THE US/SOVIET ARMS COMPETITION: QUANTITATIVE/QUALITATIVE ASPECTS

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Washington, D. C.

1 July 1974

THE NATIONAL WAR COLLEGE

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STRATEGIC RESEARCH GROUP

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By

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FOREWORD

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The research and writing for this study were performed by Colonel Richard M. Jennings, United States Army, who is assigned to The National War College as a Senior Research Fellow.

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ABSTRACT

1. Purpose. This study seeks to give decisionmakers an unclassified analysis of the nature and intensity of US/Soviet arms competition since World War II and to point out implications for future national security policy.

2. Discussion. This study is the first of three studies by the author on the US/Soviet arms race. It places emphasis on the overall indicators of the race and strategic nuclear arms. Scholars have concluded that a quantitative arms race usually leads to war, but a qualitative one does not. This study sets up operational definitions for these type races, and tests the US/Soviet case by charting trends in military personnel, nuclear arms, defense expenditures and fear/hostility. The results indicate that:

a. From the standpoint of a classic quantitative arms race, an overall intense US/Soviet race occurred in 1949-1953 and a moderate one in 1961-1968. The relative burden of arms on the two populations decreased after the mid 1950's.

b. The competition has become more qualitative, marked by a move to higher technology by the USSR. Soviet defense spending and R&D investments have shown a steady rise.

c. In nuclear delivery systems, the Soviets surpassed the US in total delivery systems in 1970, but still lag in qualitative areas and total reentry vehicles.

3. Conclusions.

a. Most forces in the near future should act against a resumption of the quantitative race. These include the chance to use the CPR as a balancer, the increased concern of the superpowers for domestic problems, and the lessened utility of future increases for political power.

b. US/Soviet arms may be entering a period of "normal military activity." This will probably see a moderate level of tension, without large rises in arms levels. Defense budgets will remain high, but without heavier per capita burden. The situation probably includes a qualitative arms race, but should not lead to war. The nation with the best technology will make the scientific breakthroughs or be able to rapidly reduce any weapons advantage of the adversary.

c. The US should be in a favorable economic position in this contest. But it needs steady effort and a well-managed defense program, strong on R&D, with the perspicacity to phase out obsolete or redundant arms systems.

THE US/SOVIET ARMS COMPETITION: QUANTITATIVE/QUALITATIVE ASPECTS

Views on the "arms race" between the United States and the Soviet Union differ widely and are often argued with emotion. Most writers have deplored its costs and effects, both real and envisaged, though some see the race as inevitable or even functional in the type of international system existing today. Most seem to agree that an arms race of some type has been taking place since the beginning of the Cold War, but there seems to be little agreement as to its nature and intensity.

Some questions on which there may be commonly voiced opinions, but which still need analysis are: Has there been a US/Soviet arms race throughout the postwar period? If so, how rapidly has it been run? Has the race been predominately quantitative or qualitative? And has it ended?

This study attempts to give decisionmakers precise answers to these questions, and to point out implications for American national security policy. It does not seek to identify the causes of specific fluctuations in US/Soviet arms levels, though the reader may gain such insights from the data presented. The quantitative/qualitative aspect may be a key one, for it has been posited that a quantitative arms race often ends in war, whereas a qualitative one does not. Samuel Huntington based this conclusion in 1958 on the proposition that a qualitative race inherently leads to parity of weapons power and a stable balance.[1] The results of the study give qualified support to his thesis but indicate that the race has been more complex than envisaged a decade and a half ago.

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[1] Samuel P. Huntington, "Arms Races: Prerequisites and Results," Public Policy (Cambridge: Harvard University Press, 1958), pp. 41-86. This view is not shared by all analysts. Raymond Aron, for example, sees the qualitative aspect as the main threat to US/Soviet coexistence. Peace and War (Garden City, N.Y.: Doubleday and Co., 1966), pp. 428-429. Some Soviet writers see technological arms improvements leading to further spirals of the race and instability. Yu. Arbatov, "USA: The Great Missile Debate," Izvestia, April 15, 1969, Current Digest of the Soviet Press, Vol. XXI, No. 15.

There are limitations involved in studying US/Soviet arms relationships, in that the Soviet data must be based for the most part on Western estimates. Such estimates may be based on little evidence or may suffer from an "intelligence lag" or the tendency to overestimate the adversary's forces. But particularly since the early 1960's the US Government has had better knowledge of Soviet military equipment. Further, this study attempts to establish trends over a period of years, not to make a strict comparison of the sizes of the two superpowers' arms, and errors in estimates are less likely to affect long-term trends than absolute values of a point in time.

An arms race differs from a state of war or normal military activity.[2] But how can the period of an arms race be identified? One reason for the lack of a clearer picture of the duration and intensity of the US/Soviet race is that no one has given the term "arms race" an operational definition and then applied empirical evidence against it. As a definition, this study will use a quantified version of Huntington's 1958 definition: "progressive competitive peacetime increases in armaments by two states or coalitions of states resulting from conflicting purposes or mutual fears." To measure "armaments," let us use the variables of defense expenditures, military personnel, and military equipment. These should be considered both in the absolute sense and in regard to the relative burden they place on the populations.

What pace should be required to qualify an arms competition as a race, and how can we precisely tell a quantitative race from a qualitative one? Let us specify that a quantitative race must have annual increases of armaments

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[2] Quincy Wright differentiated an "arms race" from "normal military activity" primarily by stipulating that arms races see steadily larger arms levels and defense budgets (in real terms), whereas normal military activity is an average of levels over years with or without great change or acceleration. A Study of War, Vol. II (Chicago: University of Chicago Press, 1942), pp. 689-695. Hans Morgenthau stated that an arms race sees a constantly increasing burden of military preparations devouring an ever greater part of the national budget and ever deepening fear and insecurity. Politics Among Nations, 4th ed. (New York: Alfred A. Knopf, 1967), p. 174.

averaging 5 percent or more over at least a three-year period.[3] A corresponding increase must be noted in the adversary state within one year plus, in the case of forces or weapons, the development or "lead" time to field the particular type of force. According to scholars in the field, a quantitative race is also accompanied by rising tension and fear.[4]

In defining a qualitative race, one could stipulate as a requirement either incremental or revolutionary change. The latter implies that the qualitative changes not only improve effectiveness, but also make the preceding technology obsolete. Let us choose this interpretation rather than the incremental one and use Huntington's definition that a qualitative race "replaces existing forms of military force (normally weapons systems) with new and more effective forms of force."[5] Such a race, of course, has a quantitative aspect, in that each major technological change sets off a quantitative race in the new weapons system which lasts until the next revolutionary breakthrough.

Selecting the pace required for a qualitative race is difficult. But a reasonable assumption would be that the new forms of weapons should replace the old on an average of every five years. This would be a rapid rate of change

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[3]Checking some well-known historical races for the rates of increase: The increase in defense expenditures for eight world powers involved in the extended arms race from 1883 to 1913 averaged about 7 percent annually, but grew to about 14 percent from 1908-1913. The increase of five European powers in military manpower was 2 percent annually from 1884 to 1914, rising to 3 percent from 1908-1914. The expenditure and manpower increases of the four great European powers and the US in the 1930-1938 arms race were greater, but the tempo of this race was probably affected by the demilitarized nature of Germany at the outset and the Spanish Civil War. See Lewis Richardson, Arms and Insecurity (Pittsburgh: The Boxwood Press, 1960), pp. 111-120.

[4]Huntington, Wright, Morgenthau, and Richardson, in the works previously listed, all mention this characteristic.

[5]Huntington, "Arms Races: . . .," pp. 66-72.

compared to pre-World War II arms races, which saw revolutionary changes more at a frequency of about every 10 or 20 years. Indeed, prior to the mid-19th century, changes were made at a pace involving centuries. But the modern rate of technological change has risen dramatically. In a qualitative race, tension and fear do not necessarily rise, because though scientific, military, and industrial personnel are heavily involved, the bulk of the population is not.

An Arms Race? Basic Indicators

Do key variables indicate that there has been a constant quantitative arms race during the 1945-1973 period?

In tracing "peacetime increases" of armaments, we run into a problem during the years of US involvement in the Korean and Vietnam Wars. Some of the increases in these limited war years were intended against Asian enemies, not the Soviet Union. But no matter in what region a state's military forces are deployed, an adversary state probably sees them as a part of the opponent's power that could be shifted against it, at least in part. Let us assume,

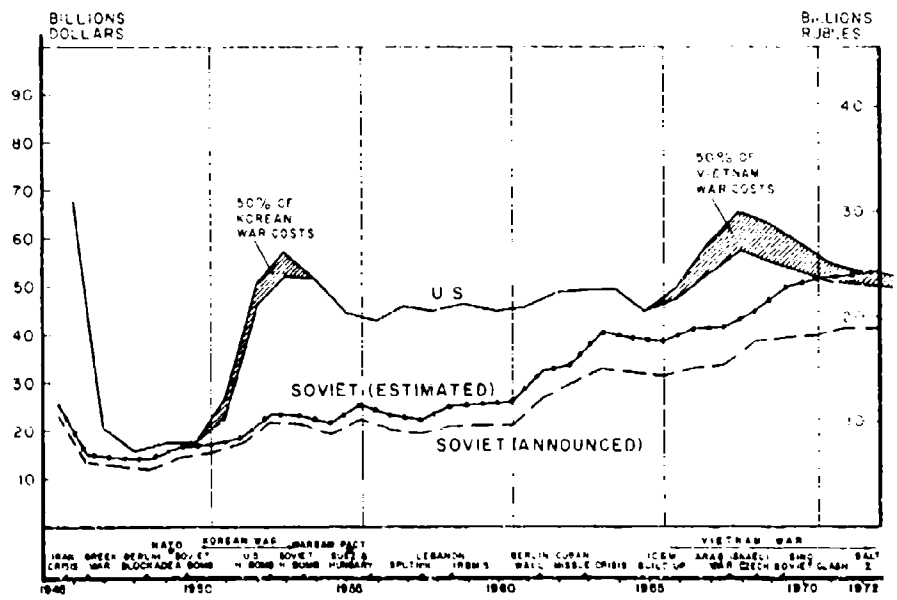

Fig. 1.- US/USSR Defense Expenditures (Constant 1958 Prices).

Sources: US Department of Defense (Comptroller), The Economics of Defense Spending--A Look at the Realities (Washington, D.C., 1972), p. 192. Soviet announced defense and science expenditures are from successive issues of the Soviet Government's annual statistical book, Narodnoe Khozyaistvo SSSR (Moscow: 1957, 1965, 1972), adjusted to constant prices by deflators compiled by Dr. Stanley H. Cohn for US Congress, Joint Economic Committee reports.

therefore, that 50 percent of the extra or incremental US arms for the two wars should be excluded from the total for the US/Soviet race. Since the USSR supplied military equipment to Communist belligerents, this aid should also be excluded.

Figure 1 shows the total budget outlays for defense by the two superpowers in constant dollars and rubles (that is, with inflation considered).[6,7] Both states increased their defense expenditures about threefold in the 25 years following the 1947 postwar low. The 1950-53 buildup is marked, even excluding half of the Korean War incremental costs. Indeed, on the US side, if war costs are excluded, a rough plateau exists after the 1950-53 buildup. The Soviet trend has been more of a steady rise, and it fails to follow US reductions after 1968.

The overall 1947-1973 period would qualify as a race (barely), using the annual 5 percent criterion, for the US averaged about 6 percent annually and the Soviets 5 percent for announced expenditures and 7 percent for estimated.[8]

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[6]These charts are based primarily on defense budgets and omit some defense-related costs such as some funds for stockpiling, atomic and space research, and foreign military assistance; nor do they include veterans' pensions or interest on the national debts incurred from military spending.

[7]The exact totals used for all figures and more information on sources, to include the poll questions used for Figure 8, are available in appendices at the Strategic Research Group, National War College, Washington, D.C.

[8]The broad trends in Soviet expenditures in Figure 1 should be sufficiently valid for our purposes, but the exact actual Soviet expenditures cannot be considered definitely known and cannot be strictly compared with US expenditures. For these reasons, Figure 1 shows both announced and estimated Soviet defense expenditures and shows them in rubles rather than dollars. The estimated figures for the USSR include an additional 8 percent to account for MVD/KGB troops and one-half the science budget to account for hidden military research and development costs. The ruble scale on the charts has been inflated relative to the dollar scale corresponding to a defense-buying ratio of one ruble

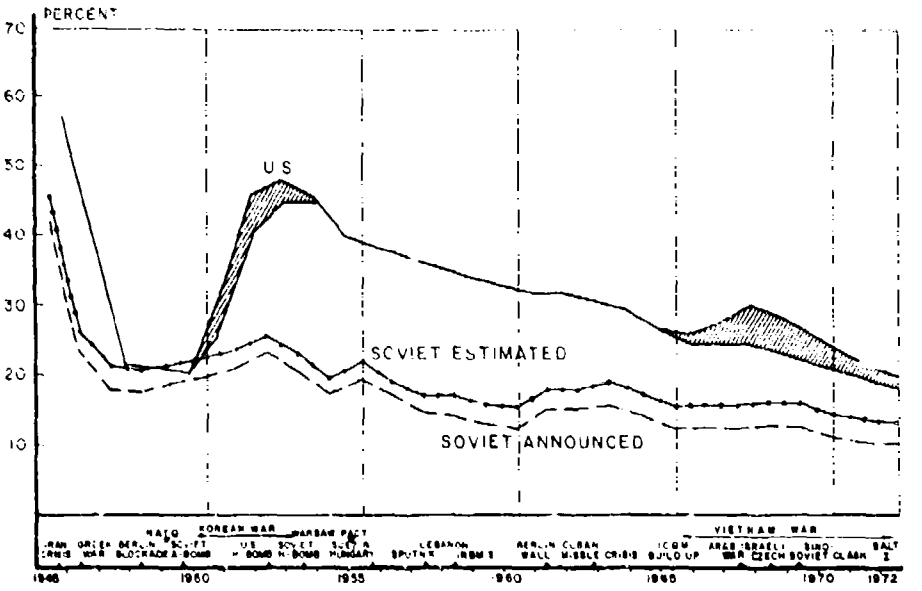

Fig.2.--US/USSR Defense Expenditures As Percent of Public Spending.

US public spending includes estimates for state and local. Soviet figures cannot be strictly compared to the US because of the different economic systems. Sources. See Figure 1; US Bureau of the Census, Historical Statistics of the United States, Colonial Times to 1957, p. 722; US Department of Defense, (Comptroller), op. cit., p. 192.

But the populations, gross national products (GNPs) and governmental budgets have also increased since the early postwar years. When compared as a function of governmental spending (Figure 2) or GNPs (Figure 3), the overall period 1947-1973 does not look like an arms race. Only in FY 1949 and FY 1951-1953 for the US and 1949-1952 and 1961-1970 for the Soviets did the relative national resources devoted to defense show significant increases.[9]

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equals 2.38 dollars recommended by Drs. Emile Benoit and Harold Lubbell. "The World Burden of National Defense," Disarmament and World Economic Interdependence (New York: Columbia University Press, 1967), p. 40.

[9]The figures for GNPs are, of course, only estimates; and it is difficult to validly compare US and Soviet figures. These estimates, however, are sufficient to show trends.

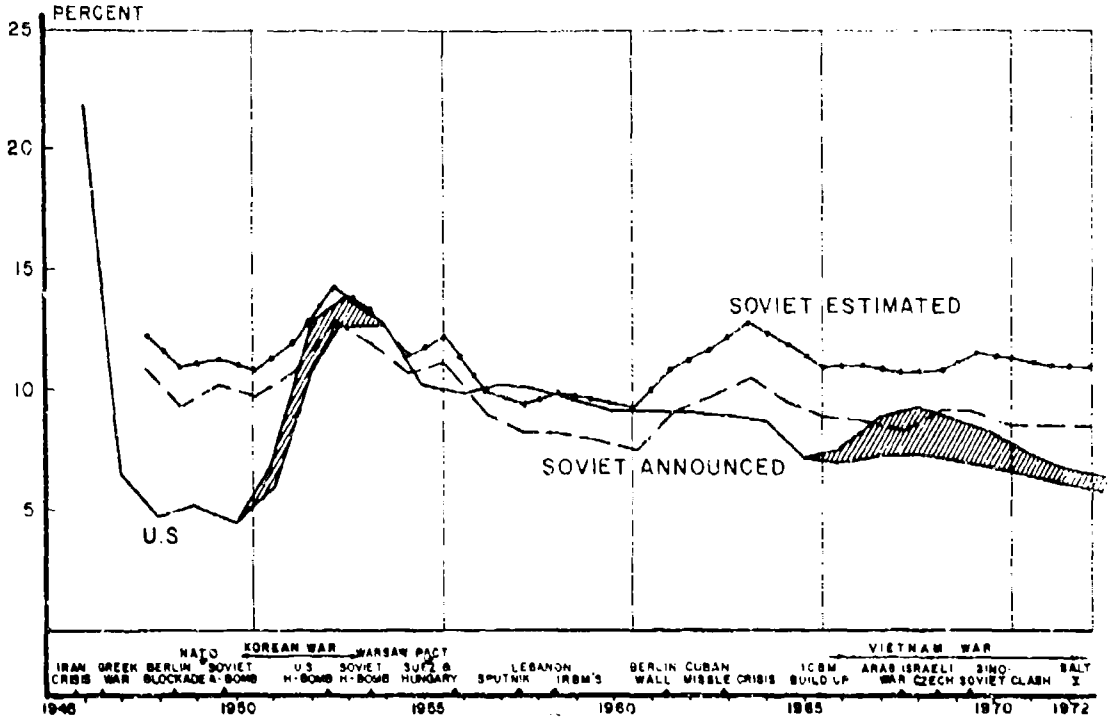

Fig. 3.--US/USSR Defense Expenditures as Percent of GNP.

Sources: US GNP's are from US Council of Economic Advisers, Economic Report of the President, 1973, p. 194. Soviet GNP's are estimates based on factor costs of Dr. Stanley H. Cohn for US Congress Joint Economic Committee reports. If the method of Dr. Abraham Becker is used, Soviet GNP's would be about 10-15 percent higher, with a corresponding lower defense expenditure percent. See his Soviet National Income 1958-1964 (Univ. of California Press, 1969).

Per capita defense expenditures (Figure 4) indicate more of a race, despite the growth in population, though US per capita spending flattened out after the Korean War. However, when we also consider that per capita income has greatly risen, as reflected in GNPs, we must conclude that the relative financial burden of arms on the population after 1953 does not indicate an arms race.

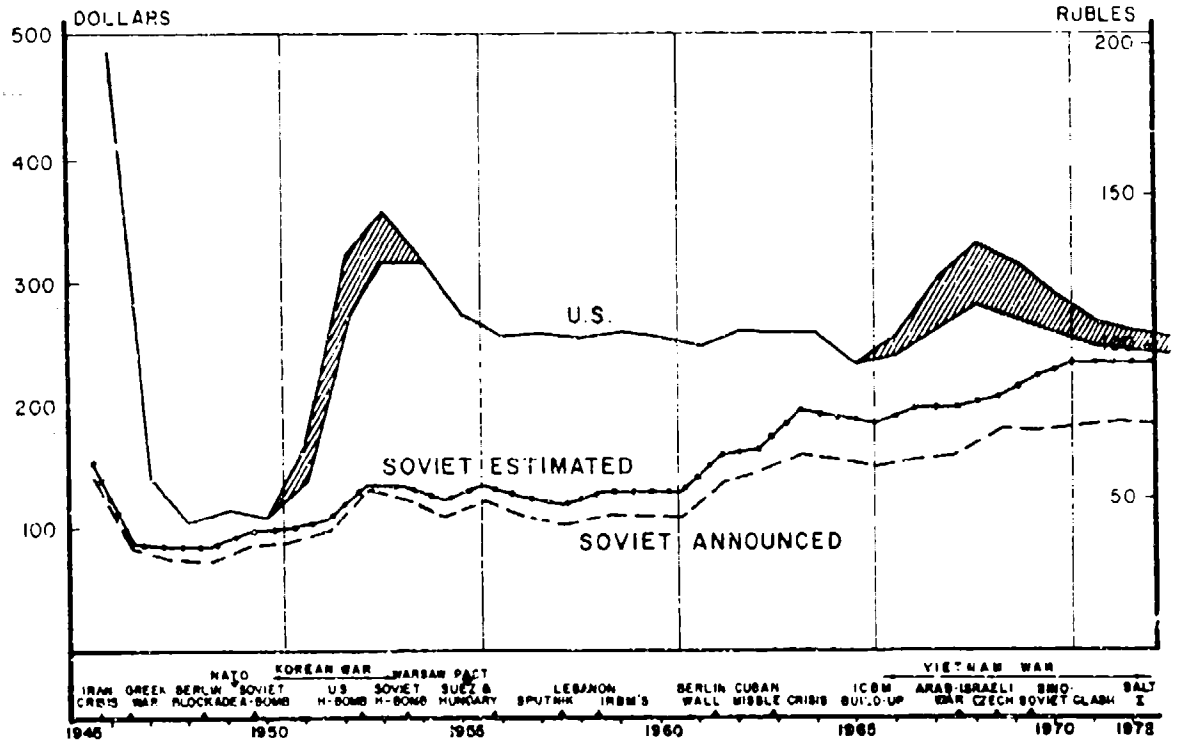

Fig. 4.--US/USSR Per Capita Defense Expenditures (Constant prices 1958=100).

Sources: US population figures are from the US Bureau of the Census. Soviet population figures are from UN Demographic Yearbooks and Narodnoe Khoziaistvo SSSR, 1922-1972.

We should also examine the trends of defense expenditures of the two major alliances led by the superpowers. The expenditures of NATO and the Warsaw Pact are shown in Figure 5.[10] The trends in alliance spending follow those of the two superpowers, and the conclusions regarding the periods in which an arms race occurred would be similar.

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[10] In this case, the defense expenditures have been converted to constant dollars by using the official exchange rates for NATO countries and the exchange rates recommended by Drs. Benoit and Lubbell for the Warsaw Pact in "The World Burden," p. 40. The comparability of the Warsaw Pact data to NATO data can only be considered approximate. However, this does not invalidate the significance of the trends over time.

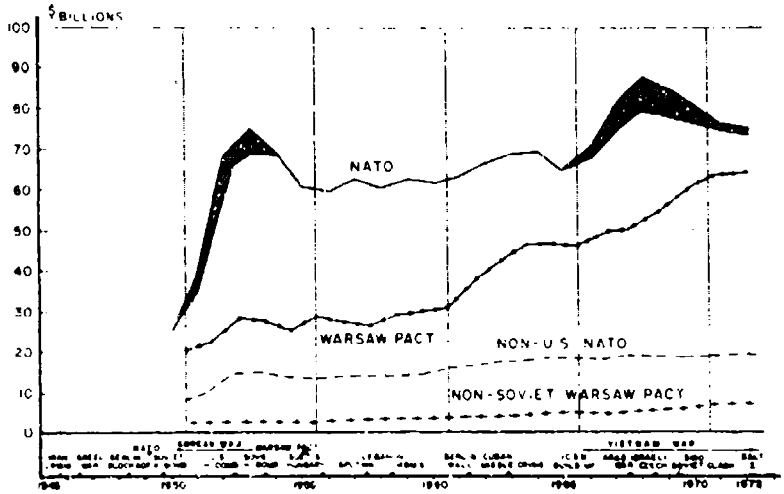

Fig 5 --NATO/Warsaw Pact Defense Expenditures (Constant 1960 Prices).

Sources Estimated Soviet expenditures are used in the Warsaw Pact total. The non-US NATO expenditures and the non-Soviet Warsaw Pact expenditures are from the Stockholm International Peace Research Institute, SIPRI Yearbook, 1972 (New York Humanities Press, 1972), p. 92.

Trends in Military Manpower

Turning to an examination of military forces, Figure 6 shows the total military manpower of the US and the USSR

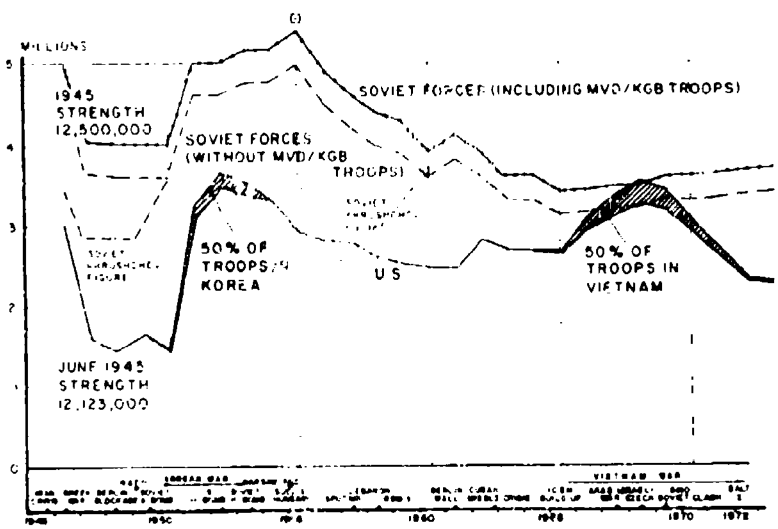

Fig. 6 --US/USSR Total Armed Forces Strength.

Sources: US Department of Defense, Fact Sheet, (March, 1972), The Military Balance, 1972-1973, p. 6, 8, 74, successive issues of US War Department/Department of the Army Intelligence Review, 1945-1960.

during this period. After World War II, the US reduced to a lower level than the Soviets. But if one accepts the Khrushchev-announced 1948 figure, one could not say that the US demobilized while the USSR did not.[11] In Western Europe, Allied ground forces in 1946 dropped from 4.4 million to 880,000, far below the level of the Soviets.

US manpower, after a short-lived spurt in 1948-49, rose during the periods of the Korean War and of "flexible response" in the 1960's. Overall, the US manpower level correlates closely with the level of defense expenditures, except in 1969-72, where it drops more sharply, probably reflecting the higher personnel pay for the volunteer army.

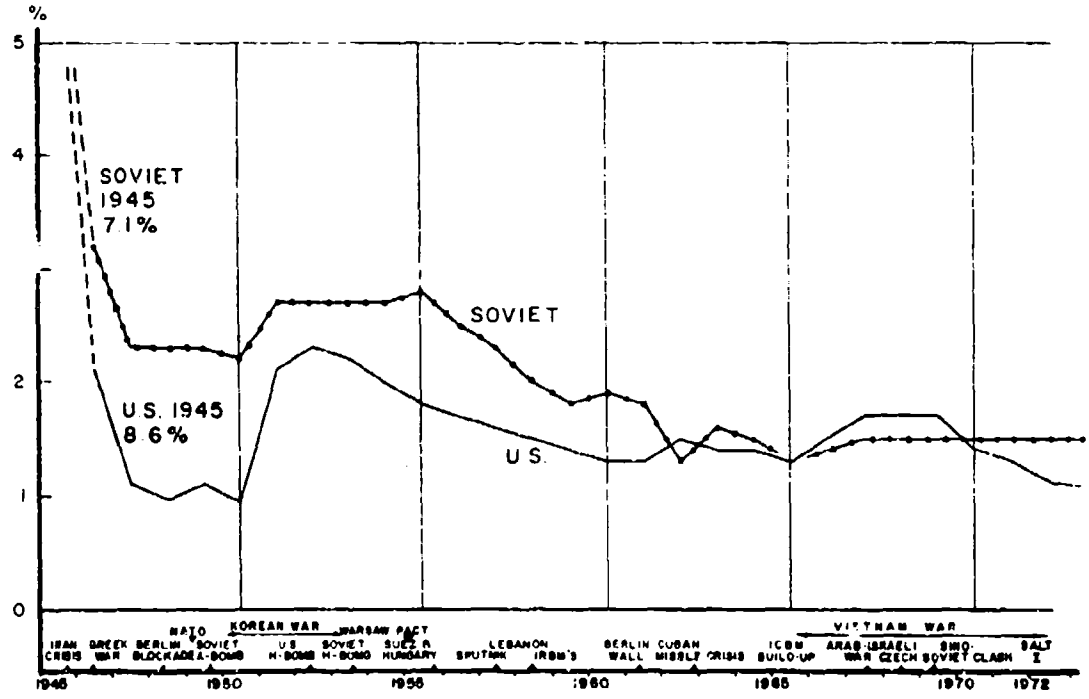

Fig. 7.--U.S./U.S.S.R. Armed Forces as Percent of Population.

Sources: See Figures 4 and 6.

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[11] Khrushchev announced, in a 1960 speech, that the USSR had cut its forces to a figure of 2,874,000 in 1948. This would be about 25 percent of its 1945 forces. Khrushchev's speech is quoted in The New York Times, January 15, 1960, pp 1-2, or in Pravda on the same date.

Soviet military manpower continued to rise for two years after the Korean War. The large Soviet personnel drops in the 1956-59 period saw only moderate decreases in defense spending, and the large boosts in spending in 1961-63 and 1967-69 were not accompanied by major personnel increases. This suggests that the USSR, following the guidelines of Khrushchev's policy of modernization and strong reliance on nuclear rockets, began emphasizing qualitative improvements in technical weaponry after 1955.

Looking at the relative burden of military troops to the populations (Figure 7) indicates that, except for the Korean and Vietnam War periods, the trend has been toward less of a burden of military service on the population.

Fear and Hostility

We have previously assumed that arms races resulted from competition, conflicting purposes, and mutual fear. Few would dispute that the US and the Soviet Union during the period under discussion were competitive and had, for the most part, conflicting purposes. Since a quantitative arms race is accompanied by rising fear, we should examine fear or hostility as another variable indicating when a quantitative arms race occurred.

A measurement of fear and hostility may be obtained from comparing poll results of the American population; unfortunately, similar data is not available for the Soviet population. Though there is no poll throughout the period that uses the same question, by noting the results of polls which used similar questions, we can get an idea of the trend.

Figure 8 shows with line A the percent of Americans from 1945 to 1948 expecting war with the USSR within one year, with line B the percent from 1947 to 1954 expecting war in ten years or less, and line C the percent expecting war in two years or less. The indicators rose sharply during 1946 and 1947, peaked shortly after the Czech coup in 1948, and again after the Berlin blockade. They dropped in 1949, then reached their highest peak after the North Korean invasion of 1950 and the Chinese Communist drive into Korea in winter 1950-51. After 1951, the indications of fear began slowly to recede. Line D shows the percent of Americans who, when polled, expected war within the next five years. It reflects the same Korean War peaks, a further decline in fear in the late 1950's, but a sharp jump-up in 1960 after the U-2 incident and the breakup of the Big Four conference.

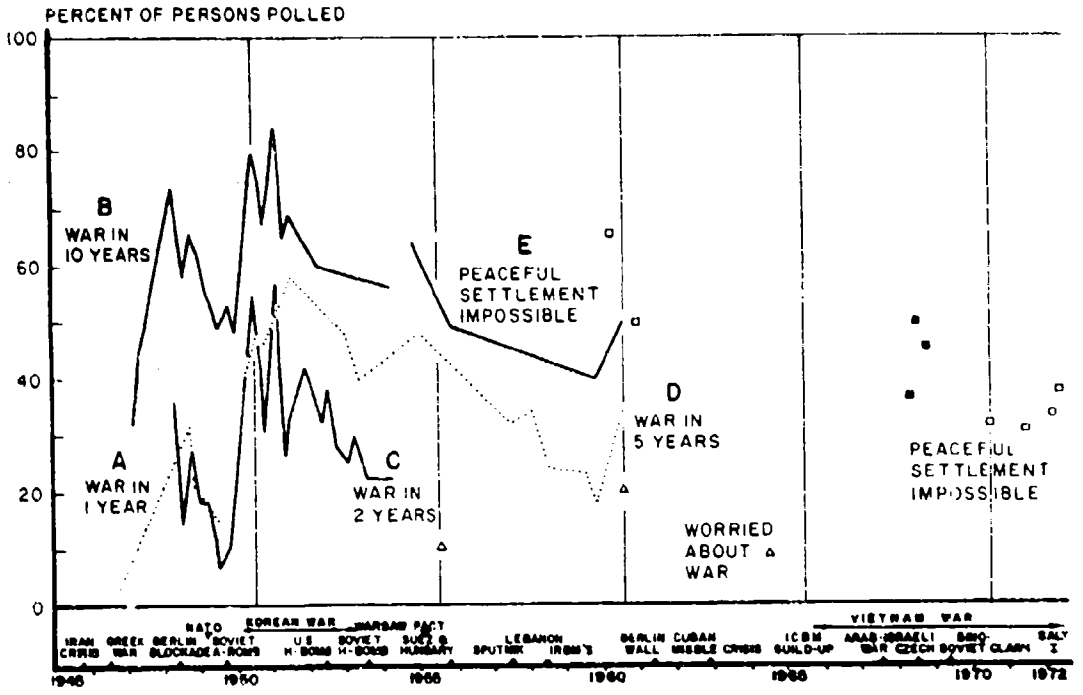

Fig. 8.--Fear/Hostility of the U.S. Population.

Another question asked in the 1954-1960 period, whether there would be war with the Russians sooner or later (line E), points to the same trend. Tracing the trend after 1960 becomes spottier. One indicator is a question asked in 1956, 1960 and 1964 about the chances of the country getting into war. In 1956, 11 percent of Americans were "pretty worried" about it; in 1960, 21 percent were pretty worried about it; but in 1964, only 10 percent were pretty worried about getting into war (triangles on chart).

An indication that fear of war with Russia had, in relation to 1960, lessened in 1970-1972 are the results of a question asked as to whether it was possible or impossible to reach a peaceful settlement with the Russians (squares on chart). The percent of Americans believing that it was impossible was above 50 percent in 1960 but down in the 31-38 percent range in 1970-1972. There was, however, a short-lived jump after the Soviet invasion of Czechoslovakia in 1968, when a similarly-worded question saw the "not possible" percentage jump from 37 percent in July before the invasion to 50 percent by end-August, then down to 45 percent by October.

These trends are reinforced by Gallup's findings as to the opinions of Americans toward the USSR. Only five percent of Americans registered a favorable opinion of the Soviet Union in 1954, but this rose to 17 percent in 1967 and 34 percent in 1973.

Thus, the poll results indicate little fear/hostility in 1945, some rise in 1946, a rapid rise in fear/hostility during 1947-1948, and again in 1950-1951. After the Korean War, there has been a gradual decline, punctuated by a rise in 1960 and short-lived jump in 1968.

This variable, then, would support a thesis that a quantitative race occurred only during the 1947-1953 period or during the 1960-1961 period. However, we previously noted that major increases in defense expenditures and military manpower did not occur in 1947 or early 1948, so the evidence for an arms race in those years is slim.

Results of Basic Indicators

We have then examined the major variables which would point to an overall quantitative arms race: defense expenditures (both absolute and relative), total military manpower (both absolute and relative), and fear. All suggest that an intense US/Soviet quantitative arms race occurred during 1950-1953. Only the hostility/fear index supports the thesis that such a race occurred in 1946-early 1948. The relative defense spending, troop levels and hostility/fear indexes do not support the judgment that such an arms race occurred after 1953. None of these indicate that such a race occurred after 1968, except that Soviet defense spending showed some rise. The absolute defense expenditures and troop levels indicate that the Soviet side of the quantitative race continued until 1955 and that the 1949, 1961-1962 and 1965-1968 years saw quantitative races.

Our finding that in most respects there was no quantitative race in overall armaments after the mid-1950's does not necessarily mean, however, that there have been no arms races of more specific types within the period. There may have been qualitative or quantitative races in single-force components extending into more recent years. "Common knowledge" points to a continuing arms race in strategic nuclear weapons, and the publicity given the "expansion" of the Soviet Navy would point to the possibility of a race in naval arms.

Quantitative Nuclear Trends

Looking first at the strategic nuclear component, what have been the quantitative trends in offensive and defensive forces?

In the field of strategic offensive delivery vehicles, we are concerned primarily with intercontinental bombers and missiles, and the Soviets didn't get in the game until after the mid-1950's. The American buildup of strategic bombers in the late 1940's and through the 1950's is well-known, and the growth in the number of ICBM's and submarine-launched ballistic missiles (SLBM's) in the 1960's has been well-publicized. As a summary, we can total the number of strategic bombers, ICBM's, and SLBM's and note the trends (Figure 9). US levels do not qualify as increases of arms race magnitude after 1963 because it began cutting back in bombers in that year and leveled off its missile deployment in 1967. The Soviet level continued to rise until 1973 because there was little cutback in its small bomber force to offset its increases in missiles. Soviet deployment of land-based ICBM's halted in 1972, but deployment of sub-marine missiles continued.

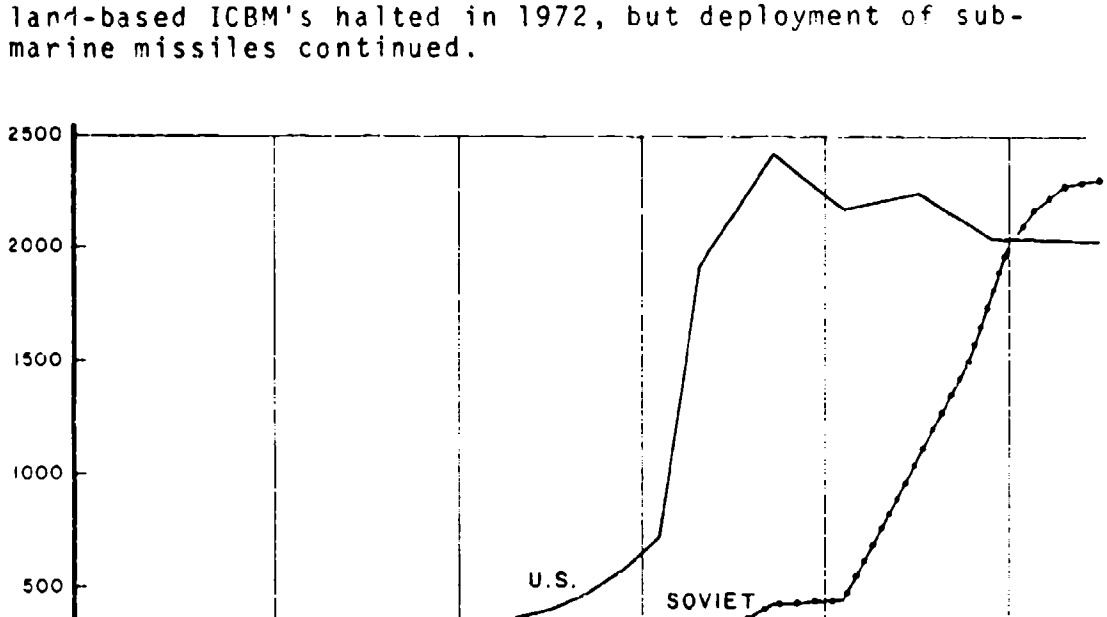

Fig. 9.--Total Intercontinental Delivery Vehicles (Long-range Bombers and Ballistic Missiles)

Sources: US Strategic Air Command, The Development of the Strategic Air Command (Hq SAC, 1972); US Secretary of Defense, FY 73 Posture Report, p. 27; Robert Kilmarx, History of Soviet Air Power (New York: Praeger, 1962), pp. 252-254. Medium-range bombers (less than 6000 nm range) are not included.

The number of deliverable nuclear warheads, however, has continued to increase on the US side. Figure 10 shows the number of warheads that could actually be delivered in one strike by the ballistic missile force and long-range bomber force of both sides--the total force loadings. It does not include multiple reentry vehicles (MRV's), but does include multiple independently targeted reentry vehicles (MIRV's), beginning about 1969.[12] The conversion to Poseidon SLBM's accounts for most of the increase. Similarly, though the number of US strategic bombers has declined, with the deployment of Short-Range Attack Missiles (SRAM's) on B-52's and F-111's, the number of deliverable nuclear bombs has probably risen.

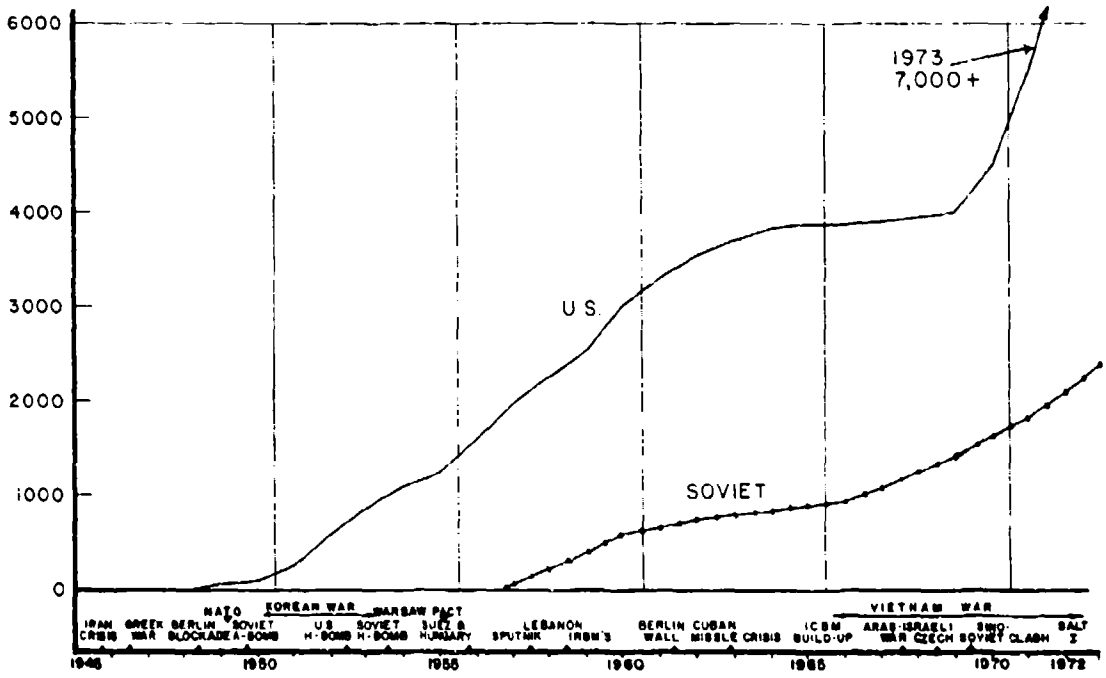

Fig. 10.--US/USSR Total Force Loadings (Long-range Bombers and Missiles)

Sources: 1972 figures are from US Secretary of Defense, Annual Posture Statement, FY 1973. Other figures were computed using the following unclassified approximations: four weapons in Soviet Bison aircraft and two in Bears; four weapons in B-36's, six weapons in B-52's, three warheads per Polaris A-3, and ten warheads per Poseidon missiles.

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[12] It has been estimated by US scientists that when the MIRV programs are complete in several years, the US will have 10,264 separately targetable strategic nuclear weapons

This analysis has not included medium bombers, aerial tankers, MRBM's or IRBM's. Nor has it dwelt on forward-based US systems, of which some 500 could hit portions of the Soviet Union. Medium bombers do not have an intercontinental round-trip delivery radius, but with inflight refueling could make a one-way strike. In the late 1950's, the Strategic Air Command had about 1300 B-47's and B-58's, but now retains only about 70 FB-111's. US aerial tankers numbered over 1,000 in the 1959-1962 period, but have dropped to about 600. Soviet Long-Range Aviation still possesses about 700 medium bombers, but has only about 50 tankers. Both powers developed MRBM's and IRBM's in the late 1950's. The US has phased its out, but the USSR still has about 600, primarily targeted against Western Europe.

Unclassified information on total warheads and megatonnage is scarce. If we included warheads at the delivery sites, in storage areas, and tactical nuclear weapons, US total warheads reportedly rose from several hundreds in 1950 to about 40-50,000 in the 1962-1963 period and has been estimated at 100,000 by 1970.[13] The Soviet output has been smaller, but still has risen at an intense rate.

In megatonnage, the US from 1950 to 1960 raised the explosive power of its nuclear arsenal from about 10 to about 30,000 megatons. After the early 1960's, the US, shifting its emphasis from large bomber-delivered weapons to MIRV's and SRAM's, somewhat reduced its megatonnage.[14]

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and the USSR 6,295. T. W. Rathjens and G. B. Kistinowsky, "The Limitations of Strategic Arms," Scientific American, Vol. 222 (January, 1970), p. 20. On the other hand, if the Soviets replaced their present ICBM's with those recently tested, they could raise their total throw-weight from 6-7 million pounds to 10-12 million pounds. Secretary of Defense James Schlesinger, Annual Defense Department Report, FY 1975.

[13] MIRV's are here considered as a separate warhead, Gordon Dean, Report on the Atom (New York: Alfred A. Knopf, 1957); Herbert York, Race To Oblivion (New York: Simon and Schuster, 1970), p. 33, 41-42; The Stockholm International Peace Research Institute SIPRI Yearbook, 1969-70 (New York: Humanities Press, 1970), p. 380.

[14] York, Race To Oblivion, and Admiral Thomas H. Moorer, USN, "US-USSR Strategic Forces Today," Commander's Digest (US Department of Defense, November 15, 1973).

Data on Soviet nuclear warheads are extremely scarce, but there is reason to believe, in view of the Soviets' rapid increase in missiles, that their total megatonnage has continued to rise to about the US level.

In the area of strategic nuclear defense, the USSR has built up and still retains larger forces in all aspects: air defense, ballistic missile defense, and civil defense.

The USSR maintained over twice the number of air defense aircraft as the US from the late 1940's until about 1968, raising their force from about 1,000 to 2,000 in the late 1948-49 period, then to a high of about 4500 in 1962. In the late 1960's, both sides reduced the numbers of interceptors in their Air Defense Commands, until by 1973 the Soviet force numbered about 2,800 compared to about 560 American, including national guard units. The heavier effort by the Soviets in this field may be seen as the obverse or complement to the US effort in heavy bombers.

Each side deployed air defense missiles in the 1960's and the Soviets continued to build up until by 1971 they had a force of about 10,000 deployed (Figure 11). Both powers also invested heavily in warning and command and control systems. By 1970, the US had spent about $30 billion on a continental air defense system, and the Soviets probably about $75 billion.[15] Deployments of ABM's, of course, have been small.

The USSR has always taken civil defense measures more seriously than the US. During the 1960's, the Soviets increased the construction of shelters and the training in civil defense courses, making such training mandatory in 1968 for school children and factory workers. The US made a small spurt in civil defense in the early Kennedy years but has recently been spending only slightly over $100 million compared to $500-1,000 million by the Soviets.[16]

Military satellites do not in all cases serve a strategic nuclear defensive function, but have been of increasing importance in this field in the past decade. At the

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[15] York, pp. 188-191.

[16] US Department of Defense, Civil Preparedness Agency, Office of the Comptroller; Leon Goure, Civil Defense in the Soviet Union (Berkeley: Univ. of California Press, 1962) and Soviet Civil Defense, 1969-1970 (Coral Gables, Florida: Univ. of Miami, 1971).

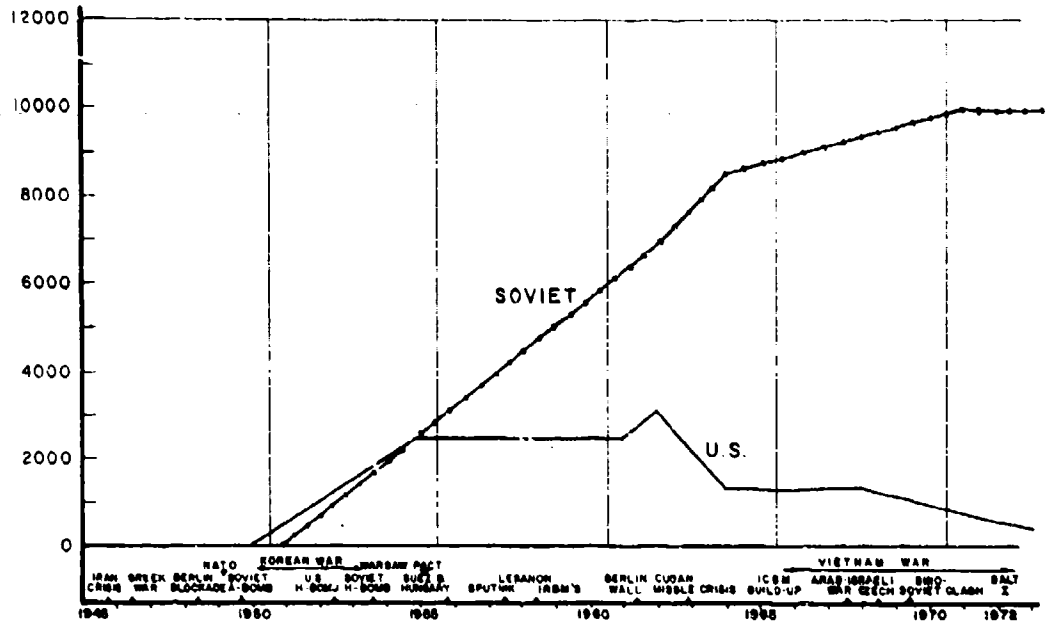

Fig. 11.--US/USSR Air Defense Missiles

Source: US Secretary of Defense, FY 73 Posture Report, p. 43; Admiral Thomas Moorer, op. cit., p. 12. Years prior to 1962 are estimated from data in DOD annual reports.

end of the 1950's, both superpowers began launching satellites for military purposes. The US has built up an array of early warning satellites. The Soviets lagged somewhat behind, but have recently been launching an increasing number.

Have expenditures for strategic nuclear arms shown an increase? US defense budget expenditures for strategic nuclear forces rose during the 1950's, peaked at about $11 billion in FY 1962, then dropped to a level of $7-8 billion from 1965-1973. Figures on Soviet expenditures are not available, but the size of their missile buildup after 1965 would indicate that their outlays for strategic nuclear arms have continued to rise.

Summarizing our observations on the quantitative aspects of US and Soviet strategic nuclear arms: In regard to most indicators--total offensive delivery systems, air defense aircraft and missiles, total megatonnage, and overall expenditures in strategic weapons--the US conducted an arms race buildup till 1962-63, then shifted to a qualitative emphasis except for numbers of deliverable nuclear warheads (reentry vehicles). The Soviets, meeting the American ante to stay in the game, kept up their quantitative drive through 1973 until, in addition to their quantitative superiority in defensive systems, they had achieved a rough parity in offensive systems.

One might then conclude that, except for numbers of deliverable warheads, the US gave up the conduct of a quantitative race; and since the increase in warheads (the progression to MRV's and MIRV's, and to the multiple attack missiles on bombers) to a large extent made most earlier American single-warheaded delivery vehicles obsolescent, that the warhead increase was more a qualitative than a quantitative step.[17] Strictly following our operational definition, we could conclude that since it had become one-sided, the quantitative race ended in the 1960's. But, using another interpretation, since the US is steadily increasing its reentry vehicles and the Soviets are rapidly building ballistic-missiles submarines, one could conclude that a race is continuing in the numbers of nuclear weapons which can hit the adversary's homeland, which is, after all, a key criterion.

Qualitative strategic nuclear improvements

Qualitative improvements in offensive nuclear weapon systems in the 1945-1973 period have been spectacular, both in regards to warheads and delivery vehicles.

Within five years after the explosion of the first crude A-Bombs in 1945, intercontinental B-36's replaced the medium-ranged B-29's. Two years later, hydrogen bombs began to replace the fission bombs, with a jump in explosive force of almost one thousand times. Within another five years, the B-36's were replaced by jet-propelled B-47's and B-52's with air-to-air refueling techniques further extending their ranges. The Soviets responded with the Badger, Bear, and Bison bombers.

Though the development of jet aircraft was a great military breakthrough, the introduction of the nuclear-tipped ICBM was the greatest qualitative advance in the 20th century and perhaps in the history of arms. The liquid-fueled intercontinental ballistic missiles deployed at the end of the 1950's were followed quickly by the storable liquid and solid-fueled ICBM's and SLBM's in the early 1960's. In the late 1960's and early 1970's, the US concentrated on improving the reliability, accuracy, command and control, and penetration ability of their systems.

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[17] Soviet writers see MIRV's as bringing about a qualitative new stage in the nuclear missile race. V. Shestov, "Nuclear Rubicon," International Affairs, No. 6, 1969.

TABLE 1

EVOLUTION OF STRATEGIC NUCLEAR OFFENSIVE FORCES[a]

	United States	Soviet Union
1st Generation Bombers (Fission Bombs)	B-29, B-50, B-36	TU-4 (No intercontinental capability)
1st Generation Bombers (Fusion Bombs)	B-29, B-50, B-36	TU-4 (No intercontinental capability)
2d Generation Bombers (Fusion Bombs)	B-47, B-52, B-58 with Hounddog missiles	TU-16, TU-20 Mya-4
1st Generation Strategic Missiles	Atlas, Titan, Regulus	SS-6, 7 & 8 SS-N-3, 4 & 5
2nd Generation Strategic Missiles	Minuteman I & II Polaris A-1, A-2, A-3 (MRV)	SS-9 Mod 1, 2 & 3 SS-11, SS-13, SS-N-6
3rd Generation Missile and Bomber Systems	Minuteman III (MIRV) Poseidon (MIRV) B-52's with SRAM FB-111 with SRAM	SS-9 Mod 4, SS-X-18 SS-X-17 SS-X-19 SS-X-16 SS-N-8 New ICBM Silos TU-22, TU 16, Mya 4 with stand-off missiles

[a] Missile information is from the US Chairman of the Joint Chiefs of Staff, Posture Statement, FY 73, Chart No. 1, and from Secretary of Defense Schlesinger's Annual Defense Department Report, FY 1975. US aircraft information is from the Strategic Air Command's The Development of SAC (Hqs. SAC, 1972).

Table 1 summarizes some of the major phases in the qualitative development of strategic delivery systems. The Soviets have lagged behind their US counterparts, but steadily gained ground. The striking point is that there have been six revolutionary changes in strategic offensive systems in 28 years!

Qualitative improvements in strategic defensive systems progressed markedly during much of the period but slower than offensive systems in the later years. Air defense interceptors, of course, were constantly improved, particularly in the 1950's. with many models obsolescent before they could be produced and deployed. Perhaps even more revolutionary were the introduction of air defense missiles in the 1950's and the new systems of air defense warning and detection.

Steady technological developments were made in ABM technology. The Americans developed three successive ABM systems prior to the SAFEGUARD, but did not deploy them. The Soviets may not have developed as many systems, but were the first to deploy ABM missiles. In recent years, the technological research and testing of improved ABM missiles has continued.

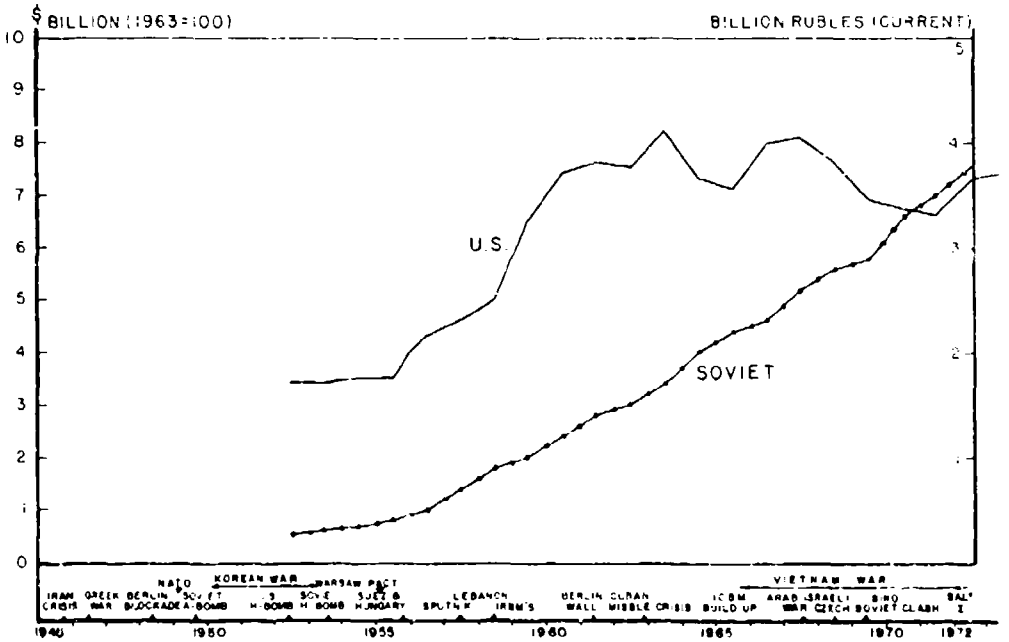

Fig. 12.--US/Soviet Military R&D Expenditures (Constant 1963 Prices)

See footnote 16; National Science Foundation, National Patterns of R&D Resources, Funds and Manpower in the US, 1953-1979 (Washington: NSF, 1969); SIPRI Yearbook, 1972, pp. 222-23.

The emphasis on research and development by the two powers, as shown by military R&D expenditures, is another indicator as to the extent that the arms competition has been qualitative. In making such a comparison (Figure 12), we cannot be sure of Soviet military R&D expenditures, but their announced expenditures for science give a general idea of the trend.[18] Soviet investments in the field have taken a steady climb, with no tapering off, as in the case of the US in the later years of the period. As a percent of total defense expenditures, Soviet R&D has steadily increased, whereas the US leveled off after the 1956-60 spurt.

Summarizing our findings on strategic nuclear weapons: There have been progressive qualitative increases at the required rate and therefore a sustained qualitative arms race in this field. On balance, it appears that a race in strategic nuclear weapons occurred with both quantitative and qualitative features; but in the later portion of the period, it became predominantly qualitative, at least on the US side, though the MIRV/SRAM developments also have a quantitative aspect.

Competition in General Purpose Forces

While the race focused on strategic nuclear weapons, there were also important strands of the arms race in tactical nuclear weapons and general purpose force components. Space does not permit a detailed analysis here; these forces are covered in detail by another study of the author.[19] But some of the important points should be mentioned.

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[18] In our study, the Soviet trend is portrayed by 50 percent of the All-Union Science budget category, which should be valid to show the trend but not as a comparison with US military R&D, according to the study issued by the US comptroller General, "Comparison of Military Research and Development Expenditures of the US and the Soviet Union," Part II--Declassified version (Washington, D.C.: GAO, January 31, 1972). R&D expenditures, of course, are used for both strategic nuclear and nonnuclear arms.

[19] Colonel Richard M. Jennings, "US/Soviet Arms, 1945-1973: Questions of Cycles, Symmetry, and Balance," (Washington, D.C.: The National War College, 1974).

General purpose force levels generally followed those shown for total military forces in Figure 5. Notable exceptions are that the air forces began building up prior to the Korean War (in 1948) and aircraft and navy ships continued to increase through 1955. A quantitative naval race occurred in the early 1950's, but the naval competition in recent years has been qualitative and geographic. From 1955-1960, the Soviets made cuts in the numbers of nonnuclear ground, air and naval forces and embarked on a more qualitative program.

From the qualitative standpoint, the pace of the general purpose race has been almost as intense as that in strategic nuclear weapons in types of arms of relatively new technology. This would include tactical nuclear weapons, guided missiles, aircraft, and electronic devices. In the older types of weapons, such as small arms, tanks, cannon, and surface ships, the rate of development has been faster than in previous peacetime periods, but slower than in the more newly-discovered arms types.

Conclusions and Implications

The analysis has indicated, if Western estimates of Soviet arms are roughly correct, and the operational definitions and variables chosen accurately represent reality, that the US and the Soviet Union carried on an arms race during much of the time since World War II, but in many periods it has not progressed rapidly. A quantitative race occurred during 1949-53 and possibly 1961-68, but not during 1945-48,or 1955-60, and since 1968 it has been largely one-sided. Indeed, from the standpoint of the more traditional concept of an arms race, a race took place only during the first period mentioned. The quantitative US/Soviet race gives the appearance of having stopped, except in numbers of deliverable nuclear warheads.

Overall, the race became progressively more qualitative, focusing on strategic nuclear weapons, but there have also been quantitative aspects in the nuclear arms race, and qualitative aspects in the competition in general purpose forces. The race has been characterized by the fulfillment of the Soviet challenge to American nuclear superiority. Overall, but particularly on the Soviet side, there has been a trend toward a higher ratio of machines and firepower to men.

The analysis supports the judgment that an arms race contains both quantitative and qualitative features. There is no pure genus of either type. The question thus centers on the predominating characteristic, and in the current US/Soviet case, this has become the qualitative.

Despite the Soviet drive in science, technology, and strategic nuclear forces, the Americans have retained the qualitative lead. At times, it appears that the USSR has tried to balance a qualitative deficit with a quantitative measure, which may be a normal feature of arms races not previously noted.

The trend toward a predominately qualitative race has been accompanied by a more stable equilibrium between the US and the USSR and the establishment of a new military power ratio between the two superpowers. A condition of rough nuclear parity was accepted by the US at the same time that East-West agreements implicitly ratified the post-World War II boundaries in Central and Eastern Europe. Though US/Soviet relations were far from a full detente, the evidence of cooperation in limited fields, reinforced by this study's evidence on the hostility/fear of the US population, indicates that tensions, though temporarily sparked by incidents as the invasion of Czechoslovakia and the 1973 Arab/Israeli War, have tended to subside. Thus, the evidence tends to undermine the old axiom that all arms races lead to war and to support Huntington's 1958 hypothesis that a qualitative race which sees the replacement of older systems by new contributes to arms parity, a balance of power, and stability.

Support of the latter must remain qualified, however, for other factors may have caused Soviet policies to be less bellicose, including the need to concentrate power on the Sino/Soviet border[20] and the influence of strategic nuclear vulnerability. The mutual nuclear vulnerability which obtained in the latter portion of the period tended to make the actions of both superpowers more cautious and general war less likely.

The judgment that the quantitative arms race, in most respects, ended in the late 1960's must remain tentative, as it was tied to arbitrary, though reasonable, definitions.

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[20] For a detailed discussion of the Chinese element in the US/Soviet arms relationship, see the author's National War College study, "The Tripolar Arms Race." (Washington, D.C.: 1974). Soviet views of the Moscow-Peking-Washington power triangle is given in A. A. Topornin, "The Balance of Power Doctrine and Washington," USA, No. 11, 1970; V. P. Lukin, "American-Chinese Relations: Concept and Reality," USA, No. 2, February, 1973, Current Digest of the Soviet Press, Vol. XXV, No. 11.

Arms levels are dynamic, sometimes remaining temporarily at plateaus before pushing on to new increases. This could be a plateau similar to the one that existed between 1955 and 1960. Much depends on Soviet and US actions in the next few years, the results of the SALT II and MBFR negotiations, and future PRC foreign and defense policy.

Implications for defense policy

If we accept the proposition that predominately qualitative arms races are less likely to end in war than quantitative ones, then the present US policy on strategic nuclear delivery systems appears wise, if the Soviets do not try for numerical superiority. There is no guarantee that they will not.

The race has reached the point where both powers must soon reassess their goals and strategies. For the challenger, having achieved a rough though asymmetrical numerical parity, the question is how hard to try for superiority. There is little question but that the Soviets will continue to try to eliminate the gap in quality; indeed, it has pushed ahead with the testing of MIRV's and new missiles. For the challenged state, which for various reasons has accepted parity under a policy of sufficiency, the question is how to respond to the challenge, and how to define "sufficiency" under changing conditions.

There are reasons why the Soviets, after the fulfillment of the SAL I level of SLBM's, may concentrate on qualitative improvements such as MIRV's. To continue a quantitative race plus the qualitative one, plus the arms concentration on the NATO and Chinese borders, would probably preclude faster progress in the Soviet economy and standard of living. Also, Soviet arms policy has tended in some ways to emulate that of the US, and might, if doctrinal and bureaucratic factors do not override, move towards a "sufficiency" standard, which Khrushchev appears to have used during part of his regime.

Most elements in the current situation applying to both superpowers would seem to work against the resumption of the quantitative race. The lessened bipolarity of the international system, primarily the opportunity to use the PRC as an external balancer of power, should have such an effect. The increased concern of the superpowers for domestic problems and the apparent lessening of their drives toward worldwide goals are also tending to reduce conflict. The US appears to have largely abandoned the Wilsonian-type goal of a world composed of democratic states on the US model. To what extent

the USSR has changed its goal of shaping the world into a system of Russian-dominated socialist states working toward communism remains debatable, but it is significant that Soviet leaders have moderated the means to that end. The Nixon/Kissinger "Structure of Peace" is based on the premise that the major powers will accept less universalistic national objectives because the gains from aggressive military actions appear not to be worth the costs. The overhanging spectre of mutual nuclear vulnerability, and the ambivalence of third-party action within the US/Soviet/PRC triangle should serve to strengthen the forces of moderation. The high costs of new weapons systems are another factor bearing against quantitative increases. Finally, looking at the thousands of offensive nuclear weapons now deliverable in one strike, the question increasingly becomes to what extent further numerical increases add to political power.

Some forces will continue to favor a quantitative race. The dynamics of "the security dilemma" (one state's security is another state's threat) will continue to exert influence. The quantitative aspect of MIRV's has a destabilizing effect. A school of thought in each country will argue, not without some reason, that higher levels would bring more prestige, power, and political clout. There is a natural tendency to overestimate the forces of the adversary and by seeking apparent "parity" or "sufficiency" to initiate a new round in the race. This tendency was heightened in the past because the Soviet adversary kept his arms levels secret. The growth of nuclear capability in the PRC or other countries presently without nuclear weapons might cause the two superpowers to expand their ballistic missile defenses. But these factors in the near future do not appear as strong as those working against the resumption of the quantitative race.

What may result is a level of tension somewhere between cold war and detente accompanied by a continuing level of armaments, high in an absolute and budgetary sense and in technological change, but not in relative burden to the US population. Within this fairly stable equilibrium of military power, the main competition may take place between the US and Communist societies, with emphasis on the economic, social, and psychological planes.

US/Soviet arms competition may complete the move, after modest quantitative reductions reflecting the SALT II and MBFR negotiations, and on the American side the limitations in size dictated by the concept of volunteer forces, to a level of "normal military activity" in the sense described

by Quincy Wright.[21] "Normal military activity" in an environment of explosive technological change and superpower rivalry by nature probably includes a qualitative arms race.

Considering the pace of technical development, a qualitative arms race may be inevitable for a great power that chooses not to lapse into technological inferiority. Scientific breakthroughs will continue and will touch off new phases in the contest. Within the qualitative race, quantitative sub-races will occur after every new revolutionary weapons development, as each side attempts to beat the other in creating a superior force in the new arm.

Arms agreements cannot be expected to control the qualitative race because they normally are successful only against quantitative aspects of arms competition. Qualitative arms agreements are difficult to verify and cannot include unforeseen new weapons. Agreements can, however, help control the pace of the quantitative sub-races. Some limited qualitative agreements may occur, primarily because of the Soviet need to constrain US technical progress, but these would merely divert the race to other qualitative areas. As in the economic theory of oligopoly, the competitors may make explicit or implicit agreements to dampen the race, but such "holidays" usually last only until the next revolutionary technological or political event takes place.

What then should be the guidelines for American defense policy in such a race?

The situation is not as gloomy as one might think. The Soviet Union, with smaller allies and requirements to maintain forces both in Europe and in the Far East, will be in the less favorable economic position for the long run. The US has the further advantages of being the richer contestant, with a lead in technology. Against these factors, the US needs to find a way to reduce the disparity between US and Soviet manpower costs. Further, the Soviet Union, by virtue of its autocratic political system, can, to a certain extent, better maintain a priority for arms spending. So in terms of <u>defense-usable</u> financial capacity, the Soviets are not as far below the US as a comparison of GNP's would indicate. But while US society has always been oriented toward civilian

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[21] One could, of course, judge that the activity since the Korean War NATO/Warsaw Pact buildups in the early 1950's was the normal military activity of a bipolar rivalry, and that we are dropping to a lower level that reflects new power relationships.

goods, most sources predict a growing demand for consumer goods among Soviet citizens.[22]

The production of high quality military items may be a growing burden to the USSR. The military establishment now takes a larger share of the country's machinery, machine tools, and electronic output than in America. In the case of defense products, quality control is assured by military officers at the plants, with the result that such products are normally of higher quality than those destined for civilian consumption. These factors might seem at first to weigh in the Soviets' favor, but not in a period of growing civilian demand for quality products. Soviet leaders may face the choices of continuing to devote high-quality technology to the military to the neglect of the civilian sector, shifting some priority to civilian products and accepting a slower pace of arms development, or expanding the overall qualitative production of its industry by obtaining the assistance of foreign technology (read detente).

Such an interpretation is, of course, speculative and does not mean that the future situation will not include risks nor that America can relax. If the Soviets do not improve civilian goods production (and we have little evidence yet of major shifts in this direction though the Ninth Five-Year Plan proposes limited changes), they could probably continue the recent rate of arms competition indefinitely. They have announced continued emphasis in the future on scientific research and technological improvements. On the political side (and the political relationships really govern the arms activity), US/Soviet relations could rapidly worsen, or Sino/Soviet detente or major shifts in the Western coalition could quickly turn the balance of power to the disfavor of the US. Nor would it seem that the US can make further large-scale unilateral reductions in its general purpose forces; qualitatively high forces lacking in number not only might be insufficient to back up diplomacy but would run the risk of being overwhelmed at the outbreak of war, similar to American forces initially in Korea. And, of course, the chance will exist that the adversary will make major technological breakthroughs altering the power ratio.

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[22] This judgment and the comments on the Soviet economy in the following paragraph reflect the opinions of economic experts in the US Congress, Joint Economic Committee, 93d Congress, 1st session, compendium, Soviet Economic Prospects for the Seventies (Washington, D.C.: US Government Printing Office, 1973).

Technology will always threaten to upset the balance, though the state of mutual nuclear vulnerability based, particularly on the US side, on a myriad of weapons systems should reduce the likelihood of dangerous, destabilizing breakthroughs in offensive nuclear systems.

These points indicate that the US must give high priority to a strong military research and development program to retain its lead in technology for both nuclear and general purpose forces. Such a program cannot neglect basic research, a main source of radically new ideas. Further, in economic and scientific cooperation with the Soviets, the dangers of indirectly giving technical assistance to their arms effort should continue to be weighed in the equation with the apparent social, psychological, and political advantages of detente. Americans should not forget that the nation with superior technology will either make the breakthroughs or be able to rapidly reduce any technological weapons advantage of the opponent. Moreover, when it feels quantitatively pushed, that nation usually has the option of introducing a superior system.

The US should not eschew the implementation of revolutionary new programs. The cases of the hydrogen bomb, nuclear-powered submarines, and MIRV's all indicate that if the state making the technological breakthrough hadn't implemented its program first, the adversary state probably would have soon done so. This does not necessarily mean that all innovations must be deployed at the fastest rate money can buy.

The main policy question in a qualitative race becomes not merely "how much is enough?", but "how fast should we go ahead?" In situations where the existing US systems are superior to the adversary, the pace of introduction of the new technology can be more deliberate. Cases in point are the Trident submarine system and the B-1 bomber. An eye can be kept on the adversary's developments in the field, and programs can be accelerated or decelerated as appropriate. In situations where the adversary jumps ahead in a critical weapons area, the pace of technological development and deployment must be on more of an "all-out" basis. The most favorable time for deploying a revolutionary new system may well be when the adversary has just completed a massive buildup in the old.

In addition to the importance of technological innovation in a qualitative contest, the long-term winner may well

be the one who best adapts strategy to new forms of force and who most successfully identifies and phases out obsolescent and redundant arms systems. We should carefully assess, for example, the impact of such current developments as nuclear submarines, aircraft and missiles of greater range and effectiveness, satellite detection and communications, and MIRV's. In the face of vast offensive firepower, the vulnerability of systems becomes a prime criterion. Have we fully applied the meaning of these changes to elements of our defense posture such as overseas bases and surface warships? Should not the exponential increase in nuclear reentry vehicles have some effect on our older, less effective delivery systems? And what will be the strategic impact of future developments such as laser weapons? If old forms of force are kept after the new are introduced, the quantitative feature (plus heavier burdens) rejoins the race.

A qualitative arms race will be easier on the nerves of the population than a quantitative one, but not necessarily on the nerves of the nation's elite. The requirement on defense leaders, scientists, and industrialists to prevent the adversary from gaining an advantage will be unceasing. For example, in the nuclear race, as the accuracy and quantity of offensive warheads increase, defense leaders must constantly worry about the survivability of land-based ICBM's. The possibilities of developing a cheap and totally effective ballistic missile defense or ASW measures capable of neutralizing nuclear submarines will continue to threaten to destabilize the balance.

US defense officials thus face a difficult but not impossible task. The future competition calls for a professional program, based not on myth or obsolete shibboleths, but on continuing research, analysis, and good management. They must convince the public that we are not conducting a mad arms race with increasing burden on the individual. But under the foreseeable conditions of the international system, US security will require steady effort, intellectual perspicacity, and substantial defense budgets.