrition, interdiction of forward-deploying forces, disruption of control, and simply the increased complexity of operations inherent in the introduction of these systems would force consideration of prolonged operations. They may also believe that although they might be able to fulfill their immediate strategic objectives in 3 to 4 weeks, final victory in such a war would take much longer. These concerns have become magnified by the increasing U.S. emphasis on multitheater military operations in the event of a future war. Although the evidence is somewhat fragmentary, it appears that for some time the Soviets have been planning for a war of at least one year's duration.[177]

One clear source of concern for the Soviets, which appears to be associated with this conclusion, is the ability of the Soviet economy to make the transition to wartime status and then to support and sustain prolonged military operations. The problem was relatively simple as long as Soviet military planners believed that a future war would be short and fought primarily with the resources and stockpiles on hand prior to the war's outbreak. More recently, however, Soviet military planners have demonstrated increasing sensitivity to the issues associated with the requirement to sustain Soviet war efforts over a prolonged period. The most recent reference to preparations for a 1-year war duration specifically addressed the problem of sustaining tank production over such a period in order to support frontal forces requirements.

Finally, such a conclusion has several potentially troubling implications for common Western assumptions regarding Soviet preferences for short war and quick victory. The assumption that denial of such preferences and the imposition of delay on Soviet planning and execution cycles could contribute, perhaps significantly, to deterrence of Soviet aggression is not uncommon in Western thinking. Obviously, the Soviets, for reasons of alliance cohesion and the postponement (perhaps even the avoidance) of escalation, would seek to achieve

their objectives as quickly as possible. The Soviets have also taken measures to smooth the transition of the Warsaw Pact forces to wartime status. Beyond this, however, the Soviets seem to believe that it is only prudent to prepare for more prolonged conflicts; they appear to be identifying the command and control and logistic requirements associated with such a scenario. It is conceivable, therefore, that there may exist a considerable asymmetry between Western assumptions regarding Warsaw Pact tolerance of prolonged scenarios and actual Soviet military planning.

Non-nuclear strategic systems might have an important role to play against war support targets in the context of such a prolonged war scenario. Here again, incentives for restraint in the use of nuclear weapons could open up a number of employment opportunities for these systems. U.S. thinking on the potential utility of non-nuclear strategic capabilities may be limited by assumptions about the Soviet approach to war. If some of these assumptions are relaxed, other dimensions of the problem may emerge.

Evolving Offensive-Defensive Mix in Military Planning

Closely related to the issue of increasing scale are evolving Soviet views on the future relationship between offense and defense. Soviet military theoreticians have apparently concluded that it has become necessary to reevaluate the mix of offensive and defensive activities in future operational planning. The trend was apparently under way as early as 1980, but seems to have assumed increasing importance in the mid 1980s. Unfortunately, Soviet investigations of this issue have been obscured by the recent attempt (in response to the dictates of Soviet political strategy) to portray Soviet military strategy as non-provocative. This political strategy has clearly been designed to reduce international tensions and provide sufficient breathing space for the Gorbachev restructuring programs to take effect. Consequently, political leaders, civilian national security experts, and, to a lesser degree, military spokesmen have increasingly referred to a new Soviet military doctrine and military strategy that emphasize the conduct of defensive-only military operations.

At the level of military theory, however, the introduction of high-accuracy systems, and particularly the depths to which these systems are capable of operating, has led Soviet and Warsaw Pact analysts to undertake "a complete reevaluation of the very essence of the defense on the future battlefield."[178] According to this analysis, defensive objectives were formerly achieved by actions conducted within the tactical zone designed to "pulverize" the enemy in a series of defensive battles. While enjoying the advantage of selecting the locale for the battle, the defender was forced to cede the more important advantage--the

initiative--to the attacker. Soviet offensive preferences have long been evident in the emphasis on the importance of seizing and retaining the initiative as one of the key principles of Soviet military art. The introduction of deep-strike, precision-guided weapons could affect this calculation in several ways, however. First, the defender's strikes will not be limited simply to the tactical zone, but may be conducted across the depth of the enemy's deployment. More significant, however, the opportunity would exist for the defender to seize the initiative himself, rather then cede this all-important advantage to the attacker.

> Now the defender, being able to reach the enemy at distant pre-battle positions, on march routes, and in assembly regions, does not have to only wait for the blow, for the strike. He himself can make the decision about the beginning of the battle. The choice of time of the encounter has ceased to be an exclusive attribute of the attacker.[179]

The optimum time for such strikes, according to Soviet analyses, would be "right at the time when the enemy is preparing to attack, or else when the enemy is moving up to the lines to go on to the attack."[180]

Such attacks could produce rapid and sharp changes in both the correlation of forces ("the weaker can suddenly become the stronger") and the overall situation. The Soviets have long believed that such changes would characterize nuclear operations, but have come to realize that future deep-strike, precision-guided weapons would impart similar characteristics to non-nuclear operations. It may be this aspect in particular which underlies the Soviet view of the increasing similarity between nuclear and conventional operations and provides part of the foundation for Soviet forecasts of impending revolutionary transformations in the nature of future warfare.

It is important to note that this dimension of the Soviet forecast predates the adoption of a more defensive-oriented military doctrine by at least 6 years and probably longer. As early as 1980, Soviet military theoreticians, such as Major General Vorob'yev, were acknowledging the increased blurring of the distinction between offensive and defensive means. In light of the recent emphasis on nonprovocative strategies, Vorob'yev concluded, ironically, that as a result of the potential inherent in future high-technology fire systems, both the attacker and the defender would attempt to fulfill their missions "by active *offensive* methods."[181] As a result, should the defender be able to preempt the attacker's preparations successfully, the defender would have an opportunity to seize the initiative and launch a counteroffensive under very favorable conditions.

This dimension of the Soviet forecast of the nature of future war has a number of potential implications for Soviet strategic planning. First, the Soviets

obviously are fearful of the potential inherent in these systems to enable a defender to preempt an enemy's offensive preparations. For example, the Soviets have acknowledged that the U.S. Army's AirLand Battle concept plans to achieve its defensive objectives, in part, through deep fire destruction not only against first-echelon forces, but also against the second echelon and reserves of the attacker.[182] The Soviets also anticipate air and missile attacks on Warsaw Pact airfields designed to disrupt sortie generation in support of the air operation. Obviously, in order to be most effective, these attacks would have to preempt Soviet actions. The potential for delay and disruption of Soviet operations and the requirement to provide defense against such attacks progressively deeper into rear areas are not lost on Soviet strategic planners. This trend underlines the need for more attention to the phase of their modified fire support doctrine that is designed to cover forces moving forward out of assembly areas by means of preemptive attacks on enemy long-range fire systems. By 1986, the Soviets had included deep attacks against not only enemy fire systems, but also aircraft at airfields and control posts.[183]

Second, an enhanced possibility of preemptive defense, like the prospect of higher rates of attrition, forces the Soviets to reconsider their approaches to echelonment, dispersal, and deployment. According to a recent Warsaw Pact analysis,

> [t]hese weapons with great range are definitely forcing a greater dispersal of troops which are located in the depth. Regions of concentration, assembly regions for the offensive, etc., will have to be larger. Reserves, second echelons, and forces approaching from the rear will have to be shifted and arranged in smaller formations over greater areas so as to make of themselves the greatest possible number of potential targets.[184]

A third implication is the need to revisit the overall issue of defense within Soviet military planning. Soviet military scientists have become increasingly concerned that their military art was too preoccupied with offensive operations at the expense of a more balanced offensive-defensive mix. Reminders of the last such preoccupation with offense accompany many recent Soviet analyses. For example, the Soviets have concluded that

> [a] situation of not studying thoroughly defensive methods, allowing a leading to large casualties, is unacceptable. The appearance of new struggle means and methods has resulted in the unending increase in the volume and complexity of defensive measures.[185]

Fourth, the Soviets are also examining the potential advantages offered by the adoption of a more balanced offensive-defensive mix. Such an integrated

approach would seem well suited to overcoming the potential effects of attrition, particularly on forces operating on critical axes of advance. Forces operating on secondary axes could transition to defense and release forces for deployment to more critical areas. In order to exploit the defensive potential of long-range fire systems, the Soviets have apparently devoted more attention to the elaboration of fire doctrine in the context of defensive operations. Between 1983 and 1986, the Soviets apparently expanded their doctrine for fire support of defensive operations to include deeper attacks against a deploying enemy force.[186]

Soviet attention has been focused not just on defense at the tactical or operational level, but also on the role of strategic defense in continental TVDs. Indications of such a reevaluation are evident in modifications to the "Strategic defense" entry in the 1986 edition of the *Military-Encyclopedic Dictionary*. According to the 1983 edition,

> [s]trategic defense may be conducted either at the beginning of or in the course of the war, on an entire front or on a strategic axis.[187]

In contrast, the 1986 edition asserts that strategic defense may be conducted "in one or several TVDs (strategic axes)."[188] As another sure indicator of increasing Soviet interest, the subject of wartime strategic defense operations has received recent attention, along with considerable revision, in military-historical analyses. From this, it seems evident that military theoreticians are considering the potential opportunities to be derived from the conduct of defense on a broader scale. The Soviets could be examining the potential benefits inherent in the conduct of strategic defense in one TVD in order to reallocate resources to another, more critical, area. Given the potential impact of new systems, successful strategic defense operations could create more favorable conditions for a subsequent counteroffensive. The Soviet experience at Kursk in 1943 is considered "classic" in this regard, although the Soviets recognize that conditions as favorable as those at Kursk will not always be available.[189]

Finally, at least one Warsaw Pact analysis has indicated that a better offensive-defensive mix could have potentially interesting cost implications.[190] The Soviet military, however, has consistently, and rather vehemently, maintained a preference for active, rather than passive, defensive operations. In particular, there is nothing to indicate that the Soviets would forego preemptive fires and strikes throughout the depth of the enemy, even as its forces were preparing to conduct defensive operations.

Reevaluation of the Initial Period of War and Surprise

Trends in the development of high-accuracy weapons and the offensive-defensive mix may be related to one additional dimension of the Soviet view of future war. The Soviets, influenced by the above considerations, have also been rethinking many of their basic conclusions regarding the nature of the initial period of war and the factor of surprise.

Nearly 2 decades ago, the Soviet General Staff Academy undertook a major study of the initial period of war. According to the Commandant of the Voroshilov General Staff Academy, then Army General Ivanov, this research was conducted under instructions from the Soviet Minister of Defense. Ivanov reported the results of this research in a series of articles in the Soviet General Staff journal *Voyennaya Mysl'* in the early 1970s and in a book published in 1974.[191] The study noted the increasing importance of the role of surprise, the trend toward prepositioning of large force groupings capable of initiating significant military operations at the very beginning of a war without a prolonged period of mobilization, and at least the potential for creating the conditions in the initial period for a victorious conclusion to the war. The integration of strategic and theater nuclear weapons into the forces of both major alliances served to underscore for the Soviets the importance of an accurate estimation of the nature of the initial period of war.

A combination of factors converged in the mid 1980s, however, that apparently forced the Soviets to revisit the issue of the initial period of war. First, the Soviets professed to see an increasing aggressiveness on the part of the Western alliance and especially the United States. They continued to assert that a massive, disarming first nuclear strike remained the preferred U.S. approach to initiating combat operations and pointed to the strategic offensive forces modernization efforts, especially those associated with the development of prompt hard-target kill capabilities, as evidence of U.S. intentions. Although the propaganda value of such assessments is obvious, prudent military planners could not fail to continue to consider such scenarios. Soviet military theoreticians continued to remind their readers that

> first massive nuclear strikes are able in large measure to predetermine the entire course of the war and to bring about such losses in the rear and in the forces that could place the people and the country in an exceptionally difficult position.[192]

There was little to distinguish this 1985 conclusion, however, from Soviet perceptions of the threat of strategic nuclear strikes in the early 1960s.

The Soviets appear more concerned with the potential of new non-nuclear systems to replicate the impact of strategic nuclear forces on the initial period of

war. The Soviets repeatedly describe the "rapid-action" and the range of these new systems as creating similar difficulties for the defender. In a 1985 analysis of the initial period of war, for example, Lt. General Evseyev concluded that

> even when war begins with the use of conventional means, which possess large destructive force and significant range of operations, and also airmobile forces and powerful armored means, the initial period could exert a huge influence on the consequent course of the war.[193]

The Soviets pointed, in particular, to U.S. theater doctrinal developments as evidence of U.S. incentives to preemptively attack targets on Warsaw Pact and even Soviet territory with little or no strategic warning. According to these analyses, AirLand Battle, for example,

> envisions the surprise initiation of military actions with the newest means of maximum destruction of the enemy and the conduct of decisive actions by ground, air, and naval forces to a depth, simultaneously enveloping the territory of an entire country.[194]

The main conclusion of these studies conducted in the mid 1980s was provided by Lt. General Evseyev's analysis. According to Evseyev,

> [t]he main content of the initial period of war in contemporary conditions may be the conduct by the opposing sides of nuclear strikes or strikes with the use of conventional means and, from the very beginning, active military operations by forces, deployed in strategic groupings in peacetime for the achievement of the main goals of the war. Mobilization, deployment of armed forces to the TVDs and the transition of the economy to a wartime status will be completed simultaneously.[195]

Beyond this, however, it is evident that a number of other factors are compelling the Soviets to undertake this reevaluation. Soviet military planners believe that they have been insufficiently sensitive to alternative contingencies for the outbreak of hostilities. They seem concerned over the necessity to broaden the scope of their planning scenarios to encompass a wider variety of circumstances for the initiation of war. General Gareyev, for example, has concluded

> the contemporary system of strategic deployment can not be oriented simply to only one of the most favorable variants for us, but must more flexibly support the organized deployment of the forces in any conditions of the initiation of war by the imperialist aggressor.[196]

This concern appears linked to a growing Soviet military perception that political considerations may override military preparations during a crisis period. Gareyev has argued that no matter what the purely military advantages, political factors may increasingly inhibit and even prevent prewar mobilization. This trend could have several interesting implications for wartime decision-making, however. In particular, Soviet decision-making and behavior during the crisis or "threatening period" and during the escalation process could be profoundly altered by this trend. For example, the political leadership is sure at least to attempt to impose more control over the course of events during both the threatening period and after the outbreak of hostilities, and would probably be less willing to allow purely military considerations to dictate Soviet options and choices. The implications of this trend for Soviet behavior during the threatening period were acknowledged by General Gareyev, then Chief of the Military Science Directorate, as early as 1985. Gareyev warned that political considerations could constrain not only the process of strategic deployment, but mobilization in general prior to the outbreak of war.[197]

Gareyev seems to be acknowledging a political concern that purely military responses to a crisis could be unduly provocative and even counterproductive. Tighter political control over military measures could enable the Soviets to manage such a crisis more skillfully and might even permit them to achieve their objectives without resort to military force. At a minimum, less provocative, more ambiguous Soviet behavior could create havoc in an already precarious NATO crisis decision-making process. Although the political leadership seems determined not to be driven by purely military considerations, it will also need to carefully balance diplomacy with military mobilizational and deployment measures necessary to meet wartime requirements.

Concern within the military over the latter problem has been both expressed by Gareyev himself and manifested in the renewed attention to requirements for the initial period of war. Gareyev called attention to the necessity to develop alternative forecasts of the potential conditions and situations from which military conflicts may occur.[198] Gareyev's concern appears to center on the possibility that the Soviet Union might not be able to manage the circumstances leading up to such a conflict. Although there is little evidence that Soviet military scientists believe NATO would initiate offensive operations, the ongoing offense-defense reevaluation could force the Soviets to modify some long-standing principles. In particular, the preeminent Soviet objective during the threatening period and in the initial period would be to impose control over the course of events. Control is achieved by quick and decisive efforts to gain and hold the initiative over the enemy. As can be seen from above, however, the Soviets may suspect their ability to fulfill this objective may be in jeopardy.

Better integration of offensive and defensive efforts and the introduction of long-range systems with an effective doctrine for their deployment in defensive operations might offset the potentially disastrous effects anticipated in such scenarios. Assuming a mobilization decision was delayed because of such political considerations, Soviet military planners could rely on their own preemptive strikes throughout the depth of the enemy's deployment. These would take place as the Soviets strive to complete their mobilization and, ironically, substantially improve conditions for subsequent offensive operations.

All of this, in turn, relates to the ongoing reevaluation of the factor of surprise in future warfare. Surprise reemerged as a key Soviet concern in the mid 1980s probably as a result, again, of their evaluation of the potential impact of new technologies on future warfare. In general, much of the Soviet attention has been devoted to methods and requirements for avoiding surprise. They continue to assert the primacy accorded to surprise attacks in Western military theory, but there is considerable continuity in their view of the difficulty of achieving strategic surprise. Soviet analysts continue to argue that "to achieve full surprise in the face of well organized reconnaissance is now extremely complicated."[199] Soviet attention seems focused, instead, on the contribution of new technologies to the achievement of operational and tactical surprise. One recent Soviet analysis, for example, pointed to the contribution of these technologies for the employment of unexpected forces or methods of operations as one of the best approaches to achieving surprise at this level.[200] The employment of fuel-air explosives, for example, could achieve a tactical surprise that could quickly unravel the integrity of the defender's operational echelonment. The Soviets believe that higher command echelons should then be able to exploit this surprise to achieve operational and even strategic results.

NOTES

1. See, for example, Army General V. Shabanov, "The Material Foundation of Defense Power," *Krasnaya Zvezda* [Red Star--hereafter, *KZ*], August 15, 1986, p. 2.

2. This conclusion has appeared in many Soviet sources; see, for example, MSU N.V. Ogarkov, "The Defense of Socialism: The Experience of History and the Contemporary Period," *KZ*, May 9, 1984, p. 3; Col.-General M.A. Gareyev, *M. V. Frunze - Voyennyy teoretik. Vzglyady M. V. Frunze i sovremennaya voyennaya teoriya.* [M. V. Frunze - Military Theoretician. The Views of M. V. Frunze and Contemporary Military Theory.], (Moscow: Voyenizdat, 1985), p. 240; Marshal S. Akhromeyev, "The Superiority of Soviet Military Science and Soviet Military Art--One of the Most Important Factors of Victory in the Great Patriotic War," *Kommunist*, No. 3 (February) 1985, p. 60.

3. A. A. Babakov, *Vooruzhennyye Sily SSSR Posle Voyny* [The Armed Forces of the USSR After the War] (Moscow: Voyenizdat, 1987), p. 233.

4. Col. General M. A. Gareyev, "The Combat Readiness of the Soviet Armed Forces and the Defensive Power of the Country," in Lt. General D. A. Volkogonov, ed., *Marksistsko-leninskoye ucheniye o voyne i armii* [Marxist-Leninist Teachings on War and the Army], (Moscow: Voyenizdat, 1984), p. 297.

5. See the discussion in Notra Trulock, III, "Soviet Perspectives on Limited Nuclear War;" in Albert Wohlstetter, Fred Hoffman, and David Yost, eds., *Swords and Shields: NATO, the USSR, and New Choices for Long-Range Offense and Defense*, (Lexington, Mass.: Lexington/D.C. Heath, 1987).

6. Ogarkov, "The Defense of Socialism," p. 3.

7. For the content of the proposals see, "Declaration of General Secretary M. S. Gorbachev," *Pravda*, January 16, 1986, p. 1.

8. The first Soviet characterization of their strategic nuclear forces as a "TRIAD" appeared in Shabanov, "The Material Foundation of Defense Power," *KZ*, August 15, 1986, p. 2.

9. Army General D. T. Yazov, *Na Strazhe Sotsializma i Mira* [On Guard of Socialism and Peace] (Moscow: Voyenizdat, 1987), p. 34.

10. Ibid.

11. N. Nechaev, "Military Communications: Trends in Their Development," *Tekhnika i vooruzheniya* [Technology and Armaments] No. 6 (June) 1986.

12. Maj. A. Ivankov, "Communications - by Laser Beams," *KZ*, October 22, 1987, p. 3.

13. Ibid.

14. Yazov, *On Guard*, p. 16.

15. Col. V. Bondarenko, "Scientific-Technical Progress and Military Affairs," *Kommunist vooruzhennykh sil* [Communist of the Armed Forces--hereafter, *KVS*], No. 21 (November) 1986, p. 14.

16. Ogarkov, "The Defense of Socialism," p. 3.

17. See, "High-Accuracy Weapons," in Marshal S. F. Akhromeyev, ed., *Voyennyy entsiklopedicheskiy slovar* [Military Encyclopedic Dictionary--hereafter, *MED-86*] (Moscow: Voyenizdat, 1986), p. 172.

18. Lt. General V. G. Reznichenko, *Taktika*, [Tactics--hereafter, *Tactics-87*] (Moscow: Voyenizdat, 1987), p. 23.

19. See "Reconnaissance-Strike Complex," *MED-86*, pp. 616-617.

20. Col. Yu. Molostov, "Defense Against High-Accuracy Weapons," *Voyennyy vestnik* [Military Herald - hereafter *VV*] No. 2 (February) 1987, p. 83.

21. Ogarkov, "The Defense of Socialism," p. 3.

22. Maj-General I. Vorob'yev, "Contemporary Weapons and Tactics," *KZ*, September 15, 1984, p. 2.

23. See Notra Trulock, III, "Weapons of Mass Destruction in Soviet Military Strategy," paper presented at Joint Conference on Soviet Military Strategy in Europe, sponsored by the Boston Foreign Affairs Group and the Royal United Services Institute for Defense Studies, Oxfordshire, England, September 24–25, 1984.

24. See Lecture Materials from the Soviet Voroshilov General Staff Academy, "Army Offensive Operations," (Mid 1970s).

25. See, V. Makarevskiy, "'Blitzkrieg' in the STR [Scientific–Technical Revolution] Age and its Technical Support," *Voyennyye znaniya*, No. 9 (September) 1986, p. 44.

26. Lt.–General P.A. Zhilin, *Istoriya voyennogo iskusstva* [History of Military Art], (Moscow: Voyenizdat, 1986], p. 417.

27. Maj–General N.N. Kuznetsov, "On the Categories and Principles of Soviet Military Strategy," in *Hanoi Tap Chi Quan Doi Nhan Dan*, No. 6 (June) 1984, translation LN 894–86, p. 7.

28. For 40 km, see Makarevskiy, "'Blitzkrieg' in the STR Age," p. 44; Reznichenko, *Tactics–87*, p. 38, refers to 100 km–range.

29. Maj.–General I. Vorob'yev, "New Weapons and the Principles of Tactics," *Sovetskoye voyennoye obozreniye* [Soviet Military Review – hereafter *SMR*], Part 2, No. 2 (February) 1987, p. 18.

30. Col.–General I. Golushko, "The Rear in Conditions of the Use by the Enemy of High–Accuracy Weapons," *Tyl' i snabzheniye* [Rear Services and Supply], No. 7 (July) 1984, p. 18, and Lt. General V. G. Reznichenko, *Taktika* [Tactics], (Moscow: Voyenizdat, 1984), p. 106.

31. Reznichenko, *Tactics–87*, p. 34.

32. A. Dvoretskiy and V. Potashev, "On the Concept 'Air–Land Operation,'" *Vestnik PVO* [PVO Herald] No. 8 (August) 1984, p. 77.

33. Vorob'yev, "New Weapons and Principles," p. 18.

34. Colonel A. Sergeyev, "Reconnaissance in the Armies of the NATO Countries," *VV*, No. 11 (November) 1983, p. 84.

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77. Kuznetsov, "On the Categories and Principles of Soviet Military Strategy," p. 8.

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87. Marshal A. A. Grechko, *The Armed Forces of the Soviet State*, (Moscow: Voyenizdat, 1975), translated and published under the auspices of the United States Air Force, p. 156.

88. Col. S. Bartenev, "The Economy and Military Power," *KVS*, No. 14 (July) 1980, p. 70.

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92. Department of Defense, *The FY 1987 Department of Defense Program for Research and Development*, (Washington, D.C.: U.S. Government Printing Office, 1986), p. II-3.

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94. Bartenev, "The Economy and Military Power," p. 71.

95. DoD, *Soviet Acquisition of Militarily Significant Technology*, p. 10.

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97. See, for example, "Conference at the CPSU Central Committee," *Pravda*, August 9, 1986, p. 2.

98. "Meeting of Military Leaders in the Kremlin--Speech of Comrade L.I. Brezhnev," *Pravda*, October 28, 1982, p. 1.

99. Maj.-General A. Gurov, "Combat Readiness of the USSR Armed Forces: Efficiency of Material Supply," *KZ*, December 9, 1982, p. 2-3.

100. Ibid., p. 2.

101. Lt.-General A.I. Evseyev, "On Certain Tendencies in the Change of the Content and Character of the Initial Period of War," *VIZh*, No. 11 (November) 1985, p. 20. See also Col. G. Lukava, "The Factor of Surprise in the Aggressive Policy of Imperialism," *KVS*, No. 11 (June) 1986.

102. A.I. Sorokin, ed., *Sovetskiye vooruzhennyye sily v usloviyakh razvitogo sotsializma* [The Soviet Armed Forces in Conditions of Developed Socialism], (Moscow: "Nauka", 1985), pp. 108-109.

103. Koziej, "Anticipated Directions for Change," p. 1.

104. Col. N. Goryachev, "Know and Capably Apply Entrusted Weapons and Military Equipment," *KVS*, No. 2 (January) 1987, p. 76.

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107. Col.-General M.A. Gareyev, "The Creative Character of Soviet Military Science in the Great Patriotic War," *VIZh*, No. 7 (July) 1985. See also Col.-General D. Grinkevich, "The Factor of Time in Battle," *VV*, No. 11 (November) 1986, p. 5.

108. See "Conference at the CPSU Central Committee," p. 2.

109. Yazov, *On Guard*, p. 26.

110. Ogarkov, *History Teaches Vigilance*, p. 50.

111. B. M. Bondarenko, *Sovremennaya nauka i razvitiye voyennogo dela* [Contemporary Science and the Development of Military Affairs], (Moscow: Voyenizdat, 1976), p. 109.

112. Soviet sources from the early 1960s characterize the period of the late 1950s as a transitional stage. See, Trulock, "Weapons of Mass Destruction," for more detail.

113. Gareyev, "The Creative Character of Soviet Military Science," p. 28.

114. Bartenev, *Economic Opposition in War*, p. 11.

115. Marshal S. F. Akhromeyev, "The Glory and Pride of the Soviet People," *Sovetskaya Rossiya*, February 21, 1987, p. 1.

116. See, for example, Lukava, "The Factor of Surprise in the Aggressive Policy of Imperialism," and Zubkov, "The Concern of the CPSU for the Strengthening of the Economic Basis of the Military Power of the Socialist State."

117. "Defense Minister Yazov Addresses Writers," *FBIS Daily Report-Soviet Union*, FBIS-SOV-87-243, 18 December 1987, p. 66.

118. Contrast the discussion in V. V. Zhurkin, S. A. Kaganov, and A. V. Kortunov, "On Reasonable Sufficiency," *SSha: Ekonomika, Politika, Ideologiya*, No. 12 (December) 1987, with Yazov, *On Guard*.

119. "Economist on Implications of Disarmament," *FBIS Daily Report-Soviet Union*, FBIS-SOV-88-022, 3 February 1988, p. 5.

120. "MOSCOW NEWS Interviews General Treytak," *FBIS Daily Report-Soviet Union*, FBIS-SOV-88-036, 24 February 1988, p. 73.

121. "Chernavin on Anniversary, 'Defensive' Doctrine," *FBIS Daily Report-Soviet Union*, FBIS-SOV-88-037, 25 February 1988, p. 71.

122. Lt. General V. Serebryannikov, "The Correlation of Political and Military Means in Defense of Socialism," *KVS* No. 18 (September) 1987, p. 12.

123. "Madrid's Diario 16 Interviews Military Leaders--Lebedev on NATO, Economy," *FBIS Daily Report-Soviet Union*, 20 August 1987, p. H2.

124. "CPSU Central Committee Resolutions on Restructuring and the Party's Cadre Policy," *Pravda*, 29 January 1987.

125. Army General V. Shabanov, "High Technical Equipment," *SMR*, No. 3 (March) 1987, p. 2.

126. Reznichenko, *Tactics-87*, p. 5

127. Bartenev, *Economic Opposition in War*, p. 104.

128. "Kulikov Views Army Anniversary, Polish Ties," *FBIS Daily Report-Soviet Union*, FBIS-SOV-88-037, p. 69.

129. Army General A. D. Lizichev, "October and the Leninist Teaching on the Defense of the Revolution," *Kommunist*, No. 3 (February) 1987.

130. Babakov, *The Armed Forces of the USSR*, p. 213.

131. Rear Admiral V. Gulin and Captain First Rank I. Kondyev, "The Defensive Direction of Soviet Military Doctrine," *Morskoy Sbornik* [Naval Collection] No. 2 (February) 1988, p. 13.

132. "Madrid's Diario 16 Interviews Military Leaders--Lebedev on NATO, Economy," p. H2.

133. See the discussion of naval-related issues in Gareyev, *M. V. Frunze*, p. 305; for a possible Navy response see the lead editorial in *Morskoy sbornik*, July 1986.

134. Gareyev, "The Creative Character of Soviet Military Science," p. 28. At the publication of this article, Garayev was the Chief of the General Staff's Military Science Directorate. He has since been elevated to the position of Deputy Chief of the General Staff.

135. Akhromeyev, "The Superiority of Soviet Military Science and Soviet Military Art," p. 62.

136. Vorob'yev, "Contemporary Weapons and Tactics," p. 2.

137. Reznichenko, *Tactics-87*, p.28.

138. Col. General V. A. Merimskiy, *Takticheskaya podgotovka motostrelkovykh i tankovykh podrazdelenyy* [Tactical Preparation of Motorized-Rifle and Tank Subunits] (Moscow: Voyenizdat, 1984), p. 8.

139. Yazov, *On Guard*, p. 33.

140. See, for example, Col.-General M. A. Gareyev, *Obshchevoyskovyye Ucheniya* [Combined Arms Exercises], (Moscow: Voyenizdat, 1983), p. 225.

141. On the inevitability issue see, for example, MSU V. Kulikov, "To Curb the Arms Race, *KZ*, February 21, 1984, p. 3.; on increased attention to operations in a nuclear environment, see Col. F.D. Sverdlov, *Takticheskiy Manevr* [Tactical Maneuver], (Moscow: Voyenizdat, 1982) and Army General P.N. Lashchenko, *Iskusstvo Voyenachal'nika* [Art of the Military Commander], (Moscow: Voyenizdat, 1986), and on initial period of the war compare Maj. General V. Matsulenko, "Certain Conclusions from the Experience of the Initial Period of the Great Patriotic War," *VIZH*, No. 3, 1984, with Lt General A.I. Evseyev, "On Certain Trends in the Changes of the Content and Character of the Initial Period of War," *VIZh*, No. 11, 1985.

142. Murrey Marder, "Defector Told of Soviet Alert, KGB Station Reportedly Warned U.S. Would Attack," *Washington Post*, 8 August 1986, p. 1.

143. Akhromeyev, "The Superiority of Soviet Military Science and Soviet Military Art."

144. Gareyev, *M. V. Frunze*, p. 240.

145. See, for example, Yu. Zhilin, "The Factor of Time in the Nuclear Age," *Kommunist* No. 11 (July) 1986, pp. 115–123.

146. MSU S. F. Akhromeyev, "The Great Victory," *KZ*, May 9, 1987, p. 2.

147. "Yazov Addresses Meeting," *FBIS Daily Report – Soviet Union*, FBIS-SOV-88-035, 23 February 1988, p. 69.

148. "Akhromeyev on Armed Forces Anniversary, History," *FBIS Daily Report – Soviet Union*, FBIS-SOV-88-034, 22 February 1988, p. 87.

149. Col. V.P. Shipovalov, "Struggle with Tanks," *VIZh*, No. 9 (September) 1986, p. 45.

150. Molostov, "Defense Against High-Accuracy Weapons," p. 83.

151. Reznichenko, *Tactics-87*, p. 25.

152. A. Dvoretskiy and V. Potashev, "On the Concept 'Air-Land Operation'," p. 77.

153. Reznichenko, *Taktika*, p. 110.

154. Col-General I. Golushko, "The Rear in Conditions of the Use by the Enemy of High-Accuracy Weapons," p. 18.

155. Altukhov, *Fundamentals of the Theory of Troop Control*, p. 1.

156. Golushko, "The Rear in Conditions of the Use by the Enemy of High-Accuracy Weapons," p. 15, and Reznichenko, *Taktika*, p. 58.

157. Maj.-General I. Vorob'yev, "New Weapons and the Principles of Tactics," *SMR* No. 1 (January)1987, p. 18.

158. Reznichenko, *Taktika*, p. 88.

159. Vorob'yev, "New Weapons and Principles of Tactics," p. 18.

160. Ibid.

161. Koziej, "Anticipated Directions for Change," pp. 4–5.

162. Gareyev, *M.V. Frunze*, p. 244.

163. Koziej, "Anticipated Directions for Change," p. 5.

164. Zhilin, *History of Military Art*.

165. See "Scale of operation," in *MED-86*, p. 618.

166. Notable exceptions include Carl Builder, *The Prospects and Implications of Non-Nuclear Means for Strategic Conflict*, Adelphi Paper No. 200 (London: IISS, 1985).

167. L.I. Ol'shtynsky, *Vzaumodeystviye armii i flota* [Cooperation of the Army and Navy], (Moscow: Voyenizdat, 1983), p. 7.

168. Marshal N. V. Ogarkov, "Military Strategy," *Sovetskaya voyennaya entsiklopedia* [Soviet Military Encyclopedia], Vol. 7 (Moscow: Voyenizdat, 1982), p. 564.

169. Vorob'yev, "The Relationship and Reciprocal Effects between Offense and Defense," p. 7.

170. G.V. Sredin, et. al., *Chelovek v sovremmennoy voyne* [Man in Contemporary War], (Moscow: Voyenizdat, 1981), p. 132.

171. Ogarkov, "The Defense of Socialism," p. 3.

172. Ibid.

173. See, for example, Evseyev, "On Certain Tendencies and Changes in the Content and Character of the Initial Period of War," p. 16.

174. Zhilin, *History of Military Art*, p. 407.

175. Gareyev, *M. V. Frunze*, p. 240.

176. M. M. Kir'yan, *Voyenno-teknicheskiy progress i Vooruzhennyye Sily SSSR* [Military-Technical Progress and the Armed Forces of the USSR], (Moscow: Voyenizdat, 1982), p. 314.

177. See, for example, MSU V.D. Sokolovskiy, ed., *Soviet Military Strategy*, edited, with an analysis and commentary, by Harriet Fast Scott, (New York: Crane, Russak & Co., 1975), p. 28. All three versions of this work, published in 1962, 1963, and 1968, respectively, carried this reference. For a later reference to combat operations extending over the period of one year, see Bartenev, *Economic Opposition*, p. 126.

178. Koziej, "Anticipated Directions for Change," p. 4.

179. Ibid.

180. Ibid., pp 4-5.

181. Vorob'yev, "The Relationship and Reciprocal Effects Between Offense and Defense," p. 9.

182. Reznichenko, *Taktika*, p. 78.

183. "Fire Support of Forces Moving Forward," *MED-86*, p. 506.

184. Koziej, "Anticipated Directions for Change," p. 4-5.

185. Kuznetsov, "On the Categories and Principles of Soviet Military Strategy," p. 12.

186. Compare the entry for "Strategic Defense," in MSU N.V. Ogarkov, ed., *Voyennyy entsiklopedicheskiy slovar'* [Military Encyclopedic Dictionary—hereafter, *MED-83*], (Moscow: Voyenizdat, 1983), p. 710 with the same entry, "Strategic Defense," in MED-86 , p. 710.

187. "Strategic Defense," *MED-83*, p. 710.

188. "Strategic Defense," *MED–86*, p. 710.

189. See, for example, A. N. Bazhenov, "Ways to Increase the Stability of Operations of Defense," *VIZh*, No. 5 (May) 1987.

190. See Colonel Longin Mucha, "Defensive Military Doctrine – The Essence of Changes," *Zolnierz Wolnosci*, 13 July 1987. The author is indebted to Harry Orenstein of the Soviet Army Studies Office for bringing this article to his attention.

191. See S. P. Ivanov, "The Initial Period of War," *Voyennaya Mysl'* [Military Thought] No. 5, 1971, p. 42; and S. P. Ivanov, *Nachal'nyy period voyny* [The Initial Period of War] (Moscow: Voyenizdat, 1974).

192. Evseyev, "On Certain Tendencies and Changes in the Content and Character of the Initial Period of War," p. 16.

193. Ibid.

194. Ibid.

195. Ibid.

196. Gareyev, *M. V. Frunze*, p. 242.

197. Ibid.

198. Ibid., p. 436.

199. Zhilin, *History of Military Art*, p. 407.

200. See the detailed analysis of these methods in M.M. Kir'yan, *Vnezapnost' v nastupatel'nykh operatsiyakh Velikoy Otechestvennoy voyny* [Surprise in the Offensive Operations of the Great Patriotic War], (Moscow: "Nauka," 1986).

APPENDIX C: HISTORY OF U.S. STRATEGIC PLANNING EFFORTS

by Aaron Friedberg

This appendix provides a brief survey of the major U.S. national strategic planning efforts of the last 4 decades. Its aim is to characterize the purposes, scope, and focus of these efforts, and to trace continuities and changes in their treatment of a number of recurring issues.

Since 1947 every Administration has made at least one attempt, and in some cases several, to define a comprehensive national strategy for the United States. These efforts have differed in their timing, purpose, method of preparation, and end product. Newly elected Presidents typically order high-level, interagency studies to specify goals and lay out the various possible methods of achieving them. These studies usually result in the issuance of a Presidential directive intended to guide the bureaucracy in implementing a new Administration's preferred strategic approach. Broad reviews of national policy have also been undertaken in response to developments, actual or anticipated, which seemed to invalidate aspects of an existing strategy. Such efforts have often involved outside experts as well as Government officials, and they have typically produced reports that offer analysis and advice but do not take the form of authoritative policy guidance. Finally, toward the close of an electoral term, a number of Presidents have initiated a reexamination of past policies, either in the hope of correcting errors in a possible second term or in an attempt to influence the thinking of whoever comes after them. These studies have sometimes been followed by Presidential directives but, because of their timing, this has not always been the case.

A chronological listing of the major documents follows:

Truman

NSC 20/4 (November 23, 1948) "US Objectives with Respect to the USSR to Counter Soviet Threats to US Security"

NSC 68 (April 14, 1950) "United States Objectives and Programs for National Security"

NSC 141 (January 19, 1953) "Reexamination of United States Programs for National Security"

Eisenhower

NSC 162/2 (October 30, 1953) "Basic National Security Policy"

"Meeting the Threat of Surprise Attack" (February 14, 1955) Report of the Technological Capabilities Panel of the Science Advisory Committee ("Killian Report")

"Deterrence and Survival in the Nuclear Age" (November 7, 1957) Security Resources Panel of the Science Advisory Committee ("Gaither Committee Report")

Kennedy–Johnson

"A Review of North Atlantic Problems for the Future" (March 1961) ("Acheson Report")

"Basic National Security Policy: Short Version" (August 2, 1962)

Nixon–Ford

NSSM 3 (September 1969) "Military Policy"

NSDM 246 (December 1976)

Carter

PRM/NSC–10 (July 1977) "Comprehensive Net Assessment" and "Military Strategy and Force Posture Review"

PD–62, PD–63 (January 1980)

Reagan

NSDD–32 (May 1982)

PATTERNS OF SUCCESS AND FAILURE

One measure of the effectiveness of a planning effort is its success in shaping subsequent Government policy. By this standard it can be said that attempts to define and codify national strategy have tended to decline in effectiveness as an Administration increases in age.

Efforts completed shortly after an election come at a time when the President's ability to impose his will is typically at its peak and when there is at least a commonly felt need within the Government to set general strategic guidelines. Thus, after intensive debate among its drafters, NSC 162/2 established what were to stand over the next 8 years as the dual cornerstones of the Eisenhower Administration's basic national security policy: a continued commitment to containing (as opposed to "rolling back") Soviet expansion

coupled with a desire to avoid doing grievous harm to the American economy. In order to achieve these ends NSC 162/2 recommended a moderate, sustained defensive buildup characterized by an increased emphasis on the deterrent utility of strategic and tactical nuclear (as compared to conventional) weapons, coupled with a greater willingness to rely on alliances.

While some have succeeded, attempts at making mid-course corrections run the risk of simply being ignored, either because the danger that provokes them initially is perceived to have passed or (in those cases where they are the work of outside experts) because the people who produce them lack influence inside the Government. If completed in advance of some major, public catastrophe, such efforts can potentially provide a ready plan for strategic changes that might otherwise have been impossible. NSC 68, which grew out of a feeling of dissatisfaction with existing defense programs and recommended a sizable expansion in spending, was completed in April 1950, but not adopted as national policy until several months later, after the outbreak of the Korean War. The Gaither Committee report, which focused in large part on the imminent emergence of a Soviet intercontinental ballistic missile (ICBM) threat, was finished within weeks of the Sputnik launch in October 1957. Although he chose not to do so, President Eisenhower could have used the Committee's findings as a powerful argument for substantial increases in strategic offensive and defensive programs.

Unless an Administration succeeds itself (as could have happened in 1976 or 1980), or is succeeded by another one of the same party (as was possible in 1952, for example) end-of-term efforts at strategic planning will probably have to rely for their impact on the sheer force of the arguments they present. In this case, the most likely path of transmission for the ideas of an outgoing Administration may well be indirect, through the medium of public debate over strategic issues. Despite this fact, none of the planning efforts reviewed here seems to have given any consideration to the question of how that debate could best be shaped. When they have become known at all, the results of these as well as the other kinds of studies have usually been leaked (often selectively) by participants in the process.

Historically, valedictory documents have not fared particularly well, even when the analysis they contained was quite impressive. Thus, the Truman Administration's concluding reexamination of national security programs (NSC 141) laid out a strong, coherent rationale for a continued expansion in defense spending (with additional dollars to go to continental defenses and assistance for selected non-European countries), but its recommendations were rejected as too expensive by a new, cost-conscious Republican Administration.

DIAGNOSIS, INTEGRATION, AND INNOVATION

A review of the past suggests three strategies for increasing the likelihood that a planning effort will prove effective. These might be called the diagnostic, integrative, and innovative approaches. The first would offer a broad-brush diagnosis of existing problems accompanied by recommendations for a very general line of treatment. To take one example: most of NSC 68 was devoted to making the case that the United States was, whether it liked it or not, locked in a global cold war with the Soviet Union. The proposed response was essentially to spend more money; how much and on what were not specified.

The integrative approach is embodied in the format of the Gaither Commission report, which identified a specific threat (that posed by Soviet long-range bombers and ballistic missiles) and spelled out two sets of interlocking programs for coping with it. Highest relative priority was assigned to measures aimed at "securing and augmenting" U.S. deterrent power, with lesser importance being given to efforts to improve population defenses. Both sets of proposals were accompanied by 5-year programmatic budgets and an assessment of their likely economic impact.

A third possible model is that of the Killian report, which took as its unifying theme "meeting the threat of surprise attack" and then spun off a large number of loosely related recommendations for funding quite specific technical programs. These were aimed at everything from initiating research on high-energy jet fuels and airborne nuclear propulsion systems (to increase the range of U.S. bombers), to accelerating the pace of existing IRBM (intermediate range ballistic missile) and ICBM programs, to improving overseas communications through, among other things, the use of satellites. Priority among the various possible programs was not clearly assigned nor was an overall plan or budget put forward. Nevertheless, the Panel's report did succeed in planting a number of seeds that would eventually bear significant fruit.

SCOPE AND FOCUS

Past strategic planning efforts have focused on different geographic areas and have varied according to the emphasis given to problems of nuclear as compared to conventional strategy. In general, over the last 40 years there has been a movement toward the "periphery" and (at least in relative terms) away from nuclear issues.

From the late 1940s to the early 1950s Europe was widely seen as the principal locus of the U.S.-Soviet competition, an assumption reflected in the strategic planning efforts of this period. Although the geographic focus of these

efforts was narrow, they tended to consider all the various instruments that might be brought to bear in the region, from economic assistance for the recovering Western democracies to covert operations intended to weaken the Soviet Union's grip on its new, Eastern satellites.

With the apparent stabilization of the political and military situations on either side of Europe's "iron curtain," American strategists turned their attention increasingly to the intercontinental theater. Throughout the 1950s, as will be discussed in the section on perceptions of the Soviet Union, the great majority of the analysis contained in high-level planning papers like NSC 141, NSC 162/2, and the Killian and Gaither reports dealt with the burgeoning strategic nuclear competition and, in particular, with the growing vulnerability of the United States to nuclear attack. Other issues appeared in these documents mostly to the extent that they were seen to be linked to the central strategic balance. Thus the credibility of U.S. threats and security guarantees in various parts of the world was a topic to which planners returned with some frequency and with increasing anxiety.

By the early 1960s the superpower struggle for influence in the less developed areas, a subject that had always received a certain amount of attention, began to emerge as a problem of foremost concern. The "Basic National Security Policy" documents drafted at the outset of the Kennedy Administration devoted far more space than had ever previously been given to the question of how best to conduct the peripheral competition. The geographic focus of these papers was broad and the discussion of the various instruments that might be needed to achieve U.S. objectives in the Third World was quite sweeping. Deep concern over the extra-European periphery is also reflected both in NSSM 3 and in PRM 10, with the authors of both papers struggling to formulate an appropriate strategy for the periphery and to specify the military forces necessary to support it.

The mid-1970s also mark the beginning of a turn back toward Europe and, in particular, toward an effort to come to grips with the combined impact of changes in the nuclear and conventional balances. Conventional force planning issues were dealt with in a comparatively cursory way in the papers of the 1940s and 1950s. So long as the nuclear balance remained favorable to the United States it was assumed, more or less openly, that the prevailing imbalance in ground forces was, if not desirable, then at least acceptable. The possibility that existing U.S. conventional forces might not be adequate in an emerging era of nuclear "parity" began to be addressed seriously during the Kennedy Administration. From the early 1960s onward, this problem has received considerable attention, with a substantial fraction of both NSSM 3 and PRM 10 devoted to conventional forces.

THE PROBLEM OF PREDICTION

Every strategic plan is based on some expectation about what the future will look like; yet since the late 1950s, U.S. planning efforts have contained fewer deliberate efforts at prediction than was the case previously.

The period from 1945 to 1960 saw the working through of technological possibilities that first became evident during the course of the Second World War. Long-range jet bombers and ballistic missiles and large arsenals of atomic bombs and perhaps of even more destructive weapons were all just over the technical horizon when the war ended. As the Soviets acquired these systems, the United States would be vulnerable to direct, devastating attack in a way that it had never been before. Thus, in the immediate postwar period, American strategic planners were concerned with anticipating and trying to cope with the emergence of each element in an unfolding series of new threats. The central question was not so much *what* would happen but rather *when* it would occur.

Despite their intentions, during this period U.S. planners generally did better at sketching the broad outlines of the emerging strategic environment than at predicting the timing of specific events. The implicit assumption that underlay the major planning efforts from NSC 20/4 onward (that the Soviets, like the United States, would not forego any opportunity to augment their striking power) was repeatedly proven correct. Thus, the Russians did acquire atomic and hydrogen bombs, and they did so sooner than had been widely anticipated. On the other hand, the pace at which Soviet stockpiles expanded appears in retrospect to have been slower than expected. Straight line projections of the sort presented in NSC 68 overlooked the technical difficulties that had to be overcome before mass production of nuclear weapons became possible. That such weapons would exist (and exist in some numbers) by the end of the decade was correctly anticipated in the early 1950s. More specific attempts to project the precise size and composition of the Soviet arsenal do not seem to have done particularly well.

Similarly, American planners were correct in believing that the Soviets would eventually acquire intercontinental range ballistic missiles, too optimistic in their predictions of when the first signs of such a capability might appear (not until the early to mid-1960s, according to the Killian report, instead of 1957 as turned out to be the case) and too pessimistic in their anticipation of how rapidly the threat would grow (the Gaither commission, for example, expected that the Soviets would have a substantial ICBM force by 1962 at the latest). As with nuclear weapons, the U.S.S.R. was quick to test prototypes but slower to deploy full-scale operational forces. We now know that, during the late 1950s and early 1960s, the Soviets preferred to concentrate their efforts in both bombers and missiles on building up intermediate-range, peripheral strike forces. This possibility is not

discussed in any of the high-level strategy papers reviewed here. Instead, the assumption on which planners seem to have operated was that the Soviet Union would pursue the possibilities opened by the new technologies in more or less the same fashion as the United States. A better understanding of the technical constraints and strategic considerations influencing Soviet decision-makers might have led to better predictions.

Most of the projections made during the 1940s and 1950s were in support of threat assessments, but there were also some efforts at what might be called predictive net assessment. Both the Killian Panel report of 1955 and the Gaither Commission report of 1957 contain fairly extensive speculations about the coming strategic environment. These projections went forward in several stages. First, assumptions were made about the pace of technological advance, and, from these, very general estimates were attempted of what the forces of the two superpowers might look like at some specified point in the future. Next, the possible interactions between anticipated forces were considered under a range of operational scenarios (surprise attack with no advance warning, first strike against alerted forces, retaliation after first strike, and so on). The likely net military consequences of these interactions were identified and the resulting consequences for the overall superpower relationship inferred.

The Gaither report, for example, laid out four phases (beginning in 1957 and running until roughly the mid-1970s) distinguished by different mixes of Soviet and American offensive and defensive forces. From mid 1957 until late 1959 or early 1960, each superpower was credited with having the capability substantially to disarm its enemy in a surprise attack at a time of "lessened world tension" (in other words, when the enemy's forces were not on a high level of alert). As the Strategic Air Command (SAC) improved its alert procedures the United States would probably be able to carry out a decisive attack even if it were surprised. "This," the report noted, "could be the best time to negotiate from strength, since the U.S. military position vis-a-vis Russia might never be as strong again." One factor that threatened to erode that position was the apparent Soviet decision to concentrate on developing ballistic missiles. Although the Soviets were expected to increase their inventory of long-range jet bombers, "the small number of these produced in recent months and the apparent lack of air- refueling of her large number of medium jet bombers indicate the Soviets are probably taking a calculated risk during this period and are shifting a large part of their national effort from manned bombers to long-range ballistic missiles."

A second phase (beginning in 1959/60 and ending in 1961/62) would be marked by the emergence of a significant Soviet megaton warhead ICBM delivery capability. The United States was not expected to be able to field an ICBM force of its own during this time nor to deploy an effective early warning or

antiballistic missile system to cope with the Soviet force. As a result, the period just ahead threatened to be a "very critical" one for the U.S.: "SAC could be completely vulnerable to an ICBM attack directly against its bases and weapons stockpile." After an initial disarming missile strike, Soviet bombers flying at high and low altitudes would be able to deliver a decisive attack against the United States.

During the phase projected to last from 1961/62 until 1970/75, both sides would increase their ICBM capabilities and acquire some capacity to detect and (toward the mid-1960s) to offer some defense against missile attack. It was also anticipated that by this time SAC would have a significant part of its bomber force on 7- to 22-minute alert. Under such circumstances neither side might be able to destroy the other's forces, but even a second strike could be decisive if the attacker had not implemented, "at minimum, a nationwide fallout shelter program."

In the phase that would begin in the early to mid-1970s and last for an indefinite time afterwards, both the U.S. and the U.S.S.R. would produce second and third generation ICBMs with "solid propellants, CEPs measured in the thousands of feet instead of several miles, and with larger megaton warheads and quicker reaction time." Both would also develop improved defenses and an intense technological competition between offense and defense would ensue. This would be a period "of extremely unstable equilibrium" with both powers having the capacity to destroy almost all of their enemy's urban population (despite active defenses and blast shelters), and each straining for some temporary technical advantage that might allow it to "come near to annihilating the other."

This projection did contain a number of errors. It was wrong on the timing of the Soviet buildup, did not anticipate the possibility of political constraints being placed on defensive systems, and failed to foresee the full extent of accuracy improvements or their implications for warhead size. Nevertheless, as a heuristic device and as a general picture of the likely future course of the strategic competition, it is not at all bad. Once again, general patterns seem to have been easier to predict correctly than specific details.

By the end of the 1950s extended, explicit attempts at prediction seem to have fallen out of favor. In any case, none appear in the later strategic planning documents. This may have been due in part to the belief that such projections had not done particularly well in the past. It may also reflect a change in the nature of the strategic competition and the movement from a period in which the landmarks defining its stages were fairly clearly visible to one in which those dividing lines have become more difficult to discern. Predicting when the Soviets will have a certain functional capability (the capacity to destroy all American

fixed targets in a single strike, for example), or even realizing it when they do, seems to be a lot harder than attempting to fix the date at which they will acquire a particular weapon or trying to anticipate the rate at which a certain element of their forces will grow.

URGENCY, OPTIMISM, AND PESSIMISM

The early 1960s mark a dividing line between the roughly 15-year period during which national strategic planning documents were characterized by a sense of urgency and a considerable degree of pessimism about the future, and the more relaxed and generally optimistic tone of subsequent efforts. Ironically, it seems in retrospect that American fears of weakness were greatest during the period of our maximum relative strength. Those concerns appear to have diminished as the U.S. position has eroded.

Although they acknowledge that a condition of "cold war" may persist for some time, the most striking feature of the early planning papers is their tone of anxiety and concern. While not considering a clash with the Soviets to be imminent, NSC 20/4 warned in 1948 that "there exists a continuing danger of war at any time." Unless offset by prompt action, ongoing Soviet programs were likely to "result in a relative increase in Soviet capabilities vis-a-vis the United States and the Western democracies." In any case, "by no later than 1955 the USSR will probably be capable of serious air attacks against the United States with atomic, biological and chemical weapons. . . ." There was also the possibility that "Soviet political warfare might seriously weaken the relative position of the United States."

These passages suggest themes that were to recur for at least the next 10 years. The ever present possibility of war, the specter of an eroding military balance, the growing vulnerability of the continental United States, and the danger of "losing the peace" all figure prominently in subsequent documents. In 1950, NSC 68 warned that the year 1954 would be "a critical date for the United States." Five years later, the Killian report cautioned that, as early as 1958, "the deterrent effect of U.S. power" could be "dangerously lessened" by the rapid expansion of Soviet strategic forces. In 1957, the Gaither committee concluded its report by warning: "The next two years seem to us critical. If we fail to act at once, the risk, in our opinion, will be unacceptable."

By the early 1960s, the tone of high-level Government planning documents had changed substantially. The version of the Kennedy Administration's "Basic National Security Policy" paper circulated in August 1962 makes no mention of the probability of war and, indeed, urges that the United States be alert for and

open to the possibility of "temporary or partial detentes" that might be used to "build up the habit of meaningful U.S.-Soviet communications." No imminent, unfavorable shifts in the balance of military power were foreseen and, instead, emphasis was placed on finding ways of creating "a stable international military environment." The growing Soviet capacity to deliver nuclear weapons against the United States was acknowledged but, in sharp contrast to earlier documents, the utility of either active or passive measures in reducing the magnitude of that threat was called seriously into question. Only as regards the competition for influence in the less developed areas of the world does there seem to have been any sense of immediacy or danger.

Overall, subsequent planning efforts seem also to have been relatively relaxed. Neither NSSM 3 nor PRM 10 warned of the possibility of pending, unfavorable shifts in the military balance, still less of the short-term danger of war. Thus, after a shaky 15-year start, over the last two and a half decades the competition with the Soviet Union (as presented in the planning papers) seems to have settled down to a familiar set of problems that must be managed but cannot ever be finally resolved. This is, in one sense, understandable. By 1960, many of the most worrisome dangers anticipated in the early 1950s (and, in particular, the acquisition by the Soviets of atomic bombs, thermonuclear weapons, and ballistic missiles) had come to pass without the world having been brought to an end. Political relations between the superpowers had also begun to improve. For better or worse, official American strategists came to accept conditions that their predecessors might have regarded as intolerable over any long period of time (like the continued vulnerability of U.S. territory to nuclear bombardment or, for that matter, a permanent American ground presence in Europe). Depending on how they are viewed, these changes in outlook may appear as the result either of a process of maturation and an acceptance of the inevitable, or of a gradual numbing of strategic sensibilities in the face of unfavorable trends.

PERCEPTIONS OF THE SOVIET UNION

While they are not typically spelled out, contemporary American perceptions of the Soviet Union have informed every aspect of successive strategic planning efforts. Those perceptions have changed in the past, and (especially if the Gorbachev reforms are, or even appear to be, successful) they are likely to do so again in the years ahead. It is worth noting that all the elements of the presently prevailing image of the Soviet Union as a militarily powerful but ideologically moribund and economically stagnant nation have only come fully into place in the last decade.

Since the late 1940s, Soviet military might has been viewed as the principal threat to American global interests. Fear of the Red Army has been a virtual

constant, with the assumption being made (usually implicitly) from the early 1950s onwards that the U.S. and its allies could not in peacetime match Soviet forces on the ground. The 1940s, 1950s, and 1960s were marked by the anticipation and eventual emergence of mature Soviet nuclear capabilities. The early 1960s were characterized by concern over Soviet-supported communist insurgencies, the mid-1970s by anxiety over the development by the U.S.S.R. of conventional power projection forces.

In the 1940s, 1950s, and early 1960s, much attention was also paid to the ideological attraction of Soviet-style communism, at first in newly liberated Europe and then in the decolonizing less developed world. The fear that Marxism-Leninism would spread by contagion rather than through forcible imposition seems to have diminished from the early 1960s onwards. By the mid-1970s, PRM 10 portrayed the Soviet Union as no longer presenting a serious ideological threat, and the United States was seen as having moved from the defensive to the offensive in the battle of ideas.

Perceptions of Soviet economic capabilities have also changed over time. In the 1950s, there was concern that the Soviet Union, while poorer than the United States, would be able to sustain higher levels of growth over a long period of time. Thus in 1950, NSC 68 observed that the Soviet economy was only one-fourth that of the United States but cautioned that, in the coming years, the Soviet Union would be "steadily reducing the discrepancy between its overall economic strength and that of the U.S. by continuing to devote proportionately more to capital investment that the U.S." There was also some worry that a centrally controlled economy might be able to make up for its lower level of overall efficiency by being able to shift resources rapidly into militarily significant areas. Far from scoffing at the inefficiencies of a centrally planned economy, in 1957, the authors of the Gaither report actually expressed some admiration for the Soviet system: "We are faced by an enemy who is able, not only ruthlessly to concentrate his resources, but rapidly to switch from one direction or degree of emphasis to another." The United States, by contrast, was seen as having "lost the ability to concentrate resources . . . and to change direction or emphasis with the speed that a rapidly developing international situation and rapidly developing science and technology make necessary." This particular concern appears to have diminished from the early 1960s onwards. Nevertheless, throughout the postwar period, the Soviets have been seen as being able to compensate for the smaller size of their economy through their ability to concentrate disproportionately on military spending.

DEFINING OBJECTIVES IN THE MILITARY COMPETITION

That the United States would be involved in a long-term military competition with the Soviet Union was a fact accepted, albeit reluctantly, by the end of the 1940s. What American objectives in that competition should be and how they might best be pursued has, however, been a subject of continuing debate among strategic planners. In the 1950s, maintaining nuclear superiority was assumed to be the primary goal of U.S. peacetime military policy. Since the early 1960s an alternative objective, stability, has also been put forward periodically in planning documents. No intermediate goal between these two end points, and no "competitive strategy" for achieving it has yet been clearly defined.

In August 1948, the State Department's Policy Planning Staff reviewed the merits of two possible peacetime defense postures: "A . . . defense effort founded on the principle of a long-term state of readiness" versus one based "on the idea of meeting a peak of war danger by a peak of military preparedness." Building up in anticipation of a "year of maximum danger" was deemed too risky, in large part because the United States lacked the intelligence needed to calculate when that year might arrive. Instead, the goal identified in NSC 20/4 was the development of a level of military readiness that could "be maintained as long as necessary as a deterrent to Soviet aggression."

The idea of a steady, modest, permanent defense program was challenged in 1950 by the authors of NSC 68. Such an approach, they warned, engaged too small a fraction of America's resources and was leading toward a secular decline in the relative power of the West. If things continued as they were going, by 1954 the United States would be dangerously vulnerable to Soviet attack. Only through a concerted and "more rapid build-up of political, economic and military strength" could the U.S. and its allies ensure that "this date is, so to speak, pushed into the future. . . ."

With the passing of the Korean crisis and the advent of a new, economy-minded Republican Administration, the idea of building toward a peak year was explicitly rejected and the principle of what Eisenhower had called the "long pull" reasserted in its place. The United States, in the words of NSC 162/2, would maintain sufficient forces in-being ("with emphasis on adequate offensive retaliatory strength . . . based on massive atomic capability") to deter aggression or to "counter" it "initially" if it did occur. These forces were to be backed by "an adequate mobilization base."

The presumed basis of the Eisenhower strategy was, obviously, a continuation of the existing U.S. advantage in atomic and thermonuclear strike forces. In

1953, as in 1948, the persistence of nuclear superiority (if no longer monopoly) was the largely unspoken assumption on which rested the preferred American approach to a peacetime military competition. That superiority was defined in functional as opposed to numerical terms, and its distinguishing characteristic was the fact that the United States could conceivably disarm the Soviet Union in a first strike without being in danger of suffering a similar disarming attack. So long as such a situation could be preserved there was no need to question the adequacy of a relatively small, relatively slowly growing defense program.

Even as they based their policy on it, the authors of NSC 162/2 acknowledged that U.S. superiority might not last forever. When both superpowers had reached a "stage of atomic plenty," each would have the capacity to inflict terrible damage on the other, but neither would "be able to prevent major atomic retaliations." This could create "a stalemate" in which both sides would be reluctant to begin a general war, but which might permit the Soviets greater freedom in initiating peripheral aggression.

Less than 2 years after the promulgation of NSC 162/2, in February 1955, the Killian Panel warned that the United States would soon enter into a "period of transition" (Period III, not to be confused with the "phases" of the Gaither report discussed above). For the next 3 to 5 years (Period II), American offensive capabilities would be vastly greater than those of the Soviet Union and U.S. defenses would also improve markedly in quality. By 1960 at the latest, the Soviets would begin to acquire a large force of bombers and, perhaps, ballistic missiles. Unless the capabilities of America's defenses expanded even more rapidly (permitting a Period III–A), a new era (Period IV) would begin by the middle 1960s. This period would be "indefinite in length" and would be characterized by the fact that, even after absorbing a surprise attack, either side could launch enough weapons to destroy the other. Under these circumstances, "[a]n attack by either side would result in mutual destruction."

Far from welcoming such a condition, the authors of the Killian report warned that, because it would be "a period of instability that might easily be upset by either side,"

> Period IV is so fraught with danger to the U.S. that we should push all promising technological development so that we may stay in Periods II and III–A as long as possible, and, if we pass into Period IV, may escape from it into another period resembling II or III–A.

The maintenance of superiority was now to be the explicit object of American research, development, and building programs:

> [I]f we are to preserve a status of *superior military strength* or even if we are to endure and survive the less favorable state of stalemate

> we must maintain a strong program in basic science and other policies which help our science to flourish and our technology to be strong. . . . [S]urvival is not enough . . . a state of indefinite insecurity is not enough . . . a condition of stalemate is not enough. . . . (emphasis added)

Two years later continued American superiority seemed to be even more seriously in jeopardy. In November 1957, the Gaither Committee advised that the Soviets were on the verge of acquiring intercontinental range ballistic missiles. Immediate steps would have to be taken to increase warning time, readiness, and survivability, and the U.S. should also speed up its own ballistic missile and ICBM defense programs. Staying ahead, staying in place (in other words, preserving a situation in which the United States was relatively invulnerable to attack while the Soviet Union remained vulnerable) now meant running harder than ever. Nor would the competition end when both sides acquired ballistic missiles. The Gaither Committee predicted that, by the early 1970s, both superpowers would have significant ICBM and antiballistic missile (ABM) forces and it warned that "this could be a period of extremely unstable equilibrium." As defenses were deployed:

> The missiles in turn will be made more sophisticated to avoid destruction; and there will be a continuing race between the offense and the defense. Neither side can afford to lag or fail to match the other's efforts. There will be no end to the technical moves and counter-moves.

Once again, the early 1960s mark a noticeable dividing line between earlier and later thinking. Perhaps reassured by evidence that the U.S. advantage in long-range offensive forces had not eroded as much or as quickly as had previously been feared, the authors of the August 1962 "Basic National Security Policy" did not call for redoubled efforts to preserve an American lead. Far from believing that a continuing advantage was inevitable, however, they began to make the argument that it was no longer important. What mattered now was not superiority but *stability* or, more broadly, the creation of "a balanced and stable international military environment."

By 1962, Kennedy Administration officials were increasingly skeptical about the possibility of large-scale missile defenses. In their absence, deterrence would have to rest primarily on offensive forces sufficiently "dispersed, hardened, mobile and controlled" that the Soviets could not hope to neutralize them in a single blow, and capable, even after receiving an initial surprise attack, of "substantially reduc[ing] the military capabilities of the enemy."

If war did occur, U.S. offensive forces might be able to limit damage to some extent by attacking residual Soviet forces. Passive measures (and, in particular, a nationwide system of fallout shelters) could also play a role in reducing civilian casualties. The authors of the "Basic National Security Policy" did not, therefore, wholeheartedly embrace a condition of what would soon become known as "mutually assured destruction," but neither did they see any particularly promising way of escaping from it. Meaningful superiority was a fast receding goal and a leveling off in the military competition was beginning to seem like the best thing for which anyone could reasonably hope. Whether stability of the sort envisioned could coexist with other peacetime aims (especially the preservation of America's overseas alliances), whether it could be achieved without the active cooperation of the opposition, and what U.S. objectives should be in the event it proved unattainable were left unclear.

VULNERABILITY AND DEFENSE

Anxiety over the vulnerability of the continental United States (including both population and strategic forces) to nuclear attack was the central concern of American planners from the late 1940s through the early 1960s. With the apparent solution of the problem of force survivability and the seeming impossibility of providing protection to the civilian population, interest in both active and passive defenses declined from the beginning of the 1960s onwards. In retrospect, the 20 years from roughly 1963 to 1983 may appear as an anomalous phase during which relatively little attention was paid to the problem of defending American citizens and soil from Soviet attack.

In 1950, the Soviets were believed to be capable of carrying out some small number of atomic air raids on targets in Britain, Alaska, Canada, and the continental United States (CONUS). While acknowledging serious intelligence deficiencies, the authors of NSC 68 estimated that the Soviets already had between 10 and 20 atomic bombs and calculated that their stockpile would grow to from 45 to 90 weapons by 1952, reaching 200 by 1954. This last number was regarded as particularly important. The Soviets were already assumed to have a substantial fleet of atomic-capable bombers, and their force of such aircraft was projected to grow at least as fast as the weapons stockpile. Assuming that only half of the bombers launched reached their targets, by 1954 the Soviet Union would be able to deliver 100 atomic bombs against the U.S. Such an attack could "seriously damage this country." The year 1954 would therefore be "a critical date" for the United States. Given presently programmed air defenses, by that time the Soviets might have the capability to "greatly reduce" America's superior economic potential in a surprise atomic (and perhaps thermonuclear) first strike. As the Soviet Union's power grew, it might even be able effectively

to disable the U.S. Air Force. At that point, the prevailing assumption that the Soviets were unlikely deliberately to initiate a general war might no longer hold. "[W]hen it calculates that it has a sufficient atomic capability to make a surprise attack on us, nullifying our atomic superiority and creating a military situation decisively in its favor, the Kremlin might be tempted to strike swiftly and with stealth. The existence of two large atomic capabilities in such a relationship might well act, therefore, not as a deterrent, but as an incitement to war."

By the early 1950s, far and away the most important danger facing the United States was held to be the growing vulnerability of its home territory to air attack. In mid 1952, American civil defenses were described by the authors of NSC 141 as being "only 10% to 15% effective," and U.S. continental air defenses were considered capable of blocking the delivery of only 15 to 35 percent of enemy weapons. If no further increases were made in existing programs for active and passive defense against atomic attack, the situation would deteriorate even further until (in 1954 or 1955 when the Soviets might have from 200 to 600 fission bombs) it reached "critical proportions."

The growing atomic and, eventually, thermonuclear stockpiles of both superpowers would "steadily increase the mutually adverse consequences of general war." But, the report continued, "The controlling relationship in the atomic equation is not that of stockpiles to each other, but a rather more complicated one involving the relationship of each stockpile, plus its deliverability, to the number of key enemy targets, including retaliatory facilities." Even if their arsenal remained inferior in absolute terms, the Soviets might someday come to feel that they had the capacity for a disarming strike against the United States. Pending the development of highly reliable air defenses, "The best defense of the United States in this period of weapon transition lies in an effective . . . offensive capability sufficient to deter the would-be aggressor or render him impotent should he choose to attack."

Aside from its more narrowly military consequences, the burgeoning Soviet atomic air threat might have other, broader implications. For "the foreseeable future," a willingness to employ atomic weapons was held to be "essential to the success of [U.S.] strategic plans." That willingness might well diminish as Soviet offensive capabilities grew. Without greatly improved defenses there was thus an "increasing danger that . . . the United States might find its freedom of action seriously impaired in an emergency."

In order to bolster public morale in cold war crises, reduce the danger of surprise attack, minimize civilian casualties, and "assure the effective conversion of the nation to an all-out war effort," NSC 141 urged a substantial expansion in spending on defensive programs. Such an expansion was to be funded with

additional resources rather than with cuts in other essential programs. A total of $8.5 billion would have to be spent on active defenses, over and above that already budgeted, with the majority going to buy more fighter interceptors, surface-to-air missiles, and antiaircraft artillery, and the rest paying for tactical radars, submarine surveillance systems, and a distant early warning network.

Because both offensive and defensive technologies were changing so rapidly, "a further heavy investment now in the presently available means of destruction might not add as significantly to the effectiveness of [U.S.] continental defense as would an investment later in newer weapons." NSC 141 therefore urged an "intensive research and development" effort on better defensive systems, although it did not specify the price tag for such an undertaking.

To protect American civilians, the report's authors recommended a "substantially increased and more vigorous civil defense program." This would consist primarily of the construction of more and sturdier urban blast shelters (to cost, depending on the level of protection desired, anywhere from 2 to 9 billion dollars) and a "comprehensive program" for the dispersal of essential civilian officials.

Although it did not accept in detail the plans of its predecessors, the Eisenhower Administration did recognize the need for "an integrated and effective continental defense system." As of late 1953, the U.S.S.R. was credited in NSC 162/2 with being able to launch sufficient aircraft on one-way missions to inflict "serious damage" on the United States. With the advent of thermonuclear weapons the Soviets might "soon . . . have the capability of dealing a crippling blow to our industrial base and our continued ability to prosecute a war." Given the ongoing buildup of American capabilities the most likely eventuality was that both sides would soon reach a stage of "atomic plenty." In the ensuing "stalemate" both powers might be reluctant to initiate general war, although "if the Soviets believed that initial surprise held the prospect of destroying the capacity for retaliation, they might be tempted into attacking."

One of the most worrisome features of the emerging situation was that growing Soviet strength might "tend to diminish the deterrent effect of U.S. atomic power against peripheral Soviet aggression." As NSC 162/2's authors observed: "[A]s general war becomes more devastating for both sides the threat to resort to it becomes less available as a sanction against local aggression." With the Soviets becoming more powerful in absolute if not necessarily in relative terms they might also become more likely to react sharply to perceived American provocations.

Over the next 5 years, the apparently rapid expansion in Soviet offensive capabilities and the relatively slow growth in spending on strategic programs

under the Eisenhower Administration combined to produce two major reviews of national policy. In 1955, the Killian Panel urged a number of steps, including improvements in tactical warning and alert procedures, greater dispersal of bombers, and accelerated development of ballistic missiles, to ensure that the U.S. would always retain an overwhelming deterrent to enemy nuclear attack.

In addition to their recommendations on offensive forces, members of the Killian Panel devoted a large portion of their effort to considering ways of defending North America from Soviet atomic strikes. Defenses were held to be crucial to protecting both U.S. retaliatory power and the civilian population. In their role as a deterrent, defenses "need not necessarily be capable of stopping all forms of attack completely, but must, in the enemy's view, make attack extremely hazardous." Even so, the requirements for defense were regarded as "vast and complex." Perhaps the greatest problems to be faced in developing some system of protective measures were organizational rather than purely technical. The mission of continental defense did not fit naturally into the existing structure of the U.S. military establishment. Indeed, the panel concluded that "Although technology is important, in the end our success at defending ourselves will depend upon the effort we put in and how well we organize that effort."

First priority would have to go to completing and improving a network of early warning radars. The panel endorsed a system of at least two fixed radar lines, the first to give an initial alert and the second to provide an accurate assessment of any oncoming raid. Radar-equipped aircraft could also be used to patrol in advance of a distant early warning network. Active air defenses would consist in large measure of advanced interceptors that would increasingly play the role of launching platform for sophisticated air-to-air missiles. Given the tremendous power of thermonuclear weapons and the awesome damage they could do even if not delivered precisely on target, the Killian report recommended efforts to push the combat zone as far outward as possible. Existing defenses were especially vulnerable to Soviet bombers flying at very high or very low altitudes. These gaps would have to be filled. In order to ensure the highest possible levels of "kill," nuclear warheads would have to be used on defensive weapons, both air-to-air and surface-to-air: "These should be adopted as the major though not the exclusive armament for our air-defense forces."

With a solution to the problem of defending against bomber attacks seemingly within reach, a new and even more menacing danger was beginning to emerge. Regarding the potential threat from ICBMs, the Killian Panel cautioned against what it described as "the generally prevailing feeling of hopelessness." The Soviets might have an operational missile force in as little as 5 to 10 years, but there was not yet sufficient technical knowledge available with which to justify a

crash defensive program aimed along a particular line. What was needed was stepped up theoretical and experimental work on a broad front. Problems of detection, tracking, discrimination, trajectory prediction, interceptor maneuverability, and weapons effects had all to be resolved. But the Killian Panel concluded optimistically: "We feel certain that many of the nation's foremost scientists would gladly find time to participate in this work if they were asked." In the meantime one thing that could be done within the next 5 years was to build a radar surveillance system capable of detecting incoming missiles, providing 15 minutes warning time, and localizing the likely area of impact to within an area of 50 miles by 100 miles.

To round out its proposed defensive program, the Killian report also suggested further improvements in submarine detection and tracking systems and (because thermonuclear weapons would pose a new danger of widespread radioactive fallout) a detailed comparative study of various blast and radiation protection measures for the civilian population.

In many ways, the second of the two "crisis" reviews of the 1950s, the Gaither Commission report completed in 1957, represents the beginning of a shift in attitudes regarding the problems of continental defense. Although it began as an inquiry into the "relative value of various active and passive measures to protect the civil population in case of nuclear attack," the Commission soon expanded its charter to include the full range of strategic issues. Given the existence of long-range bombers armed with thermonuclear weapons and the impending appearance of intercontinental range ballistic missiles, the Commission concluded that neither the active nor the passive defensive measures in being or presently programmed were sufficient to provide adequate protection to the American civilians. "The protection of the United States and its population," the Commission advised, "rests, therefore, primarily upon the deterrence provided by SAC." To ensure that this deterrent would always be available, the Gaither report recommended that first priority be given to ensuring the survivability and penetration capabilities of U.S. offensive forces. To cope with the ICBM threat, bomber reaction times would have to be reduced to under 22 minutes, with aircraft dispersed to the greatest extent practical and, in many cases, shielded in 100–200 psi shelters and protected with antimissile missiles. Existing surface-to-air missiles (SAMs) and long-range radars might (by 1962) be able to provide some capability for intercepting ICBMs once they had reentered the atmosphere. Earlier intercepts would involve discriminating among warheads and decoys, a problem that was not likely to be solved soon.

If additional funds were available, the Commission went on to suggest a program of population defenses. Such an undertaking was necessary not only because war might occur either through accident or design but because "As long

as the U.S. population is wide open to Soviet attack, both the Russians and our allies may believe that we shall feel increasing reluctance to employ SAC in any circumstance other than when the United States is directly attacked."

Population protection required, first of all, active bomber defenses better able to deal with low-level raids and with Soviet use of electronic countermeasures. The Panel further recommended a nationwide fallout shelter program coupled with improved postattack recovery planning. Blast shelters were not recommended because they seemed likely to be less effective than improved air defenses. Better antisubmarine warfare (ASW) and "a program to develop and install an area defense against ICBMs at the earliest possible date" were two other parts of the Gaither report's package of suggested programs.

By the beginning of the Kennedy Administration, the elevation of the offensive deterrent and the relative downgrading of population defenses had proceeded even further. As presented in the "Basic National Security Policy" draft of August 1962, active defenses were seen as having three potential roles: improving stability by helping to protect the retaliatory forces, preventing cheap and easy enemy devastation of the United States, and "accomplishing maximum attrition of the attacking force and complicating enemy planning." The first of these objectives could probably best be achieved through other means, in particular, dispersal, mobility, and hardening. The third was apparently considered to be of marginal importance and, as to the second, the authors pointed out, this "objective will present increasing difficulty as the USSR develops more sophisticated weapons systems; hence, the actual level of resources to be devoted to this mission should be reconsidered frequently and thoroughly."

Passive defenses were also viewed with less than full enthusiasm. The purpose of such defenses was to maintain maximum feasible continuity of Government, to make possible the mobilization of national resources in the aftermath of nuclear attack, and, most important, "to prevent or limit avoidable fatalities or casualties from nuclear conflict not involving massive attack directly upon U.S. population centers." Protection from blast could be provided only by a combination of active measures and shelters and "systems to accomplish this on a nationwide basis are not yet sufficiently efficient to warrant their adoption." Fallout shelters and accompanying postattack recovery preparations were "essential" but at the same time "care should be taken . . . not to generate unwarranted expectation as to what such programs can accomplish, nor to become so preoccupied with them as to divert public attention and energy from other needed national security tasks."

The problem of force survivability seemed about to be solved without resort to active measures while, at the same time, the task of population defense was seen

to be moving steadily out of reach. The ground had thus been laid for the acceptance of a situation of purely offensive deterrence, which planners had feared and warned against only a few years before.