

AD-A034 809

GENERAL RESEARCH CORP MCLEAN VA OPERATIONS ANALYSIS DIV F/G 5/4
QUALITATIVE CONSTRAINTS ON CONVENTIONAL ARMAMENTS. VOLUME I. SU--ETC(U)
JUL 76 R A GESSERT, W W COVER

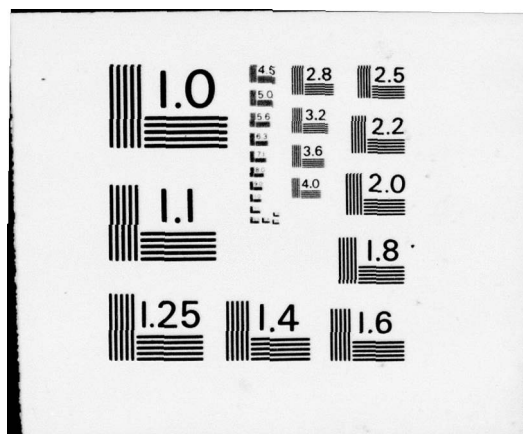
UNCLASSIFIED

ACDA/MEA-248-VOL-1

NL

1 OF 1
ADA034809





ADA034809

July 1976



B.S.

Qualitative Constraints on Conventional Armaments

Volume I - Summary

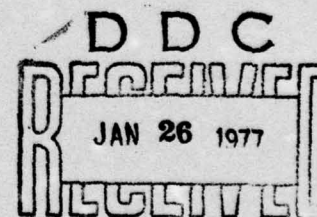
Vol 2 A034814

ACDA/MEA-248

PREPARED FOR
U.S. ARMS CONTROL AND DISARMAMENT AGENCY

PREPARED BY

GENERAL RESEARCH  **CORPORATION**
OPERATIONS ANALYSIS DIVISION
WESTGATE RESEARCH PARK, MCLEAN, VIRGINIA 22101



DISTRIBUTION STATEMENT A

Approved for public release;
Distribution Unlimited

The analysis, findings, and conclusions of this report do not necessarily represent the views of the United States Arms Control and Disarmament Agency or any other Agency of the United States Government.

V2814

11 July 1976

12 42p.

6

Qualitative Constraints on Conventional Armaments

Volume I Summary

19

18

ACDA/MEA-248-Vol-1

by


10

Robert A. Gessert, Project Chairman
William W. Cover

PREPARED FOR

U.S. ARMS CONTROL AND DISARMAMENT AGENCY

PREPARED BY

GENERAL RESEARCH  **CORPORATION**
OPERATIONS ANALYSIS DIVISION
WESTGATE RESEARCH PARK, McLEAN, VIRGINIA 22101

ACCESSION for	
NTIS	Wallo Section <input checked="" type="checkbox"/>
DDC	Buff Section <input type="checkbox"/>
UNCLASSIFIED	<input type="checkbox"/>
JUS/PROTON	
<i>letter on file</i>	
BY	
DISTRIBUTION/AVAILABILITY GROUP	
Dist.	AVAIL. and/or SPECIAL
A	

390 551
bpg

ABSTRACT

△ This study is an investigation of the desirability and feasibility of placing qualitative constraints on conventional arms competitions by means of negotiated arms control agreements. Using an inductive and empirical approach, the study develops a conceptual structure for determining whether US arms control policy should pursue such constraints in particular situations. Past experience in arms control and the principal issues involved are surveyed with attention to qualitative aspects, and the evidence of the present importance of and motivations for qualitative weapon improvement is reviewed, adducing examples in five areas of arms competition. The utility of qualitative constraints is discussed in terms of identifiable objectives; feasibility conditions are indicated and the basic forms of control are specified and analyzed. Possible types of agreement embodying desirable and feasible constraints are examined and illustrated by four candidate agreements in major areas of arms competition. Conclusions are presented indicating the circumstances under which qualitative constraints would be both desirable and feasible.

△

PREFACE

Recent arms control negotiations have emphasized constraints on nuclear armaments and forces and, when they have dealt with conventional armaments, have tended to focus on quantitative limitations. With rapid advances in technology, increased ability to pay for modern weapons in areas such as the Middle East, and increased availability of modern weapons for export, several conventional arms competitions have taken on distinct qualitative dimensions as well as quantitative ones. The US Arms Control and Disarmament Agency therefore requested this study to (1) review past attempts to negotiate qualitative constraints as well as quantitative; (2) examine evidence of particularly intense qualitative competition and the apparent motivations for qualitative weapons improvements; (3) investigate feasible forms of control over qualitative weapons improvements; and (4) assess US security interests in supporting or promoting qualitative constraints in areas such as the NATO-Warsaw Pact balance, the Middle East, the Indian Ocean, and Latin America.

The report is published in two volumes. Volume I, the Summary, is a condensation of the Main Report, contained in Volume II. Volume II also includes supporting appendices. References to documentary sources are omitted from the Summary. Complete documentation is provided in the Main Report and its appendices.

The authors are indebted to LTC William Staples of the Military Affairs Bureau (formerly, the Military and Economic Affairs Bureau) of ACDA for his patience, support, and wise counsel in the conduct of this study and to Dr. Wolfgang Klaiber and Dr. Robert Harkavy for their careful reading of the draft report and their many useful suggestions for revision, correction, and expansion of sections of the Report.

This report could not have been completed without the tireless and skillful work of Mrs. Agnes K. Bedell and Mrs. Peggy H. MacDonald whose typing and retyping of the manuscript deserve special appreciation.

CONTENTS

ABSTRACT	ii
PREFACE	iii
ABBREVIATIONS	vi
PURPOSE AND SCOPE	1
BACKGROUND	1
DEFINITIONS AND LIMITATIONS	2
Conventional Armaments	2
Qualitative Improvements	2
Qualitative Constraints	3
Desirability and Feasibility	3
APPROACH TO THE PROBLEM	3
THE HISTORICAL SETTING: DOMINANT ISSUES	4
Pre-World War I Experience	5
Inter-War Experience, 1919-1939	6
Post World War II Experience	7
Guidance from the Past	11
THE IMPORTANCE OF QUALITATIVE IMPROVEMENTS IN CONVENTIONAL ARMAMENTS	11
Motivations for Qualitative Improvements	12
Costs Associated with Qualitative Improvements	15
Competition in Qualitative Improvements	16
<u>US/USSR Competition</u>	17
<u>NATO/Warsaw Pact Competition</u>	17
<u>Middle East Competition</u>	18
<u>Latin American Competition</u>	19
<u>Indian Ocean Competition</u>	20
Some Tentative Hypotheses	21

ACDA/MEA-248 I

THE POTENTIAL UTILITY OF QUALITATIVE CONSTRAINTS	21
Preconditions for Negotiation	22
Objectives of Qualitative Constraint	22
Implementation, Verification, and Enforcement	26
FORMS OF CONTROL	26
Military Expenditures	27
Research, Development, Test and Evaluation (RDT&E)	27
Production	28
Procurement and Distribution	29
Arms Use	30
Arms Transfers	30
TYPES OF AGREEMENT	31
CONCLUSIONS	31

ABBREVIATIONS

ABM	anti-ballistic missile
CCD	Conference of the Committee on Disarmament
ENDC	Eighteen Nation Disarmament Committee
GCD	general and complete disarmament
ICRC	International Committee of the Red Cross
LOC	line(s) of communication
MBFR	mutual and balanced force reduction(s)
MBT	main battle tank
NATO	North Atlantic Treaty Organization
PGM	precision guided munition
PRC	Peoples Republic of China
QRA	quick reaction alert
R&D	research and development
RDTE	research, development, test and evaluation
SALT	strategic arms limitation talks
T&E	test and evaluation

SUMMARY

PURPOSE AND SCOPE

The purpose of this study is to investigate the desirability and feasibility of placing qualitative constraints on conventional arms competitions by means of arms control agreements.

The study is exploratory and conceptual. It does not assume that qualitative constraints are either desirable or feasible in general or in any particular arms competition. Rather, it identifies and examines the range and types of considerations and problems associated with assessing or judging the desirability and feasibility of any qualitative constraint on conventional armaments. In short, it seeks to structure the problem of determining whether US arms control policy should consider and pursue qualitative as well as quantitative constraints on particular conventional arms competitions.

BACKGROUND

It is frequently argued that arms competition, or "the arms race," in the technological era has become more qualitative than quantitative. There are three principal reasons adduced for this: first, there apparently are some inherent limits on the sizes of military forces that nations are willing or able to afford; second, advanced technology appears to be able to provide significant improvements in armaments almost without evident limit; and, third, there are obvious military advantages in being able to field forces with weapons that are superior in firepower, flexibility of employment, and sustainability to those of an opponent.

Qualitative competition in strategic nuclear forces — which have received relatively more emphasis in arms control policy and negotiations than tactical nuclear forces and conventional forces — has long been acknowledged in arms control studies and planning. In the area of conventional forces, arms control studies and policy have focused almost entirely on quantitative limitations on manpower, force units, and major armaments, as in the general and complete disarmament (GCD) proposals of the early sixties and in the mutual and balanced force reduction (MBFR) negotiations of the seventies. Qualitative improvements and qualitative competition in conventional armaments have been recognized to exist, especially in recent years since the high-intensity October War of 1973 and the Vietnam War, which saw the introduction of many new technological devices. However, there are greater analytical difficulties in assessing how these affect conventional military balances and stability than in assessing the impact of qualitative improvements in strategic forces.

Whether and how qualitative improvements and qualitative competition in conventional armaments should (desirability) and could (feasibility) be constrained are the subjects of this study.

DEFINITIONS AND LIMITATIONS

How several key terms are defined and delineated establishes the general structure and limitations of the analysis. Working definitions were provided in the terms of reference for the study and adjusted and modified throughout. Sometimes the working definitions were expanded to avoid constricting the analysis; at other times they were contracted to avoid semantic bogs in which, for example, "desirability" and "feasibility" became almost indistinguishable. The definitions that are offered below reflect this process of seeking the most meaningful delineation of terms and are still working definitions. They are intended to alert the reader to the problems of structuring the analysis and establishing its limitations.

Conventional Armaments

Conventional armaments are defined by exclusion. They exclude nuclear weapons, chemical and biological weapons, and exotic "unconventional" technological possibilities such as lethal lasers. All other weapons or armaments of land, air, and sea forces are considered. The focus and emphasis is on armaments as such and directly associated equipment that affects the firepower, the employment flexibility, and the operational protection and sustainability of the armaments (e.g., tank armor, but not maintenance and logistics vehicles and equipment).

Qualitative Improvements

In keeping with the focus on armaments as such, qualitative improvements are considered to be any development that improves a weapons capability to deliver fire, to increase mission flexibility, or to improve survivability or sustainability. Improvements are distinguished and assessed primarily on the basis of their military significance. The principal distinctions that are developed in this study are among improvements that appear to be "macrocosmically" destabilizing (threatening to give a decisive advantage to one side in an arms competition), those that appear to be "microcosmically" destabilizing (requiring matching or countering developments on other sides, thus, prompting a major change in their force planning and structure), and those that appear to be only "product improvements" (increasing the efficiency and effectiveness, but not requiring major offsetting reactions from other sides). Such distinctions are relative to existing military balances and competitions and not to the technology of the qualitative improvements.

Qualitative Constraints

A qualitative constraint is understood broadly to mean any attempt to ban, limit, or otherwise control the development or introduction of qualitative improvements. The attempt derives from concern with the significance of the improvement and necessarily implies some concern with the potential magnitude of the introduction. Hence, a qualitative constraint cannot be separated from a quantitative constraint in any absolute sense. It is possible to conceive of constraints that are almost purely quantitative, aimed solely at controlling the amount of a given category of forces or armaments that would be permitted rather than the quality of forces or armaments in that category. Even here, however, the categories reflect some judgment about the characteristics or qualities that define the category. It is not useful and probably not possible to attempt to define a constraint that is only qualitative. A constraint that would ban a particular development is best conceived as a constraint that limits the quantity of the qualitative improvement of concern to zero. Thus, all qualitative constraints are understood to require some corresponding specification of a quantitative constraint.

Desirability and Feasibility

By the desirability of a qualitative constraint it is understood that some judgment must be made whether the constraint would serve some identifiable and useful objective. Desirability deals principally with the question of whether a qualitative constraint should be pursued in some particular context. Different viewpoints can, of course, be distinguished from which to judge desirability. The most obvious distinction is between competitors in an arms competition, but others can be made on the basis of military, political, and economic interests and factors within a state. Such distinctions can lead to the analytical breakdown in the difference between desirability and feasibility in statements like "that constraint is politically desirable but militarily infeasible, or infeasible to negotiate." To avoid such analytic and semantic problems, this study attempts to confine the primary judgment of desirability to definable objectives that at least theoretically could be achieved by all interested parties and to confine feasibility to the judgment of whether a constraint can be operationally implemented, assuming it is judged desirable to some degree to all parties.

APPROACH TO THE PROBLEM

This study adopts a rather simple and straightforward approach of attempting to structure the problem inductively and empirically rather than deductively and theoretically.

- It first surveys past attempts to negotiate arms control and infers some of the principal issues that have dominated concern with qualitative constraints within those attempts.

- It next surveys the evidence that qualitative aspects of arms competition have become important in the present era. This includes: examination of the factors, trends, and motivations that appear to stimulate qualitative improvements; the cost in resources that states appear willing to commit to qualitative competition; and the characteristics of principal competitions between the US and USSR, between NATO and the Warsaw Pact, in the Middle East, in Latin America, and in the Indian Ocean.

- It then examines the potential utility of qualitative constraints in a broad framework, informed by but not specific to the competitions described. Preconditions of negotiability that circumscribe desirability are examined and desirability is then discussed in terms of identifiable, operational objectives of qualitative constraints. Considerations affecting feasibility are introduced.

- The feasibility of implementing a qualitative constraint is then discussed in the framework of the basic forms that control may take.

- The types of agreements in which a qualitative constraint that is potentially desirable and feasible may be developed are then examined broadly and illustrated in candidate agreements for the areas of arms competition examined earlier.

- General and specific conclusions deriving from the inductive exploration are formulated.

THE HISTORICAL SETTING: DOMINANT ISSUES

Past attempts to negotiate arms limitations, including qualitative arms constraints, can be placed within three general periods: the years prior to the outbreak of World War I in 1914; the end of World War I to the onset of World War II in 1939; and the post-World War II period up to the present. Each period was characterized by a series of attempts by major powers, often joined by numerous smaller states, to regulate, limit, or ban certain or all armaments. These periods are distinguished by distinct differences but also contain some similarities of approach to the problems of arms control.

Prevailing attitudes toward the goals of arms control differed from one period to another. In the first, principal efforts were directed towards the limitation but not elimination of arms and arms technology; and the recurrence of war from time to time was generally

regarded by statesmen as inevitable. During the second period, after "the war to end war," proposals for limitation and specific controls were not absent, but the goal of general and complete disarmament (GCD) as an obligation of civilized humanity became a main theme. In the third period, several themes successively appeared: destruction and banning of nuclear weapons as the principal menace to humanity; renewed consideration of the goal of general and complete disarmament now described as a "necessity" in view of nuclear weapons; and then a turning away again from GCD and back to less utopian negotiations aimed at quantitative and qualitative limitation of particular armaments. All three periods were characterized by expanding military technologies and forces ("arms races") that both motivated and frustrated attempts to control or limit them. Similar perceptions, pro and con, of the desirability of controls arose from considerations of national security, international stability, other foreign policy objectives, or costs. Similar lines of thought and analysis were followed, similar difficulties were encountered, and similar types of solutions have historically been proposed, attempted, or rejected.

Arms controls or limitations that were adopted in these periods came about through three general means: by imposition of victors' terms on the vanquished, as at the end of both World Wars; by voluntarism, including unilaterally adopted restraints and the subscription by individual states to international documents such as the various Geneva conventions and the Non-Proliferation Treaty; and by negotiation between two or more states acting on individual or shared national interests. Negotiated control measures in all three periods generally consisted of three main elements: an agreement on what was to be controlled, a means — stated or implied — of verification, and a procedure — again, stated or implied — for enforcement or for sanctions in case of violations. The elements of verification and enforcement inevitably gave rise to a range of considerations from world government and an international police force to trust and unilateral abrogation. In those cases, such as the Kellogg-Briand Pact of 1928, in which no means were provided for verification and enforcement, parties to the agreement relied on their own intelligence services for verification and a variety of unilateral enforcement actions. Of all the factors common to the history of arms control and disarmament attempts in all three periods, the most powerful and persistent have been political rather than technical.

Pre-World War I Experience

Of the three nineteenth century concerns — limiting national inventories of armaments, regulating the conduct of war, and controlling the transfer of weapons — the second led most directly to the opening of the modern era of arms control negotiations, although that concern had been overshadowed in many ways by the other two concerns. The Declaration of St. Petersburg of 1868 set the tone for the modern era

in its attempt to fix "by common accord the technical limits within which the necessities of war ought to yield to the demands of humanity." The Hague Conferences of 1899 and 1907 on the "pacific settlement of international disputes" continued this concern and formally opened the modern era by joining it to the concern with armaments inventories and soaring military costs. These conferences failed to secure agreements resulting in limitation of important arms development, production, or size of forces. In their attempts to ban the discharge of projectiles from balloons, the military diffusion of poison gas, and the use of expanding ("dum-dum") bullets, the conferences, however, recognized both humanitarian concerns and the technological breakthroughs of the preceding half-century, anticipated that more breakthroughs were imminent, and perceived that qualitative as well as quantitative arms factors could now be major influences in the military balance and in arms control negotiations. The determinations of these conferences on these matters and on other matters regulating codes and customs of war are still of important interest. In the same era, the "battleship gap" initiated by the British deployment of HMS Dreadnought caused strategic political-military repercussions somewhat similar to the "missile gap" of more recent times.

Inter-War Experience, 1919-1939

The inter-war period of 1919-1939, until about 1936, was one of intense attention to the problems of disarmament and arms control. Severe quantitative and qualitative arms constraints were imposed on Germany by the Allied victors. At the Washington Conference of 1921-1922, the leading naval powers arrived at agreed ratios of tonnage and main armament calibers in capital ships exceeding 10,000 tons. Wide international agreement prohibiting the use in war of gas and bacteriological weapons was established in the Geneva Protocol of June 1925 (not fully ratified by the United States until January 1975). Aside from imposed controls, the naval limitations that endured from 1922 to 1935, and, with a few exceptions, the non-use of gas in war after 1918 — both negotiated in multinational forums outside the League of Nations — stand as the most successful examples of qualitative weapons constraints between 1899 and the Limited Test Ban Treaty of 1963.

After 1919, however, the most intensive and sustained efforts — and the most unsuccessful — on behalf of arms control and disarmament took place within the League of Nations, where the ultimate goal of GCD was pursued as the means to general peace. Three stages characterized the League's efforts. From 1920 to 1925, chief attention was directed to the paramount problem of establishing security by political and legal means — a course favored by France — through definitions of aggression, systems of arbitration, and treaties of mutual assistance against aggression, all of which failed of adoption. The years from 1925 to 1932 were those of the Preparatory Commission for the General

Disarmament Conference. Attention turned to technical calculations of equivalence under the seemingly logical proposition that if formulae were developed for equating qualitative effectiveness of weapons and forces, the application of quantitative factors would then enable standardized equivalence conditions to be determined. Reductions of all nations' armed forces by some common percentage could then be made without disturbing the existing power ratios. Voluminous studies were made, but no agreement was reached. The Preparatory Commission then turned to a new principle, advocated particularly by Great Britain: prevention of aggression by differentiating between offensive and defensive weapons and prohibiting the former. The rationale, again apparently logical and retaining its advocates to the present time, held that if weapons of significant offensive capability were banned and if nations deployed only arms that were primarily defensive in nature, all would be secure. Analysts of the time referred to this concept as "the principle of qualitative control." Although it received wide ostensible concurrence as the guiding rationale, final agreement was never reached on the definitive categorizations of weapons, partly because of political in-fighting and partly because excessive attention was given to the weapons themselves and insufficient consideration to tactical uses and the types of operations in which they might be employed. Comprehensive disarmament plans put forward both by the US and UK failed of adoption; Hitler came to power in January 1933 as Germany's demands for arms equality mounted; the General Disarmament Conference then collapsed in futility in May 1934 and was followed by the five year period of rapid military expansion culminating in World War II. Besides attempting to achieve general arms reductions and to constrain the wartime uses of certain types of armaments, the League had also dealt with the subject of arms trade and transfers. At least nine proposals to control arms transfers were considered. None of them ever came into force. Despite these failures, the League did compile and publish annual statistics and other useful information on international arms transactions.

Post World-War II Experience

Against the background of failure of the League of Nations, the United Nations Organization was developed after World War II on the principle of maintaining peace through collective security. This approach was regarded as more realistic and more likely to preserve the peace than the League's concentration on general disarmament. As after World War I, the losers were at once required to disarm. The UN Security Council was seen by some as "the five policemen," but this view presupposed a continuation of the wartime collaboration between the allies that in fact foundered in the post-war bipolar confrontation of the two superpowers and their respective allies.

The wartime development of atomic weapons by the United States was regarded as the most important technological breakthrough and qualitative

distinction in weapons history. All other arms -- with a grey area sometimes allowed to chemical and bacteriological weapons -- became "conventional;" nuclear weapons and their delivery means became strategic (decisive); and in December 1946 the UN General Assembly unanimously resolved in favor of "an early general regulation of armaments." As the Cold War tensions developed, the United States briefly held an atomic monopoly while the Soviet Union held an overwhelming preponderance of conventional forces and arms. Nevertheless, the emphasis in arms control became and, in general, remained focused on control of atomic weapons as the primary issue. The Soviet Union at this stage demanded that atomic weapons be banned, but rejected the international system of verification and inspection contained in the US Baruch proposals first advanced in June 1946. By late 1949, the Soviet Union had again rejected international controls and proposals for an arms census and had detonated its first atomic weapon. In January 1950 the USSR withdrew from the UN Atomic Energy Commission. When the United States thermonuclear detonation in 1952 was quickly counterbalanced by the USSR in the following year, both sides accelerated their research for and production of intercontinental and intermediate range missiles, long range bombers, and smaller, tactical nuclear weapons. In general, the hoped-for political assurance of world security through the UN and its instrumentalities for control of arms was replaced by what Winston Churchill christened the "balance of terror" in military capabilities.

Substantial - although unsuccessful - attention was first given to conventional arms limitation in the period from May 1955 to September 1957. The USSR, countering an Anglo-French proposal of 1954, advanced a detailed plan for conventional disarmament only. As the proposals and counterproposals evolved, however, the weapons included became strategic nuclear-armed missiles. Conventional weapons did not enter into the later versions, either qualitatively or quantitatively, except as they would have been limited in deployment by the reduction of conventional manpower and units. Some areas of partial agreement were reached in the discussions of 1955-1957, but the whole matter failed. In part, at least, this failure occurred because the proposals became so comprehensive that the multitude of details swamped the major considerations. In an echo of the League of Nations and its aspirations for universal peace through disarmament, the UN General Assembly in November 1959, unanimously endorsed a resolution calling for "complete and universal disarmament," and the early 1960's saw a revival of political attention to this subject. In the UN, the Eighteen Nation Disarmament Committee (ENDC) was formed in 1961 -- this body, with enlarged membership, was redesignated in 1969 as the Conference of the Committee on Disarmament (CCD). The mounting escalation of nuclear testing led to the first major post-war arms control agreement in the Limited Test Ban Treaty signed at Moscow on 5 August 1963 by the US, UK, and USSR and subsequently adhered to by about 120 additional states. The General Assembly in 1969 reaffirmed the resolution on complete disarmament, but by then

the subject had become more of an ideal than a goal actively sought. Conventional arms constraints as such did not again receive international attention comparable to the 1955 level until the initiation of the NATO-Warsaw Pact's mutual and balanced force reduction (MBFR) talks in Vienna in October 1973. Fundamental dilemmas of quantitative and qualitative arms control have been revealed in these talks, which, in mid-1976, had not yet produced conclusive results and were continuing.

In the post-World War II period principal attention has focused on nuclear rather than nonnuclear or conventional weapons and forces. The record of the period in terms of actual agreements reached is far better than that of the post-World War I era — perhaps principally because of the greater dangers involved and because comprehensive utopian solutions were gradually eschewed. The series of fifteen treaties and conventions, ratified by early 1976, including the Antarctic Treaty of 1959, the Limited Test Ban Treaty of 1963, the Non-Proliferation Treaty of 1968, and the SALT I - ABM Treaty of 1972, showed that limited agreements could be reached in a climate of mutual interests seeking balance and stability to preclude specific dangers. Resulting from mostly bilateral or multilateral undertakings outside the UN, such treaties have placed some limits on qualitative and quantitative aspects of the nuclear arms competition in particular.

Since World War II, the principal instances of conventional weapons limitations, including qualitative aspects, have come about as part of ceasefire agreements ending several of the conventional, or limited, wars that have occurred. Besides these specific negotiations and agreements to limit deployments of weapons and forces, the post World War II era continued the concern of the late nineteenth century with weapons use and effects in the conduct of war. The International Committee of the Red Cross (ICRC), building on the work of earlier meetings, convened at Geneva in 1973 a conference of government and private agency experts to study "conventional weapons that may cause unnecessary suffering or have indiscriminate effects." Further conferences with expanded membership followed in 1974 at Lucerne and in early 1976 at Lugano. The reports of these conferences on weapons are considered to be part of a series for the UN. Such reports and any agreed positions and recommendations taken by the conferences are intended to assist diplomatic representatives in devising new protocols or declarations open to subscription by all nations along the lines of the Hague Conventions or the Geneva Protocol of 1925.

The ICRC conferences and reports appear to be motivated by philosophical concepts like those of the first period of modern arms limitation attempts and — by frequent references to the St. Petersburg Declaration of 1868 and the Hague Conventions of 1899 and 1907 — underscore the continuing importance of those historic conferences as sources of precedence and guidance. Some modern qualitative weapons improvements (e.g., greater accuracies in target identification and designation

and in delivery of fire) may make the problem of identifying "indiscriminate effects" less difficult than the perennial problem of identifying "unnecessary suffering;" however, both problems remain subjects of concern for qualitative constraints on conventional armaments. A related, but separate, development under CCD aegis was the signing on 10 April 1972 at Washington, London, and Moscow of the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological and Toxin Weapons and Their Destruction. This convention, supplementing the 1925 Geneva protocol prohibiting the use in war of these weapons, is, outside the Non-Proliferation Treaty, the only instance of an agreed constraint on development, production and stockpiling.

While the post-war dangers of superpower confrontation and the problems of strategic nuclear weapons engaged primary arms control attention after World War II, new, independent nations emerged in scores from the break-up of the older colonial empires. The diverse new states and insurgency movements had at least one common denominator — they all wanted weapons, and, in general, got them, giving rise in a new form to the third concern of the late nineteenth century, namely, arms transfers. Both the US and USSR and their principal allies armed their lesser allies and granted or sold weapons to numerous small states to induce their alliance or alignment. Further transfers, in this environment, became common; and the international commercial arms traffic prospered. Both within and outside the UN, numerous unsuccessful proposals were made for negotiated embargoes, registration, publicity, or other controls on the international arms trade. None of these efforts succeeded in reversing a trend stimulated both by demands in the Third World and competition among suppliers. In some instances, Third World recipients also developed indigenous weapons research and production capabilities. Arms acquired by the new states became increasingly sophisticated, including high performance fighter aircraft, air defense systems, deployed electronic technology, armored vehicles, and missiles. By mid-1975, the Middle East in particular was distinguished for accelerated arms procurement stimulated by nationalism and national interests, unresolved tensions, oil revenues, commercial arms traffic, and continuing client relationships. Constraints — both qualitative and quantitative — could be imposed by suppliers, and in some cases were; when these constraints were severe, however, countering political pressures quickly developed.

By 1976 no constraints had been devised for the substantial new qualitative improvements in nonnuclear arms effectiveness that were on hand or imminent, such as precision guided munitions, super incendiaries, and new antitank munitions using the high density of depleted uranium. As the technical effectiveness and power of nonnuclear arms increased, the potential damage difference between nonnuclear and nuclear operations decreased, at least in the tactical sense, and distinctions between tactical and strategic weapons tended to become blurred.

Guidance from the Past

This survey of arms control efforts from about 1850 to the present time suggests, in sum, a number of generalizations that may serve as guidance for considering qualitative constraints on conventional armaments.

1. Limitations on conventional arms must be evaluated in light of actual or potential conflict situations. Concentration on priority of reduction of political tensions as a precondition for arms limitation, or the reverse, is simplistic; both should be approached simultaneously.

2. Except in a few instances when states have been willing to accept military inferiority for temporary or "higher" purposes, constraints can best be attained in situations of relative military balance and perceptions of mutual dangers to security or national self-interest. Arms control to be enduring depends on political agreement rather than imposition or unilateral adoption.

3. Historically, qualitative constraints have sometimes been linked directly with quantitative constraints and sometimes not. Whether or not both are explicitly stated in an agreement, however, a qualitative constraint always implies a quantitative constraint.

4. In general, weapons cannot be successfully classified as offensive or defensive for arms control purposes apart from consideration of the type and level of operations in which they may be employed.

5. Technical calculations of relative weapon effectiveness ("equivalencies") are vulnerable to protracted argument and political obfuscation, and by themselves cannot serve as the determinant of limitation agreements.

THE IMPORTANCE OF QUALITATIVE IMPROVEMENTS IN CONVENTIONAL ARMAMENTS

The dominant evidence is that nations prefer competition in improving the qualities of their weapons to constraining them by formal agreement. This is particularly true in the "conventional" area; indeed, the characteristics that nations have most urgently sought to constrain were characteristics that qualified those weapons as "nonconventional" — e.g., the mass destructiveness of nuclear weapons and the indiscriminateness and potential uncontrollability of chemical and bacteriological weapons. Efforts to control such things as the offensive as opposed to defensive characteristics of conventional weapons — whether of artillery or battleships or bomber aircraft — have been far less successful or enduring.

Both the desirability and the feasibility of agreeing on future qualitative constraints on conventional armaments depend greatly on the importance that attaches to qualitative improvements in current inventories. It is frequently alleged that arms competition in the technological era is, in fact, now a qualitative competition more than a quantitative competition among the industrial states, such as the US and USSR and their NATO and Warsaw Pact allies, while among less developed states it is still primarily a quantitative competition. Much of the evidence for this statement is subject to a high order of subjective interpretation and controversial in its import. Evidence has been sought in this study in three broad areas: (1) the motivations for seeking qualitative improvements in conventional weapons that can be adduced and the factors influencing such motivations; (2) the costs and resources that nations are willing to commit to qualitative improvements in their armaments and inventories; and (3) some salient aspects of arms competitions that have taken place in significantly different regions of the world, namely, in the NATO-Warsaw Pact area, in the Middle East, in Latin America, and in the Indian Ocean.

Motivations for Qualitative Improvements

Motivation to improve the qualities of particular armaments or of entire inventories of armaments are complex, generally involving a mix of technological, military, economic, and political factors. Especially among states such as the US and USSR with sophisticated and vast technological-industrial bases, something like a "technological imperative" to improve products appears to be at work. Since weapons systems wear out in peacetime and require replacement or become obsolete by advances in other weapons systems, new designs or "generations" of such systems appear with a frequency of about once in every ten to fifteen years. The momentum, if not the motivation, to improve armaments is there because a technological dynamic exists. Product improvement can be a costly process; however, part of the technological dynamic may be to produce greater efficiencies in uses of resources as well as greater effectiveness. Old weapons systems are frequently replaced with improved models because the improved models are expected to be cheaper in the long run with better relative life-cycle costs. Moreover, improved weapon systems are often expected to effect overall economies (or, at least, humaneness) in force development by substituting technology for manpower. A poorly-managed technological momentum can, of course, produce new weapons systems that are merely more costly or more complicated and glamorous than the systems they replace. Arms control interests in controlling technological momentum can, in such instances, converge with military and economic interests.

The fact that a technological momentum exists requires that each of the superpowers maintains and improves the quality of its conventional

armaments lest its adversary develop and acquire weapons that are significantly better than its own. Not every innovation or development need be matched on a direct basis; however, each superpower will compete in most areas of military technology at least to ensure that it will not be surprised by the other's technological-military capability. To this extent, there is a qualitative competition if not an arms race between the US and the USSR and among their respective NATO and Warsaw Pact allies.

Few conceivable qualitative improvements appear to offer a decisive military advantage to the side that develops them first. Breakthroughs such as the development of gunpowder, the airplane, and nuclear munitions appear in history with relative infrequency and today would require long lead-times to achieve quantity production and deployment. However, some developments can appear to be quite destabilizing to an existing balance, requiring the other side to seek similar or offsetting — and sometimes very costly — improvements to maintain or restore the complex balance. Examples that may be cited would include the precision guided munitions (PGM), especially for antitank purposes, now emphasized by the US and NATO allies, and the potential development of new advanced armor. The former development could lead the USSR to field the latter, force both sides to a renewed reliance on high velocity antitank guns (a course probably less expensive for the USSR than for the US), and outmode NATO's present PGM's.

Competition for qualitative improvements in armaments among less industrialized states or in less industrialized regions than represented by NATO and the Warsaw Pact generally does not involve competition in weapons research and development. Qualitative competition in the Middle East, for example, is competition for purchase of present generations of weapons from the most advanced arms producing states. Every state, however, whatever its size, is concerned with real and potential threats to its existence. Perceived military threats must be offset by countervailing force if a nation state is to endure in independence. Thus, whenever a state assesses its military capabilities as substantially inferior to those of a threatening power, the threatened state normally seeks to redress the balance in some way or combination of ways, usually involving attempts to improve on the quality (as well as the quantity) of arms at its disposal. States with advanced economies and military-industrial bases first look inward to develop the required capabilities. Less-developed states look outward for military assistance and for military and political allies.

There are also economic reasons why democracies and dictatorships alike pursue armament development programs whose goals are an equal or greater amount of military power for a reduced level of spending. Product improvements and innovations are constantly sought to enhance weapon firepower and performance and to limit or reduce life cycle costs. Technological, military, and economic factors thus converge to make

qualitative improvements in armaments attractive. Relative economies in new, qualitatively improved weapons are difficult to achieve without volume production because of relatively high RDT&E and other investment costs. Hence, industrialized states frequently seek foreign sales to assist them in reducing unit costs of armaments. With several arms suppliers operating in international markets, a competitive incentive is added to others to produce and offer better models. Other motivations include support of indigenous arms industries, assuring domestic sources of supply and eliminating lead time required to reactivate production lines that are shut down, offsetting unfavorable international payment balances, and gaining leverage in recipient countries.

International political factors that contribute to motivations to improve conventional armaments or inventories are closely related to some of the military and economic factors. Among the industrialized states, the principal political factors that operate appear to be those associated with maintaining national security, denying to militarily strong adversaries political leverage that may derive from their military capabilities, and in some cases projection of power and influence into new regions. Despite the maxims of Clausewitz and Mao, the correlation between military and political factors can be exaggerated with respect to motivations to improve conventional armaments. Except for the case of Soviet naval armaments, it is difficult to find recent instances in which qualitative developments in conventional armaments have contributed to political power and influence in a direct way among the major powers themselves. Political power and influence among major powers have had a more direct relation to nuclear weapons and to quantities of conventional armaments. Political factors play a more significant role in the less developed areas of the world where military balances are less stable and less directly affected by the nuclear balance between the superpowers. Qualitative improvements in conventional armaments have symbolic as well as real military value in such regions. The symbolic as compared to the real military value may be especially important in areas such as Latin America where relatively few direct military threats are perceived, but where competition for political and economic power and influence does exist.

Closely related to the symbolic — or predominantly political — value that sometimes attaches to having more modern armaments than one's neighbors and political rivals is a putative prestige value. It is especially difficult to determine the extent to which this factor operates in motivations to develop or to acquire the latest armaments. Undoubtedly this factor does operate, especially among aspiring powers, but it generally operates in consonance with military, economic, and political factors. Analysts of political and governmental decision-making processes have also ascribed other types of motives to participants in these processes, suggesting that the real "determinants" of

military weapons may lie in organizational and service interests and other domestic factors and competitions.

Costs Associated with Qualitative Improvements

The monetary costs of seeking qualitative improvements in conventional armaments may be grouped in two broad categories: those associated with the research and development of an improved item; and those associated with its acquisition, operation, and maintenance. At present, only the more industrialized states of Western and Eastern Europe and the US and USSR, with the scientific and technological potential to do so, commit significant portions of military and national budgets to R&D on improvements in conventional armaments. R&D costs are frequently considered to be prima facie evidence of the existence of a qualitative arms race among such states.

However, as noted in the previous section, much R&D is justified, if not motivated, by a desire to achieve overall economies in providing for national military capabilities. Such economies may be sought in improved products that are less expensive to operate and maintain, in achieving a qualitative superiority in some systems that would allow less need for quantity, or by relieving manpower burdens especially in the combat elements. For countries with an arms export capability other economies such as lowered unit costs through volume sales and improvement in the balance of payments may also affect the expected return on the investment that R&D represents. Of course, this investment may be viewed as an investment of risk capital with no guaranteed pay-off of the type sought. When the expected direct payoff does not materialize — as, for example, in the US MBT-70 (main battle tank) — the argument can still be made that learning took place and, at least, by-product technologies did materialize. Hence, despite advances in cost-and-effectiveness analyses and life-cycle systems costing, no relatively unambiguous method exists for determining net cost of improvements in conventional armaments that result from R&D of new systems.

There is, furthermore, no agreed basis for comparing the expenditures of different countries and particularly those of the largest spenders: the US and USSR. In the total US federal budget, funds for military R&D can generally be distinguished from nonmilitary R&D. No such public accounting is made in the Soviet Union (and many other states as well), and most analysts believe much military R&D is hidden in nominally "civilian" programs anyway. Estimates of Soviet military R&D expenditures are, therefore, built up from many interrelated activity indicators. The relative amount of military expenditure that a state devotes to military R&D appears to depend on the level of military spending in general and whether the state is an arms exporting state as well as on the degree of industrialization.

Whether or not to improve current systems or to develop new ones, to promote or restrain exports of these systems, or to increase or decrease military expenditures, involve not only strict monetary costs but also political and military costs, and the kinds of economic costs that may not be measurable in terms of dollars, rubles or francs. A cost of great concern to both industrialized and developing countries is opportunity cost. Resources used in one activity cannot be used at the same time in another. Judging how important qualitative improvements in conventional armaments are to less developed states from the monetary and opportunity costs associated with acquisition is, however, as difficult as judging this importance to industrialized states from their R&D expenditures. In order to determine the overall economic effect, each case must be weighed individually, and a subsequent comparison among nations or regions may or may not be meaningful. The fact that many developing states have recently turned to purchase of the latest models of combat aircraft, tanks, and missiles is not necessarily a good indication of the price they are willing to pay for qualitative improvement. In many cases, the models they purchase are the only ones available as arms suppliers compete for influence or for volume sales that will reduce their unit costs.

This study did not attempt to develop and present a comparison of data revealing expenditures on qualitative improvements around the world. It is highly doubtful whether such data can be developed. Projections for the future are especially hazardous. Some costs will undoubtedly rise, especially in the areas of missile and aircraft technology. But the data necessary for making predictions and for making meaningful comparisons between or among regions and countries are not uniformly available or reliable.

Competition in Qualitative Improvements

The argument that arms competition among industrial states is predominantly qualitative while competition among less developed states is characteristically quantitative was critically reviewed in analyses of the competitions between the US and USSR and their NATO and Warsaw Pact allies, among the states of the Middle East, in Latin America, and in the Indian Ocean. While it is obviously true that industrial states have the wherewithal to compete in R&D, it is not at all obvious that they are less concerned with quantities of weapons or that developing states are more concerned with the quantities of weapons they can purchase than with their quality. A corollary of this simplistic argument is that quantitative changes in developing regions are more destabilizing while qualitative changes in competitions among industrial states are destabilizing. Recent evidence in areas such as the Middle East and, to a lesser extent, Latin America, suggests that the corollary is as dubious as the main argument.

US/USSR Competition. Qualitative improvements in US conventional capabilities vis-a-vis the Soviet Union are presently motivated by five interrelated factors: (1) the emergence of relative strategic nuclear parity between the superpowers that gives increased importance to the balance in deployed conventional capabilities; (2) the long-standing emphasis of the Soviet Union on quantitative, if not qualitative, superiority in armored ground forces deployed in and deployable to Central Europe; (3) increased Soviet interest in projection of power to other areas of the world reflected in new naval capabilities and airborne forces; (4) new economic pressures on the US and the West in general resulting from a combination of inflation and recession; and (5) the availability to both sides of improved or new technologies for military application.

From a survey of qualitative improvements in US land, air, and naval systems in the face of Soviet qualitative and quantitative improvements, it is clear that a technological-qualitative competition of rather large proportions does exist between the superpowers in the area of conventional armaments. Introduction of some of these new systems will appear destabilizing enough to specific components of the overall military balance to stimulate counter developments by the other side. However, this very competition itself tends to keep the impact of any particular development relatively small in the overall military balance. In the absence of agreed qualitative constraints, therefore, qualitative competition appears on balance to be "macrocosmically stabilizing" and "microcosmically destabilizing."

NATO/Warsaw Pact Competition. Competition in conventional weapons between NATO and the Warsaw Pact as alliance systems is, in many respects, a reflection or extension of the competition between the dominant partners of each alliance. The military balance between NATO as a whole and the Pact as a whole is similar to the balance between the US and the USSR in both quantitative and qualitative respects.

There are at least two important respects, however, in which qualitative competition is quite different. First, several countries of Western Europe — particularly, the Federal Republic of Germany, the United Kingdom, France, and to a lesser extent Italy — have advanced-technology industries that can support and make use of an array of military R&D. The economic incentives of supporting indigenous employment and using industrial capacity are relatively high in these countries, which — in comparison to the Eastern European Pact countries — can also fulfill large consumer demands. Second, the voluntarism of the NATO alliance has meant that members are freer to select the systems that fulfill their material requirements on a national basis. These two characteristics of NATO in comparison to the Pact have led to competition within NATO in qualitative improvements in armaments, contributing both to technological progress and to the lack of standardization in

NATO. Competition in qualitative improvements among the NATO partners has been abetted in recent years as arms sales outside of NATO have enlarged for a variety of complex military, political, and economic reasons.

Middle East Competition. The competition between Israel and its Arab neighbors is one of the fiercest of modern times. In contrast to the US and USSR and the major states of Western Europe, the Middle East countries have been almost totally dependent on arms supplied from other countries for this competition. The Arab states lacked both the technological base and the industrial production base necessary to develop an armaments industry of their own. Israel, on the other hand, has from its inception as a state pursued a variety of programs to modify, develop, and otherwise improve on the quality of arms available to it with a view to reducing, where possible, its dependence on arms suppliers.

It will be years before an Egyptian (or Arab World, as some envision it) armaments industry could have a significant impact on the military balance between Israel and its neighbors. Meanwhile, Israeli capabilities to modernize and adapt old weapons, including captured arms of Russian origin, are likely to continue to grow. Despite these developing trends in Arab-Israeli capabilities to produce armaments of various sorts, both the Arabs and Israelis will remain dependent on foreign suppliers for major weapons and weapons systems.

The patterns of who has supplied and what is supplied have changed significantly between the Middle East wars. Beginning in 1955 with the supply of Czech arms to Egypt and accelerated by the war of 1956, the so-called "radical" Arab states became increasingly dependent on quantities of arms supplied by the USSR and other Warsaw Pact countries. Many of these arms were of relatively low quality representing arms that were being phased out of Pact forces as they modernized. Until 1967, Israel's main supplier was France, with the US taking on a growing role by that time. Following the 1967 war, in which the air and armored forces of Israel depleted Arab armament inventories, Arab imports of qualitatively improved, high-performance weapons took on increasing importance. In this period, Egypt and Syria were dependent almost solely on Soviet supplies of modern weapons. The US became Israel's principal supplier, and French transfers to that country almost ceased. The 1973 war revealed the military impact of high intensity combat between forces armed with qualitatively improved armaments on both sides. Since the 1973 war, which also revealed the great vulnerability of Western Europe to an embargo of Middle East oil, armaments inventories have been replenished but with the pattern of almost sole Arab reliance on Soviet supplies significantly broken.

Because the competition between Israel and the Arab states — and, significantly among the Arab states — has become qualitative as well

as quantitative, a future war in the area could be extremely explosive in its intensity. Political alignments are fluid and dynamic — partly because of and partly contributing to competition among Western Europe as well as US and USSR arms supplies to that region — and it would appear to be theoretically possible and pragmatically desirable to limit both the level and geographical extent of any future fighting in the Middle East through constraints on both the quality and quantity of arms supplied to the countries in the Middle East.

Latin American Competition. In terms of relative expenditures and force levels the countries of Latin America (exclusive of Cuba), have defense establishments that are among the smallest in the world. From the Latin American point of view, however, arms competition appears to be a very real problem, primarily because of the increased costs of sophisticated weapons, their political impact, and their limited military utility in the region. The major arms competitors in Latin America are Argentina, Brazil, Chile, Colombia, Peru, and Venezuela. Cuba is not included in this discussion because — although a significant military power — both its special relation to the USSR and its proximity to the US insulate it from the dominant patterns of competition in Latin America.

After World War II and during the 1950s, the principal threat to the hemisphere was viewed as the Soviet Union. The US, as almost the sole supplier of arms provided a large quantity of post-war materiel to the Latin American armed forces. During the early sixties, however, as the major South American powers began developing the capacity to pay, their military establishments became increasingly dissatisfied with aging, obsolete equipment, and arms competition took on a character marked more by qualitative rather than by quantitative improvements in weapons and systems. Efforts by the US to stem this trend resulted in a proliferation of Western European arms sales in the region. The Soviet Union has also recently entered the market. As late as 1971, authorities were pointing out the virtual lack of guided missiles in the region. This situation has changed dramatically — all of the major nations, except Colombia, have some combination of surface-to-air, surface-to-surface, air-to-surface and air-to-air missiles.

If pending armaments orders are any indication, the future is not highly encouraging with respect to self-restraint. The armed forces of Latin American nations are no longer satisfied with obsolete, second-rate weapons and systems; and these countries, to varying degrees, are actively engaged in programs of qualitative improvement of their land, sea, and air power. The predominant competition pattern continues to be the interaction between Brazil and Argentina.

While the hemispheric or overt external threat to the Latin American nations has receded in recent years, the internal threat to domestic

security has not. This, coupled with the primacy of the political role of the armed forces on the domestic scene and the great importance that prestige holds not only on the international front but internally as well, influences directly the demand for armaments in Latin America. Operating to offset this demand are the economics of the situation, with large requirements for economic development and other alternative allocations of resources. The Declaration of Ayacucho by the Andean group of states in December 1974 is a good illustration of the potential utility of qualitative constraints on armaments competition in the region. These nations have apparently realized that opportunity costs of sophisticated weapons acquisitions divert scarce resources from pressing social problems and have called for a limitation on transfers of "sophisticated" and "offensive" weapons into the region. The success of this Latin American venture will depend, however, in large measure on the vigor of the follow-up by the participating states and on the arms policy of Brazil (not a participant in the Declaration) and its attitude toward the Declaration.

Indian Ocean Competition. The size of the Indian Ocean, as well as the number and diversity of its littoral states, increases the difficulty of generalizing about the nature of any qualitative competition in the area. While the ocean itself is the major feature shared by all the littoral, it has also been the major avenue of penetration by external powers. Thus, the Indian Ocean can be seen as a single entity only in the context of navies and seapower. Within this context, there are three broad aspects of arms competition: (1) the US vs the USSR, reflected by the presence of their naval forces in the region; (2) the relations among the many littoral states; and (3) the relations between the littoral states and the US and USSR.

The region has become a competitive arena due largely to: (1) British withdrawal of its military forces from "East of Suez;" (2) the growth of the Soviet navy and the decision to deploy Soviet naval units to the Indian Ocean in the wake of Britain's departure; and (3) a growing US awareness, prompted by the 1973 Middle East War, of Western and Japanese dependence on Persian Gulf oil and the potential vulnerability of sea LOCs from Europe and Japan to the Gulf.

Both US and Soviet naval activity in the Indian Ocean have increased since 1968, with qualitative as well as quantitative improvements in naval capabilities deployed to the region. Naval arms competition among Indian Ocean littoral states, as a regional issue, exists, however, only at a low level. Although there have been and continue to be a variety of tensions among Indian Ocean states, the absence of significant capabilities for projection of seapower among the littoral states leaves little or no potential for major military conflict on land or at sea between non-neighboring countries. India has a limited naval capability to project power or to conduct operations against neighboring Pakistan, Bangladesh, Burma, and Sri Lanka and may be motivated to complement

its nuclear capability with an expanded navy. Iran's naval expansion appears to be primarily aimed at predominance in the Persian Gulf, but, like India, Iran is known to be concerned about superpower presence in the Indian Ocean.

US and Soviet naval deployments in the Indian Ocean since 1968 indicate a trend towards increased capabilities to project power ashore also. The threat posed by such a capability, however, is not as relevant to direct US-Soviet naval confrontation as it is to the relationship between the US or USSR and the littoral states.

Some Tentative Hypotheses

This review of inferable motivations for seeking qualitative improvements in conventional armaments, of problems of determining the costs in resources and opportunities nations are willing to expend, and of existing regional arms competition suggests several tentative hypotheses.

1. Qualitative competition between highly industrialized states such as the US and the USSR, and to a lesser extent their NATO and Warsaw Pact allies, in the absence of mutual and verifiable constraints, tends to be macrocosmically stabilizing.
2. Economic incentives — though of secondary importance in comparison to perceived security needs — reinforce other incentives to achieve qualitative improvements among highly industrialized states. The incentives to reduce unit life cycle costs and to achieve economies of scale, in turn, are reinforced by desires to retain a technological-industrial capacity and full employment and a desire to offset, partially, unfavorable balances of payments.
3. Among states less favored with a sophisticated R&D capability and industrial capacity, qualitative improvements in conventional armaments are achieved through import. Where security tensions and conflict potential are high, as in the Middle East, qualitative constraint may depend principally on suppliers' constraints, which, to be sure, would face formidable economic and political obstacles. In areas where tension and conflict potential are comparatively lower, as in Latin America, qualitative constraints devised by consumers for economic reasons associated with developmental priorities would appear to have a better chance of success than producers' and suppliers' constraints.

THE POTENTIAL UTILITY OF QUALITATIVE CONSTRAINTS

Given the importance of qualitative improvement to states engaged in arms competition, the question is, what is the potential utility of qualitative constraints? Is the evidence that states will continue to compete qualitatively so overwhelming that it appears fruitless to repeat

many of the frustrating attempts of the past to negotiate qualitative constraints even on those armaments that appear to favor the offense and, thus, potential aggressors? Or on armaments that appear to be particularly destructive or inhuman? Or on armaments that appear to be so costly that acquisition of them amounts to a major diversion of resources away from the solution of pressing problems of hunger, poverty, and inadequate economic development?

Although it is recognized that tacit agreements for mutual restraint operate in some competitions, the focus of interest in this study is on the potentiality of formally negotiated agreements.

Preconditions for Negotiation

Previous experience in arms control negotiations has shown that, for potential agreements to be either desirable or feasible in the broad sense, there must be some convergence of interest in agreement among the parties to agreement. Agreements imposed by victors on the vanquished have not lasted long and have frequently stirred resentments that have increased the likelihood that the agreements would be violated or abrogated. Similarly, agreements to control arms improvement and build-up, associated with ceasefires in which there was no clear victor, have been easy and convenient to violate in Korea and Vietnam, for example.

For agreements to be politically feasible of attainment and implementation there must be some minimum degree of mutual or common recognition that a constraint agreement is more desirable than the "unconstrained" competitions that might ensue in the absence of agreement. This is not to say that an arms control agreement can only preserve the status quo; it is to say that an agreement is likely to be successful only if the parties find the status quo to be relatively acceptable and aim to avert potential, future imbalances more than to adjust current imbalances. There are at least two important exceptions to this generalization. First, the current balance may contain symmetric but highly unstable elements that both sides want to adjust or eliminate — e.g., hair-trigger, first-strike forces. Second, the current balance may contain asymmetric elements that could be traded off to reduce different worries on the two sides — e.g., Pact tanks versus NATO QRA nuclear systems.

Objectives of Qualitative Constraint

If it is accepted that negotiability of an arms control agreement depends on a convergence of interests among parties to the agreement, then the objectives of any constraint must be perceivable as the same or similar for all parties. The objectives do not need to be perceived as identical or held with the same degree of interest by all parties, but — unless they are part of some larger set of negotiations or

diplomacy in which tradeoffs are possible — negotiations will almost inevitably deadlock or fail unless all parties perceive they are achieving comparable objectives.

Formally, the categories of objectives that may be sought through arms control policy overlap to a large degree with the kinds of objectives that are sought in military policy. The principal categories common to arms control and military policy are: (1) to reduce the likelihood of war; (2) to reduce the destructiveness of war if it occurs; (3) to reduce the cost of preparing for war; and (4) to reduce political tensions. It would be misleading, however, if it were not acknowledged that there is at least one critical area in which the categories of objectives for military policy and arms control policy do not overlap. That is, broadly, in the positive linkage between a nation's international political interests and its military strength. Arms control inevitably weakens this linkage and can be construed as a constraint on political-military policy and not merely on military capabilities.

Formulated as an objective related to tendencies within the military balance among states, to reduce the likelihood of war can be a high-priority objective that all parties to an agreement can hold in common. In the superpower strategic balance, this common objective is generally held to be the basis of SALT negotiations. Whether reduction of the likelihood of war is also an operationally meaningful objective of control of conventional armaments is more problematic. It was concluded earlier that the qualitative competition in conventional armaments between the US and the USSR and between NATO and the Warsaw Pact is, on the whole, macrocosmically stabilizing rather than destabilizing. Quantitative competition in that arena is likely to prove more destabilizing in this macrocosmic sense. Therefore, reduction in the likelihood of war is not a convincing objective for qualitative constraint on conventional armaments in the US-USSR, NATO-Warsaw Pact arenas.

On the other hand, competition in qualitative improvements in conventional armaments has proved macrocosmically destabilizing in the Middle East and threatens to be potentially destabilizing in Latin America. In these areas — and possibly the Indian Ocean area — reduction in the likelihood of war is a credible and potentially operationally meaningful objective of a qualitative constraint. Such constraints in the lesser developed regions would necessarily be combined with quantitative constraints in the form, for example, of bans on the introduction of new systems, ceilings on or reductions of existing inventories of designated systems, and withdrawals of designated systems from particular areas of deployment. The criterion for designation of the new or existing systems to constrain would be systems that appear to be destabilizing because they favor offensive operations as compared to defensive operations.

A second major category of objectives of arms control is to reduce the destructiveness of war if it occurs. The bans on bacteriological weapons and on the use of chemical weapons serve this kind of objective. Agreements on no first use of nuclear weapons would also aim at this objective. In general, any type of control that attempts to limit weapons of mass destruction or of particular inhumanness falls into this category.

An objective of reducing the destructiveness of war — like an objective of reducing the likelihood of war — may be served by some qualitative improvements in armaments as much as by qualitative constraints. In the nuclear area, improvements in the accuracy of delivery, because they offer opportunities to reduce collateral damage, are frequently presented in this light. A similar line of reasoning is applicable in the conventional area. Precision guidance for air-dropped munitions is a particular case in point. By permitting ten-to-one or greater reduction in the number of bombs that need to be dropped to destroy a military target, they can significantly reduce collateral damage per target destroyed. Especially in a densely populated region like Central Europe it would appear that, on balance, there are more opportunities for increasing the control of war and reducing its potential destructiveness by the kinds of qualitative improvements in conventional armaments that current technology promises rather than by constraints on them. Reduction of the potential destructiveness of war by means of qualitative constraints appears to be a relatively unconvincing objective in areas of high technology but, potentially, a credible supporting or secondary objective in lesser developed areas.

In the previous section it was pointed out that little basis exists for ascribing net costs to qualitative improvements in conventional armaments. Nonetheless a credible and operationally meaningful objective of qualitative constraint agreements could be to reduce the costs of preparing for war.

Almost any qualitative improvement in armaments is to some extent microcosmically destabilizing in any environment of arms competition. Where a military balance is taken seriously, an improvement in some force element on one side is an improvement relative to the other side and must be matched or countered by the other side if the current balance is to be maintained. Technology does not automatically favor either offense or defense, but in regions of high-technology armaments there are increased incentives for technological innovation to focus on improved defensive capabilities and on provision of options. The microcosmic instabilities of many action-reaction phenomena, thus, may contribute significantly to macrocosmic stability. Nonetheless, this can be an exceedingly costly process. Unconstrained by formal, credible agreement, military policy and technology will constantly seek qualitative improvements that approach the limit of what resources can or will be provided. Therefore,

probably the most distinctive — if not the highest priority — objective that qualitative constraint can offer is the objective of reducing the cost of preparing for war. This objective would appear to apply almost equally in areas in which qualitative competition is characterized by indigenous competition in research and new weapon developments and in areas where the qualitative competition is a competition in acquisition from external producer states.

The fourth category of objectives, to reduce political tensions, is closely related to the first category, to reduce the likelihood of war. Instabilities in military balances may produce tensions that become the occasion, if not the cause, for war. It is also conceivable, however, that a war can start by miscalculation or accident. Therefore, it is useful to distinguish between the objectives of reducing the likelihood of war and of reducing political tensions.

The objective of reducing political tensions may well focus on constraining qualitative improvements that are merely irritants to one side or the other and not likely to destabilize the military balance or lead to costly programs of offsetting the improvement. This kind of objective is most applicable in regions in which qualitative competition is just beginning. In areas of a dense military balance or intense confrontation such as Central Europe and the Middle East, it would be exceedingly difficult to identify qualitative improvements that tend toward irritation more than instability. In Latin America and the Indian Ocean area, however, constraints undertaken for the primary purpose of reducing or averting political tensions could be meaningful and significant.

The categories of objectives discussed above are not mutually exclusive. A qualitative constraint agreement may be designed to serve more than one objective. Differing objectives may be held in differing priorities among the parties to an agreement. On the other hand, it is conceivable that in particular instances some of the objectives might not only be mutually exclusive but conflicting. In general, in the conventional area, it would seem preferable to focus on one objective and select the systems for qualitative constraint that are critical to that objective rather than to mix objectives and increase the types of qualitative improvements the agreement attempts to cover. Since different and sometimes competing objectives are at stake in any potential constraint agreement, the problem of designing a desirable agreement and specifying the systems to be controlled and the circumstances of control may be likened at a formal level to optimization methodology. It would appear preferable to seek to maximize the focal objective subject to certain limits on the extent to which other objectives might be endangered. For example, an agreement that pursues the objective of reducing the cost of preparing for war would be formulated subject to the condition that it does not increase the likelihood or destructiveness of war.

Implementation, Verification, and Enforcement

The desirability of a qualitative constraint on conventional armaments can be treated for analytical purposes as a function of whether the constraint properly implemented and complied with would achieve the objectives sought without diminishing or endangering the achievement of other valid objectives. This is a difficult but not impossible assessment to make. Once made, there is the further question of whether the constraint can be implemented with adequate assurance of compliance. It is primarily in this context that the feasibility of qualitative constraints is treated in this study.

Four broad criteria of feasibility are postulated. These may be stated in the form of questions, each of which requires a "yes" answer for a constraint agreement to be assessed as feasible of implementation. The questions are:

1. Is the matter (activity or process, set of items or systems) designated for control distinctive enough so that there are no uncontrolled matters that can perform essentially the same functions with the same impact?
2. Is the matter designated for control inherently controllable in a manner that governments can be held accountable for control?
3. Can control be verified (or violations discovered) by an outside source in a reliable and timely manner?
4. Are there recourses to the discovery of violations or the announcement of renunciation that can either provide enforcement of the agreement or assure timely response?

FORMS OF CONTROL

Most of the dilemmas of determining what types of constraints would, on balance, be desirable and feasible derive from the potentially conflicting objectives of constraint. Even when these are resolvable in particular qualitative competitions, there remains the question of how best (that is, most feasibly) to control the qualitative improvement in question. Another way of putting this question is to ask, "What activity or process is it most feasible to control to satisfy a desired objective of control?"

Potential forms of control are distinguishable by the activity or physical process or specific product to be controlled and may be associated with the entire weapons "life-cycle" from commitment of resources to disposal or replacement. The forms of control examined include control

of: (1) military expenditures; (2) research, development, test, and evaluation; (3) production; (4) procurement and distribution; (5) use; and (6) transfers. Based on these stages, differing opportunities and limitations for arms control purposes are apparent according to the characteristics of the particular stages themselves and according to the nature of the particular innovation or existing weapons system being considered for constraint.

Military Expenditures

Some control of qualitative weapons features may result from agreements to reduce total military expenditures, since at least one stage in the progression to deployment would probably be slowed down. The main arguments in favor of expenditure constraint hold that this is the simplest and most direct means of arms control, for it bypasses technical negotiations on weapon equivalences — a complex and long-drawn out process that historically has been inconclusive. Also, of course, it is pointed out that the financial and other resources saved by reducing military expenditures may be allocated to the beneficial goals of peaceful progress. General budgetary reduction, attractive as it may seem, however, is a shotgun-type approach to qualitative constraints, since it provides no assurance and possibly not even any information as to what weapons or weapons features will become constrained. A budget constraint — whether general or specific to weapons research and procurement — would succeed primarily in narrowing the field of qualitative competition. For the superpowers, this might make the competition potentially more, rather than less, destabilizing unless both sides had rather complete knowledge of the focus of the other's constrained efforts.

Finally, verification of compliance with a constraint on military expenditures would be virtually impossible, given the significant differences among states on how they report and account for their military expenditures and the opportunities that exist for concealing military expenditures in other parts of national budgets. With the resulting low confidence in compliance, a sudden abrogation of a budget-limiting agreement could leave complying parties severely disadvantaged. On balance, attempts to constrain qualitative competition by controlling military expenditures — even those nominally for R&D — appear quite unattractive.

Research, Development, Test and Evaluation (RDT&E)

Proposals to control the research stage of weapons evolution represent a relatively new approach. Despite the current academic advocacy of controls on research and military technology to constrain a qualitative race in both conventional and nuclear weapons, the desirability and feasibility of this form of control seem quite low. Verification

is most difficult especially at the stage of research prior to specific weapon development. Moreover, arms control proposals (e.g., SALT) that establish quantitative limits have frequently been accompanied by expressions of commitments to maintain or even increase research in order to gain domestic acceptance for the specific proposals at issue. Security-minded opponents of limitations on research and technology readily point out a need for military research to keep abreast of or, preferably, to anticipate new weapons developments anywhere, but especially by potential opponents (notably, the Soviet Union). Not to conduct pure and applied research in weapons areas can be seen as culpable neglect of national security.

The test and evaluation stage of weapons development appears to offer more possibilities for qualitative constraint than the research stage. Both the feasibility and the desirability of constraining a qualitative improvement at the stage of test and evaluation depend on certain characteristics of the improvement. These include, particularly, its detectability, its technological distinctiveness, and its military significance. For example, the implications of test firing a missile resemble those of test firing a new machine gun only at a high level of generality. Qualitative constraint recommendations have included proposals that the number of missile firings per year and the range areas in which they are conducted be limited and specified. For surface-to-surface and surface-to-air missiles that require test ranges of such a size that they would be detectable by unilateral national means, such proposals seem acceptable and feasible of implementation. Constraints on test firings and ranges are probably not feasible (and, maybe not desirable) for weapons of lesser types than the missile category. A satisfactory degree of verification probably cannot be achieved. Furthermore, internal pressures to complete the test and evaluation stage of such arms would likely prove to be irresistible.

The technical feasibility of establishing a control that is verifiable depends on the detectability of test firings or other field tests. The desirability, on the other hand, of such control depends more on the improvement's or innovation's technological distinctiveness and military significance.

Production

Control may theoretically be exercised in the next stage — production — in a number of forms: banning the weapon or its type outright, refraining from initiation of production, stopping or suspending production at some point, or slowing down production under a stretch-out schedule. The feasibility of constraints in any of these forms, as at all stages, will be affected by the nature and military significance of the device under consideration, and also by a number of factors peculiar to this stage.

Except in the case of bacteriological weapons, past proposals to ban completely the production of a particular device or category have not succeeded in gaining adoption. The Biological Weapons Convention of 1972 prohibits the development, production, and stockpiling of bacteriological and toxin weapons and provides for destruction (or peaceful diversion) of those existing, along with their means of delivery. In early 1976, there were no other nonnuclear production prohibition agreements in effect that were subscribed to by the United States and most other countries. If a development has advanced to the stage where a design is accepted by the military leadership as offering clear advantages, production, issue and deployment would seem to be the rational course to follow to reap the return on the R&D investment. However, constraints in the production stage are generally more feasible to verify than constraints in the R&D phase (though not necessarily the T&E phase), although a complete ban on production might be very difficult to verify. Where an approximate balance of power exists and several countries are in possession of the innovation, a slow-down in production and the limitation of production to the issue and reserve needs of the existing forces of each country or alliance system would appear to offer some opportunity for constraint.

Procurement and Distribution

Once production of an innovation has begun and is underway, disposition of the output necessarily follows and may be considered for constraint purposes under the headings of procurement and distribution. Parties to negotiation on constraint of a particular weapon or class of weapons may conceivably agree not to procure it for their own forces either from some outside source or from their own production if they are producers.

Analysis of procurement aspects for the purposes of arms control is relatively easy in the case of non-producers. For procurement control among non-producers, perceptions of mutual interest and balance are the key factors, along with the kinds of weapons designated for control. In the conventional field, this form of control might be designed to cover innovative weapons of high effectiveness and cost involving serious security concerns or, at the other end of the scale, non-controversial items on which agreement may be readily secured for the sake of demonstrating good will and showing some progress in arms control. Producer states might become parties to such constraints on procurement by undertaking not to supply the designated arms (see discussion below on "Arms Transfers").

The case of a procurement control among producers contains the same elements as for the non-producers agreement, but is far more complex because of additional political, military, and economic considerations and is probably less feasible. An agreement for complete non-

procurement from indigenous production for one's own forces is infeasible, for it is fanciful to imagine that any state while exporting a useful instrument of war will deliberately exclude itself in advance from the possession or use of that instrument. What is less fanciful and perhaps feasible is an agreement that allowed production and national stockpiling, but excluded (preferably) or limited exports, and constrained indigenous procurement in rate and/or total volume for national forces.

The distribution stage, like the others, includes certain substages or variations. When products come off the line for national procurement, they move into some mix of stockage and prepositioning, limited issue, general issue, or transfer by sales or grants. Constraints on qualitative improvements by withholding issue and stockpiling at the end of the production line appear to be infeasible. Controls on areas of distribution or deployment, however, -- which are, perhaps, more quantitative than qualitative -- appear, to be relatively feasible.

Arms Use

The Geneva Convention of 1925 precluding its signatories from the use in war of poison gas and bacteriologicals represents the kind of control -- by complete exclusion, on a global basis -- particularly suitable for these weapons and distinctive to them. The casualty producing effects of both can be accomplished by other weapons. Both carry the long-standing opprobrium of inhumanity identifiable at least since 1899, a condition not attaching to other weapons -- even nuclear -- in the same degree. These factors have been of leading importance in making use prohibitions feasible. Agreements prohibiting the use of a revolutionary new development of mass destructiveness, however, if not attained at the test stage, would probably have both high feasibility, as well as desirability, only if its general characteristics appear to be comparable to gas and bacteriological weapons.

Arms Transfers

As discussed earlier, the motivations of arms transfer suppliers are a mix of political, military, and economic factors. In the face of the strength of such motivations and the present widespread proliferation by transfers, how feasible are constraints designed to control the transfer of qualitatively improved weapons? It is difficult to imagine purely technical reasons that would preclude or seriously hamper control of transfers. No stage in the weapons life cycle would seem to offer a more feasible opportunity for qualitative constraint than the stage of arms transfer. The chief obstacles are not technical, military, or economic, but political.

Proposals for agreement among producers to confine arms distribution to their own or allied armed forces may reasonably be drawn up without seriously adverse implications for the economy or the security of either superpower, the PRC, or those other, secondary powers who together constitute the world's main suppliers. Control of transfers by the principal producers could, no doubt, never be absolute but would greatly diminish and dampen the traffic and is believed feasible, given a favorable political environment. Development of a favorable political environment would require a searching examination by participants of their national policies and objectives, along with intensive negotiations in which the extension of influence by arms transfers — including sales, grants, and training — would be severely restricted or rejected as an instrument of international action.

TYPES OF AGREEMENT

By agreement is meant a negotiated undertaking accepted and legally ratified by two or more national states. The forum for the conduct of the negotiations may or may not be the United Nations. Post-World War I and II experience shows that the more successful arms control measures have been ad hoc agreements developed outside the world body.

The structure, or type of any particular agreement is determined by five general considerations: the objective (a function of desirability and utility); the scope of participation; the form of control; the degree of constraint adopted; and the manner of implementation (including verification). Each of these factors has a number of variations, or options, making possible — at least theoretically — a wide variety of combinations. The selected combination of options defines the agreement.

The study postulated four illustrative candidate agreements (identified briefly in the conclusions below), each reflecting the principal characteristics of the arms competition and the prevailing conditions in the selected world area. For the Central European region of US-USSR, NATO-Warsaw Pact confrontation, a technological constraint was considered. For the Middle East, with its explosive political tensions and proliferation of increasingly sophisticated weaponry, control was examined in terms of a multilateral producer/supplier constraint; in Latin America, however, the prevailing situation suggested support of multilateral consumer agreements. For the Indian Ocean, the problem was addressed as a limitation on US and USSR naval force deployments.

CONCLUSIONS

The US public consensus — reflected in the policies of all the post-World War II administrations — appears to support an openness to,

if not an active pursuit of, arms control as one of the principal means to national security. In this consensus, arms control measures — if the circumstances are right — are consistent with basic national security objectives that are also pursued, complementarily, by military policies. The fundamental problem for US policy is determining when the circumstances are right — or, conversely, how much opportunity the US has for influencing the circumstances — for effective and verifiable arms control.

In general, qualitative constraints on conventional armaments vis a vis US national interests are abstractly desirable at least from a resource conserving point of view in competitions in which the US is directly involved, but ambiguous because of a US interest in maintaining a technological lead. In such competition the final judgment on desirability of any particular constraint would depend on showing not only that it is feasible to implement with assurance of compliance, but that the technological lead involved may be perishable anyhow. Qualitative constraints in competitions in which the US is not a principal contestant would be abstractly desirable principally for reasons of reducing the buildup of political tensions and the dangers of war and, perhaps, somewhat less ambiguous from the point of view of other (i.e., economic and foreign policy) US interests if they also can be shown to be feasible to implement with assurance of compliance.

The specific conclusions of the study are as follows:

1. The record of past attempts to negotiate qualitative constraints on conventional armaments is characterized by mostly futile efforts to achieve or preserve a perceived military advantage, to distinguish offensive and defensive weapon systems, to calculate mutually acceptable force or weapon equivalences, and to invoke the goal of general and complete disarmament as a moral alternative to war. Nonetheless, negotiations have succeeded in a few cases in constraining potential developments that were broadly perceived to be especially destructive or destabilizing.

2. Qualitative improvements in conventional armaments are competitively sought by modern states for strong military, political, economic, and technological reasons. States are willing to commit substantial resources and endure significant opportunity costs in order better to ensure their security through competition that has been qualitative as well as quantitative in almost all areas of the world.

3. Qualitative competition in conventional armaments between high-technology, industrialized, nuclear-armed states — notably the United States and the Soviet Union — is likely to be macrocosmically stabilizing, but may, in fact, be microcosmically destabilizing, entailing high costs. Comparatively, however, qualitative conventional competitions

are likely to be macrocosmically destabilizing in lesser-developed regions, notably the Middle East.

4. As a precondition for negotiation and implementation of a control agreement, there must exist among the parties some minimum degree of mutual or common recognition that the constraint is more desirable than the unconstrained competition that might ensue in the absence of agreement. An agreement, in general, is likely to be successful only if the parties perceive a condition of approximate military balance, and, finding the status quo to be relatively acceptable, aim to avert potential future imbalances more than to adjust current imbalances.

5. The desirability of particular qualitative constraints is a function of interrelated and variable military, political, economic, and technological factors, none of which is necessarily dominant in every situation. Considering such factors in particular circumstances, the desirability of constraints may be evaluated in terms of objectives to accomplish one or more of the following:

- a. To reduce the likelihood of war;
- b. To reduce the destructiveness of war if it occurs;
- c. To reduce the costs of preparing for war; and
- d. To reduce political tensions.

These categories of arms control policy objectives are not inconsistent with most aspects of military policy objectives. They may, however, be competitive among themselves; for example, higher costs might have to be accepted in an agreement to reduce political tensions should the latter objective be assessed as more urgent and desirable.

6. The feasibility of implementing a qualitative constraint will be largely a function of how well the activity or process of qualitative improvement or the end-product item or system can be distinguished and its control be subject to timely verification of compliance with the agreement. Since international or third-party inspection and enforcement means can generally not be regarded as reliable for states where their national security may be at stake, feasibility will depend largely on whether compliance with the agreement or detection of violations can be verified by unilateral national means and whether adequate and timely responses to violation are available to complying states.

7. Although the growth in arms technology would appear to offer in theory a wide range of opportunities for qualitative constraints,

in practice, the field is circumscribed by both desirability and feasibility analyses. The least feasible forms of control are those over research and military budgets. For truly major improvements or weapon "breakthroughs," the early test stage is the first point in development where it is feasible to apply constraint. For other conventional armament improvements, the later stages of production, distribution, and transfer offer better opportunities. The high pace of quantitative and qualitative arms acquisition in the Middle East in particular suggests controls on the transfers of sophisticated arms to that region.

8. The following candidate agreements discussed in the Main Report and supported by the appendices to this study, are offered and recommended for further consideration and analysis:

a. An agreement among high-technology states to ban production of advanced vehicular armor; objective: to reduce military costs and prevent military destabilization.

b. A producers/suppliers agreement to control conventional arms transfers to the Middle East; objective: to reduce political tensions and the likelihood of war in the area between Israel and one or more of the Arab states by constraining the input of destabilizing arms.

c. A consumers agreement to control procurement of sophisticated conventional arms in Latin America; objective: to reduce political tensions and prevent both military destabilization and cost increases through constraints on imports.

d. An expandable but initially bilateral agreement between the US and USSR to limit conventional naval strengths in the Indian Ocean; objective: to reduce the likelihood of naval confrontation and inadvertent hostilities between naval forces deployed in or transiting the Indian Ocean, to reduce political tensions in the area, and to provide incentives for Indian Ocean states to exercise restraint in naval acquisitions.

9. On balance, it appears that selected qualitative constraints on conventional armaments could be both desirable and feasible in particular arms competitions. The principal criteria for selecting those qualitative improvements to be constrained are those that appear in the specific competitions to be destabilizing in either a macrocosmic or a microcosmic sense and for which a feasible form of control can be identified. Though limited in number, significant opportunities appear to exist for US initiatives in this neglected area of arms control.

