

TACTICAL NUCLEAR WEAPONS

AN INTRODUCTION FOR THE GENERAL READER

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PREFACE

When I first undertook to write an Honors Dissertation, I chose for my general subject that of Nuclear Weapons. Not, I might add, out of any great personal interest in them, but rather because of a sense of obligation to understand the nature of what is, in the final analysis, the fundamental military and political fact of our time. The existence of a capacity, on the part of several different and rival governments, to virtually incinerate the greater part of modern civilization is the ultimate limiting factor affecting the policies and goals which the United States can set for itself in the international arena. The ultimate price of miscalculation in International Politics today is not merely War, or even defeat in War, but total, assured destruction.

Within the rather narrow bounds of the general subject of nuclear weapons lies the even more specialized field of 'tactical nuclear weapons,' a widely misunderstood and often ignored topic. I ignored it myself for quite a while after beginning my research. Gradually, however, noting the onset of a period of (hopefully) stable parity between the strategic nuclear arsenals of the Superpowers, and simultaneously great increases in what had already seemed a great Soviet superiority in conventional forces along the European front, I became convinced that tactical nuclear weapons had become a very important subject indeed. This is because tactical nuclear weapons occupy that place on the escala-

tion scale between conventional warfare and the use of the strategic nuclear weapons of the Superpowers.

It is therefore my purpose in this paper to provide the general reader with the basic factual and conceptual information which he will need to make judgements, consistent with his own value system, concerning issues to which tactical nuclear weapons relate. At the very least I hope to suggest the questions which ought to be asked, and to demonstrate the relevance of the tactical nuclear weapons controversy to many other current issues.

Quite a number of individuals have been of help to me in this project. Of the faculty at William and Mary, Dr.s Franz Gross and A.Z. Freeman have been of great help, Dr. Gross in providing advice, information, and source suggestions which I might otherwise have overlooked, and Dr. Freeman in providing me with at least one valuable contact in the military establishment. Dr. Manfred Ernst, my Thesis Director, in addition to providing me with general direction and with valuable source materials, has caused me to investigate several important areas I would otherwise surely have ignored. His questioning has forced me to more rigorously analyse my own views, and he of course merits my special thanks. Along with Dr.s Gross, Freeman, and Ernst, Lt. Col. Lawrence Mills (of the Military Science Department) and Dr. Gilbert McArthur have graciously consented to serve on my Examining Committee. All five have taken

time to discuss with me their feelings and views about my topic, and thus helped me better to understand my own. Dr. J.J. Thompson has been of great help in clearing up the bureaucratic morass in which this project had me mired for some time, and in providing general encouragement.

I'd also like to thank Maj. Gen. Norman Anderson, (USMC, ret.), Brig. Gen. Fricaud-Chagnaud (French Military Attaché), Lt. Col. Dieter Kellein (of the West German Embassy), and especially Mr. A.G. Murdoch of the NATO Information Directorate in Brussels, for their kindness in expressing their views and in providing factual information. The office of Congressman Joseph L. Fisher provided me with useful Congressional documents. Mrs. Polly Oliver did a truly excellent job of typing the thesis for me at most reasonable rates.

To each of these, many thanks.

Regarding the content of the paper, I am, of course, solely responsible for any errors of fact or opinion. The reader will notice that I have not hesitated to use the first person when stating a purely personal opinion or in explaining a personal choice of approach to a particular problem. While this may conflict somewhat with tradition, it avoids a lot of awkwardness and artificiality, and serves as a clear indication when my personal biases are at work.



Christopher Bassford

April 15, 1978

CHAPTER 1
INTRODUCTION

Introduction to the Chapter

The United States currently possesses something over thirty thousand nuclear weapons.^{1*} Of these, some nine thousand are assigned to American strategic forces, and are principally targeted on the fixed military, industrial and population bases of the Soviet Union. These weapons are aboard the 1054 U.S. 'Minuteman' and 'Titan' Intercontinental Ballistic Missiles, the approximately 500 manned bombers of the Strategic Air Command, and the 656 Submarine Launched Ballistic Missiles carried by our 41 nuclear missile submarines.

However, it is the more than twenty thousand other nuclear weapons with which this paper is concerned. These are the weapons which have been earmarked for 'tactical' use, and they are distributed around the world, almost anywhere that there are sizeable U.S. military forces. They include nuclear depth charges and torpedoes, Surface-to-Air Missiles, air delivered bombs and missiles, nuclear artillery shells, Atomic Demolition Munitions (essentially nuclear land-mines), and a wide variety of Surface-to-Surface Missiles. They are interchangeably referred to as either 'tactical nuclear weapons' or as 'theater nuclear weapons.'

For most purposes, tactical use of a weapon can be defined as its use against elements of the enemy's military forces, in direct support of friendly forces engaged in tactical combat operations. Strategic use involves strikes

against enemy industrial or population bases, made in order to reduce his long-run capacity to sustain military operations. Clearly, strikes against the enemy's National Command Authority or against his own strategic nuclear forces must be considered strategic in nature. There are, however, several areas of ambiguity in these distinctions. Strikes against military staging areas and supply facilities directly supporting front-line forces, for instance, do not fall clearly into either category. There are also important psychological considerations and matters of perspective to take into account. Destruction of a railway center in Warsaw, Poland, for example, might justly be regarded by both the United States and the Soviet Union as a tactical strike. It seems likely that the Poles would view it otherwise. A similar strike on a similar facility within the actual territory of the Soviet Union might be viewed as being essentially strategic in nature. It might depend on the point in the fighting at which such a strike was made. If made early, before the ground-rules for limited use of nuclear weapons had evolved adequately (either by explicit or by tacit agreement between the adversaries²), such a strike might touch off escalation to full-scale strategic war. If, however, it came after the establishment of a 'tradition' legitimizing such attacks, it might pass as routine. So, simply defining our subject raises the question of nuclear 'thresholds,' probably the greatest single source of controversy in the debate over tactical nuclear weapons.

The nuclear threshold is the level of political or military crisis which will prompt one or both sides to use nuclear weapons. Whether there is one clear threshold, or several graduated thresholds, is a matter of great debate among theorists, and we will address the problem directly in Chapter III.

The term 'tactical nuclear weapons' is misleading in at least one respect. There is no technical way of classifying a particular weapon as either 'tactical' or 'strategic.' Any given weapon can theoretically be used in either mode, and some identical weapon systems have assignments in each category. Using an Intercontinental Ballistic Missile (ICBM) to destroy an enemy tank invading West Germany would clearly be a tactical use. On the other hand, an atomic hand-grenade^{3*} thrown into a Soviet ball-bearing plant would with equal clarity be of strategic use. This is a rather extreme example, but it serves to illustrate a principle: Although in general weapons considered 'strategic' are of larger explosive yield and possess longer ranges, it is the assigned use of the weapon that determines its designation as tactical or strategic, and particular characteristics of a given weapon play no direct role in that designation.

The term 'theater nuclear weapons' is unsatisfactory to me simply because it does not describe either the weapons or their military use. All it does signify, in fact, is the hope of strategic planners that their use can somehow

be restricted to a narrow geographic area. This is at least somewhat doubtful, and is again a matter of thresholds.

In any case I shall leave this issue unresolved, and the reader may translate the standard abbreviation 'TNW' as meaning either 'tactical' or 'theater' nuclear weapons.

Of particular importance to anyone interested in American Military or Foreign Policy are the approximately 7,000⁴ TNW assigned to American air and ground forces in Europe. The rest are stationed at sea or in areas where the likelihood of their use is dramatically lower. The only notable exception to this is South Korea, and most of the more than 1000 TNW there will presumably⁵ be withdrawn along with American ground forces, as planned by the Carter Administration. While TNW designed for use at sea, in space,^{6*} or high in the air will be touched on occasionally, it is the weapons deployed to Europe, and intended for the land-battle there, with which this paper primarily deals.

Prior to the Vietnam War, and since its conclusion, Europe has been the prime focus of American military planning and preparation. American Foreign Policy-makers generally view Europe as the most important area for concern, as it is with Europe that the United States shares the strongest traditional, political, and economic bonds. Furthermore, it is in Europe that American military power most

directly confronts that of the Soviet Union. The American TNW assigned to the European Theater are considered to be critical to both the defense and the political cohesion of the Western Alliance. American and Western European Defense Policy is founded, to a great but little recognized extent, on the American TNW stationed in Europe and assigned to NATO tactical forces there. Political and economic considerations, rather than primarily military reasons, have prompted this development. Tactical weapons have been touted as a cheap substitute for the manpower which the West is unwilling, perhaps unable, to provide to counter perceived Soviet numerical superiority.⁷ TNW serve, along with 300,000 U.S. military personnel and their dependents,^{8*} as a visible guarantee of the American commitment to European defense. They are believed to provide the greatest visible deterrent to Soviet aggression.

Aside from their importance to the political and military security of Western Europe, these weapons play a critical role in the strategic defensive posture of the United States itself. Because of the differing strategic and geopolitical situations of the U.S. and Western Europe, however, certain inherent conflicts exist between the American and European conceptions of the roles American TNW should be called upon to play.

These differences extend to basic strategic theory. On such key theoretical concepts as Deterrence, Warfighting Capability, Flexible Response, and others (to be explained

in the appropriate later sections of this paper) there are fundamental differences of interpretation and of emphasis between the United States and her European allies, and, for that matter, between NATO and the Warsaw Pact. These differences raise serious questions. Are these weapons in fact a substitute for larger conventional forces? Do the political roles these weapons play interfere with their military and deterrence functions? Do their current dispositions offer the optimum value as a deterrent to Soviet aggression? Do they instead pose a provocative threat, or an enticingly vulnerable target, encouraging that aggression? If deterrence fails, are these weapons properly designed and deployed to provide NATO forces with a real war-fighting and warwinning capability? If not, why not?

There are NATO/U.S./Warsaw Pact differences with virtually every aspect of TNW: the specifics of their design (size, range, payload, and emission spectrum); their deployment and positioning; their targeting; the circumstances under which they would be used. All these are points of controversy.

Perhaps the question which most interests military writers on the subject of TNW is, can they be used? Not merely can they be used without fear of an inevitable escalation to all-out strategic war, an absorbing and vital problem in itself, but simply is it practicable to fight a war using nuclear weapons in support of conventional air, sea and ground forces? Can such a war be fought with any

semblance of tactical or political control? Can we expect any outcome remotely resembling traditional concepts of victory, defeat, or even stalemate?

These are the sort of questions which, in the absence of actual experience, one cannot answer with any degree of assurance. No one has ever fought a nuclear war.^{9*} Simply to ask the questions involves problems of definition, the contemplation of nearly incomprehensible complexities, and the acceptance of irresolvable ambiguities. The questions are still worth asking, however, if only to demonstrate the essential difficulties inherent in any attempt to prepare for military or political contingencies which have yet to arrive. If it accomplishes that end, this paper will have performed one part of its purpose.

Perhaps the key, all-inclusive questions which may be asked are two questions with which we will deal in the conclusion of this paper. First, to what extent do theoretical development, actual policy, and the nature of the weapons, coincide? That is, are the policies under which the weapons have been deployed consistent with the actual characteristics of the weapons, and have either the policies or the weapons been designed in accord with the theoretical rationales which are behind their existence in the first place? Second, if policy, theory, and the characteristics of the weapons do not entirely reinforce one another, to what extent is this lack of consistency due to inherent features of the political and strategic situation in which

the United States today finds itself? To what extent can improvements reasonably be expected? I will suggest my own conclusions.

In discussing TNW, the interrelationship between various aspects, technological, strategic, and political, makes difficult the presentation of ideas and information in an orderly way. The solution followed, while perhaps not entirely satisfactory, has been to write what are essentially three separate papers, each dealing with TNW from a different standpoint, and each referring to the others for discussion of issues which fall outside of its specific limits. Chapter II covers the more technological aspects of TNW. This section will discuss the capabilities, limitations and effects of TNW systems, their general technological features, their deployment in Europe, and the relationship of these factors to the political and military roles TNW may be called upon to play. That such technical information is vital to understanding may not be immediately evident, but many of the controversies over TNW hinge on what may seem technical details. The furor over the 'Neutron Bomb' is a good example.

Chapter III will discuss TNW from the standpoint of strategic theory. After a basic introduction to such key theoretical concepts as Deterrence, Escalation Dominance, and Thresholds, a Model of a conflict will be examined to

see how these concepts interrelate, and to demonstrate their implications for the debate over TNW.

The fourth chapter's focus is on NATO, and the role which TNW play in the Western Alliance. Key differences in the situations and outlooks of the United States, her Western European allies, the USSR, and the Soviet client states of Eastern Europe will be examined. Some consideration and assessment of NATO's overall military capabilities vis-à-vis the Warsaw Pact will be included, although any detailed treatment of that matter must lie outside the scope of this paper.

In the concluding chapter we will attempt to provide some answers to the questions raised in this introduction.

A few important points: Every attempt has been made to keep ideological biases from coloring the analysis, but certain fundamental biases are inescapable. My own views are that the Soviet Union is today and has been for some time the greatest threat to world peace, and that Soviet domination of the entire European continent would pose an intolerable threat to American security. I thus accept whole-heartedly the principle that the United States must, in her own interests as well as in the interests of her allies, retain the capacity to protect Western Europe against military pressure from the East. I do not really expect the USSR to make an overt attempt at the conquest

of Western Europe, but continual psychological pressure based on a Russian projection of overwhelming military superiority could, in the long-run, produce the same political results. Neither do I rule out the possibility of a military conflict in Europe. In any such conflict the NATO nations could find themselves drawn into a war in which, in the eyes of most observers today, they could not prevail short of the use of nuclear weapons.^{10*} TNW may therefore represent the only option between the conventional defeat of NATO and the outbreak of a war involving the strategic nuclear arsenals of the Superpowers.

These basic views of mine underlie my analysis, and readers who do not share them should keep this in mind. However, when viewed in the light of these basic assumptions, the question of whether and how TNW should be deployed becomes a technical question, and one on which I started my research sufficiently confused to be considered effectively impartial.

One last point: Throughout this paper the intentions and capabilities of the Soviet Union receive what some might consider short shrift. The focus is almost exclusively on the view from the West. There are several reasons for this. First of all, any and all information issued by or about the Soviet Union is suspect.¹¹ Where such information is available, and not deliberately erroneous, it is subject to so many different interpretations as to be of doubtful value. As to Soviet intentions, I am

forced to agree with Churchill that Russia is "a Riddle, wrapped up in a Mystery, inside an Enigma." While it is naturally useful to quote the best (or most widely accepted) Western estimates of Soviet military capabilities, I do not feel that my own understanding of the USSR has reached a point where I could confidently make assertions regarding the accuracy of these estimates, or offer any consistent interpretation of Russian behavior. For those interested, however, the footnotes and bibliography contain reference to several works which may prove enlightening in those areas.

1. Estimates vary, and the total changes from year to year as obsolescent weapons are retired and new ones added. These figures are from Center for Defense Information, Current Issues in U.S. Defense Policy (New York: Praeger, 1976).
2. Thomas Schelling discusses tacit bargaining tactics in The Strategy of Conflict (New York: Oxford University Press, 1960) pp. 21-52.
3. I know of no nuclear hand-grenades. They would probably be rather cumbersome devices, as about 12 kilograms of nuclear fuel is needed to produce an explosion. Laurence Martin, Arms and Strategy (New York: David McKay Company, Inc., 1973) p. 50.
4. The exact number is classified, but reliable estimates are available. See Jeffrey Record, U.S. Nuclear Weapons in Europe (Washington: Brookings, 1974).
5. At least the weapons held by U.S. Ground forces. The U.S. air units to be left there will probably retain their nuclear armaments.
6. Testing of nuclear weapons in Space is prohibited by treaty but some weapons, notably the ABM, are designed to explode in an airless environment, presumably space.
7. Eisenhower described them as being "more bang for the buck." Alexander L. George and Richard Smoke, Deterrence in American Foreign Policy: Theory and Practice (New York: Columbia University Press, 1974), p. 28.
8. American military dependents in Europe number about a quarter-million. Armed Forces Journal (September 1977) pp. 12-13.
9. Wargames, however, have been fought using simulated TNW. Two of these wargames, 'Carte Blanche' and Sagebrush,' are discussed in Chapter IV.
10. There is another view, and it will be discussed in Chapter IV, in the discussion of NATO vs. Warsaw Pact conventional strength.
11. Not all such faulty information emanates from the USSR's own information services. There are numerous U.S. agencies, private and public, which seem to specialize in the production of disinformation about the Soviet Union.

CHAPTER II
TACTICAL NUCLEAR WEAPONS
TECHNOLOGY

Introduction to the Chapter

In this chapter we examine the general characteristics, capabilities and limitations of tactical nuclear weapons. We relate these characteristics to the political and military roles these weapons may be called upon to play. In the light of these general considerations we then examine the actual nuclear weapon systems in place in Europe. In the course of this discussion we introduce most of the basic terminology which is used elsewhere in discussing these weapons, and at least allude to many of the basic problems of strategic theory and of NATO policy which are discussed in later sections.

In order to ease the discussion of technological factors and their implications, we accept, for the purposes of this chapter, the basic premise that it is in fact possible to wage a geographically limited nuclear conflict. Implicit in the fact that 'tactical' nuclear weapons are actually deployed is the assumption that they can be used, or at least that it is desirable for some reason to pretend that they can be used. In either case, TNW must be designed to accomplish the actual tasks they may be called upon to perform. A serious divergence between actual weapons' characteristics and their announced purposes can lead to conflict and suspicion, among allies and between adversaries.

This chapter is intended to provide the reader with an understanding of nuclear weapons technology sufficient to enable him to make reasonable personal judgements re-

garding issues which may involve technological details, like the current controversy over the 'Neutron Bomb'. A better understanding of the physical nature of our subject also cannot help but improve the reader's ability to understand the complex political and theoretical debates which surround TNW.

General Considerations

We will begin our look at the technical aspects of TNW with a general introduction to the characteristics of nuclear weapons. What we are looking for is technical information of direct relevance to the political and military roles of TNW, and thus scientific background will be kept to a minimum.

When looking at the characteristics of nuclear weapons it is useful to divide these into three categories: characteristics of the explosive warhead itself; characteristics of the system by which it is delivered to its target; characteristics of the weapon's launcher.

Considering warhead characteristics first, what we are primarily interested in is the effects of detonation. These fall into two basic categories, Blast and Radiological Effects. The explosive power of a nuclear device is called its 'Yield', and is measured by reference to the amount of the chemical explosive TNT required to produce an explosion of equal force. The two most common units of measurement used are the Kiloton (KT), and the Megaton (MT), meaning respectively the equivalent of 1000 tons and

1,000,000 tons of TNT. The bomb dropped on Hiroshima was designed to yield 20 KT, although the actual yield seems to have been somewhat less.¹ The yields of individual U.S. strategic warheads are generally in the range of 1-5 MT, although the Titan ICBM, of which we have 54, may carry up to 10 MT.² Some American strategic missiles carry several individual warheads, which may each be considerably less powerful than 1 MT.^{3*} Soviet strategic warheads are generally much bigger, the lower limit being about 1 MT, and they range up to around 25 MT. Although much larger warheads have been tested, these are not considered to have any practical use, and none seem to have been deployed in any functional weapon system.⁴

Beginning in the 1950s successes were achieved in producing nuclear weapons with yields of less than 1 KT. These 'sub-Kiloton' weapons, or 'mininukes', some with yields smaller than the largest of conventional weapons, offered great encouragement to those with hopes of producing true 'battlefield' or 'tactical' nuclear weapons. Today many weapons assigned to tactical use can produce sub-Kiloton explosions, while others remain capable of blasts of up to a Megaton. In general then, TNW yield in the range of less-than-one Kiloton to one Megaton.^{5*}

Roughly half the energy of a typical nuclear weapon exploded in the atmosphere (and most such weapons are designed to 'air-burst') is released in the form of 'Blast.' A one-Megaton airburst at 10,000 feet would be able to

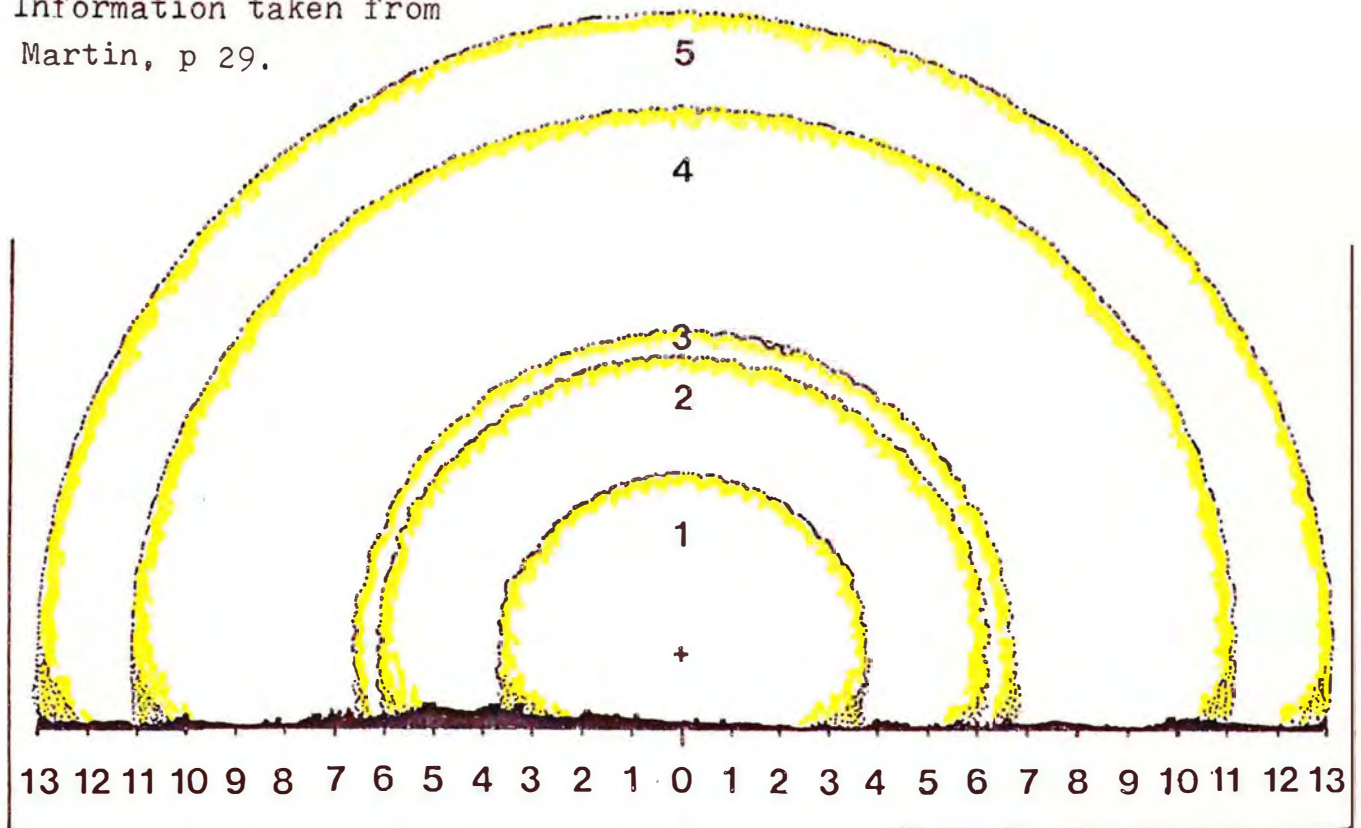
knock down brick buildings within a ground radius of 3.5 miles, thus flattening an area of some 40 square miles.⁶ The overall effects of such a blast are shown on page 21.

The second characteristic of a nuclear explosion is the release of large amounts of radiation. The remaining 50% of the energy released in the described explosion would come in this form. Some 35% would be released as Heat, or Thermal Radiation. This thermal radiation is largely generated in the first few moments of the explosion, and can burn and blind people, and start fires up to distances of several miles. This distance will vary with atmospheric conditions and with the size of the weapon.

The non-thermal radiation, comprising some 15% of the total energy output, is released as nuclear radiation. This, in turn, comes in two different forms, 'Prompt' and 'Residual' radiation. The 'prompt' radiation is that released within the first minute after the explosion begins. It radiates through the surrounding area and disappears. Its penetrative and lethal effects are very great. A human being one mile from the explosion described above would require some 50 inches of concrete between himself and the blast's center to provide adequate protection merely from the prompt radiation released.⁷

The 'residual' radiation comes mainly in the form of radioactive 'fallout.' Fallout is composed largely of the leftover debris of the weapon itself, especially if the weapon is exploded high in the air. If the fireball

Information taken from
Martin, p 29.



EFFECTS OF A ONE-MEGATON AIRBURST AT 10,000 FEET
(all distances given in miles)

1. Complete Destruction of Brick Structures.
2. Ignition of Fabrics.
3. Lethal Winds.
4. Blistering Burns.
5. Light Damage.

touches the earth, however, large amounts of material may be vaporized, drawn up into the explosion, and made radioactive. This material cools and re-solidifies as fine, radioactive dust, and may linger in the upper atmosphere for years. It may also return to earth downwind over the next few hours or days as fallout, making large areas of land dangerously radioactive.

The effects of bomb blasts are widely understood, and there seems little need here for a detailed discussion of

blast's effects on either people or man-made structures. Radiation effects, on the other hand, are less well-known, although they are well-enough understood to inspire widespread horror. It is, in fact, the combination of unparalleled and unimaginably great blast effects with silent, invisible, and deadly nuclear radiation that gives nuclear weapons their psychological and political power. Therefore a short discussion of the effects of nuclear radiation on human beings is useful.⁸

Nuclear radiation destroys body cells, and is more destructive of some organs than of others. The nervous system seems particularly susceptible. The gastrointestinal and blood-manufacturing systems also are areas where radiation may have an especially strong impact. An individual affected by radiation may suffer severe damage to all of these areas. The magnitude of the damage is largely dependent on the actual amounts of radiation received, though factors like age, physical condition and even emotional state may be important variables. The amount of radiation to which a human being is exposed is measured in 'Rads'.

Current U.S. Army radiation casualty guidelines divide victims of nuclear weapon radiation into four categories.

A. Immediate Permanent Incapacitation: This requires a dosage of about 18,000 Rads, and entails the total physical incapacitation of its victims within five minutes. They will remain totally incapacitated until death, which will occur within one day.

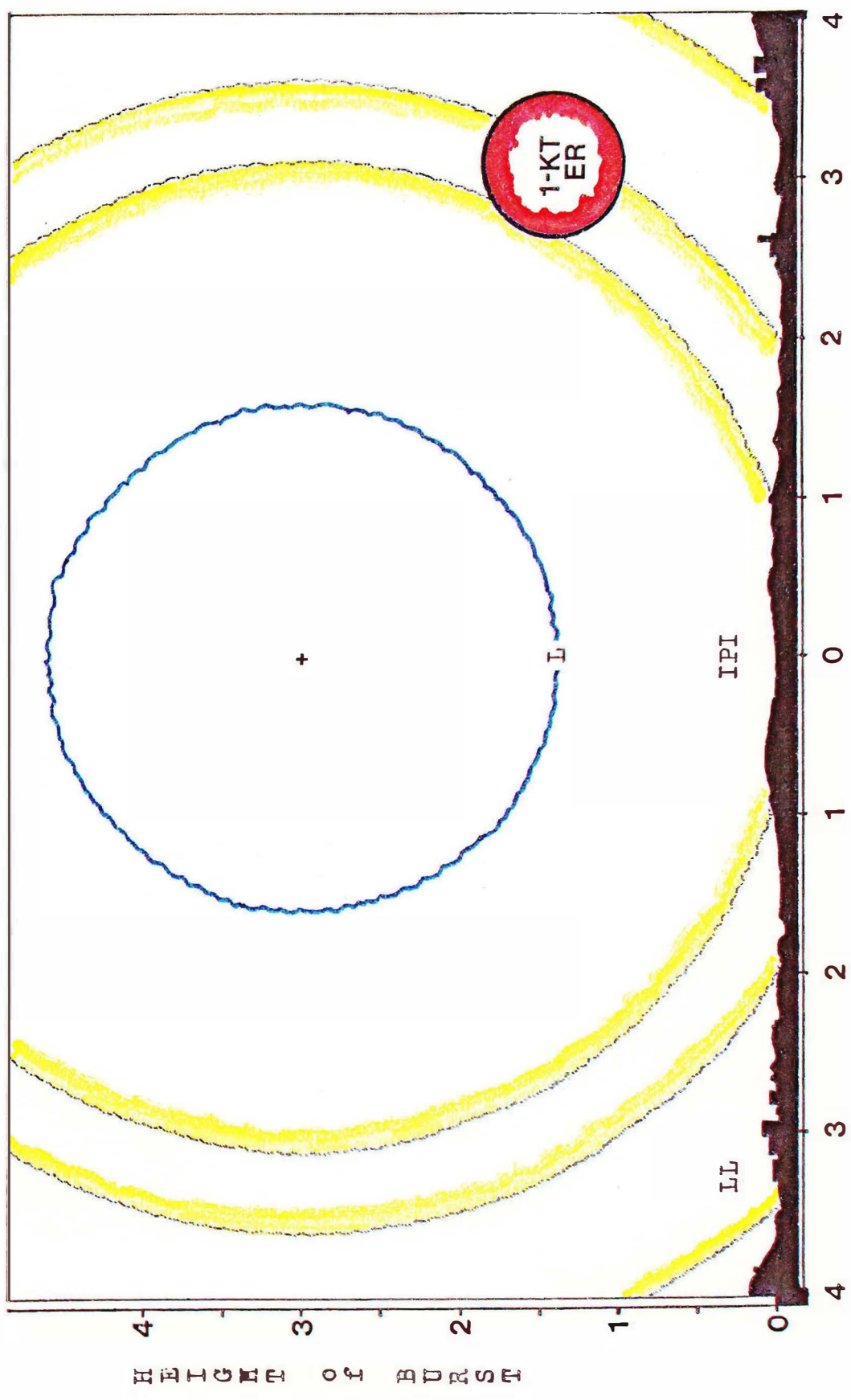
B. Immediate Functional Impairment: Such casualties will be rendered incapable of any physically demanding activity within five minutes, and will remain so until death, which will occur within one to three days. A dosage of about 8,000 Rads will cause this kind of casualty.

C. Immediate Transient Incapacitation: These casualties will become incapacitated within five minutes, and will remain so for the next thirty to forty-five minutes. They will then recover partially, but will remain functionally impaired until death, which will come in four to six days. Three thousand Rads is the mean dosage which produces this level of casualty.

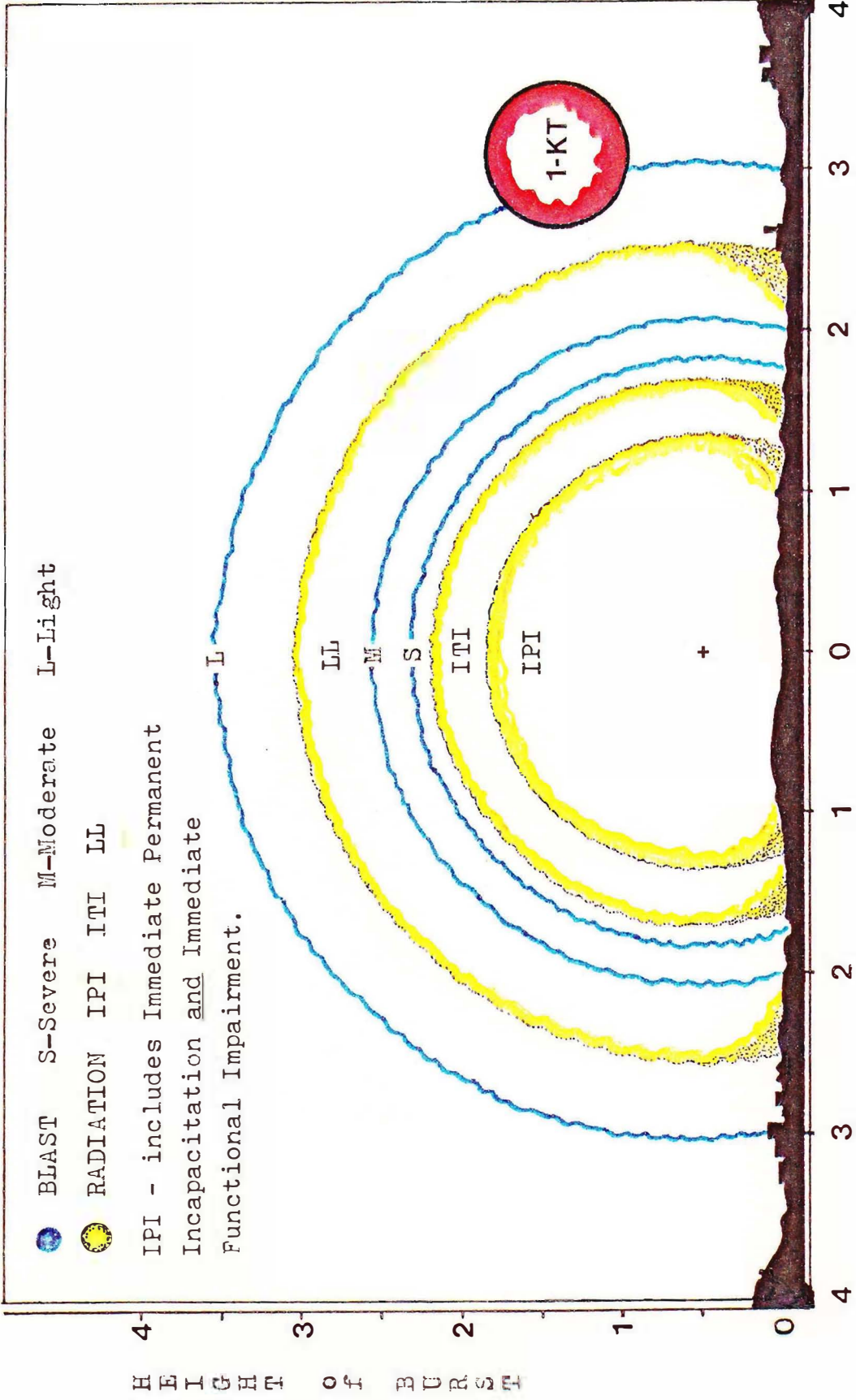
D. Latent Lethality. Victims of a dosage of between about 800 and 500 Rads can expect to become functionally impaired within about two hours. The majority of these casualties will die within several weeks. Some may respond to medical treatment and survive.

Victims of less than 500 Rads may expect to survive, but even 100-200 Rads is sufficient to produce temporary symptoms of radiation sickness. These include nausea, vomiting, internal bleeding, loss of hair and teeth, convulsions, and other traumatic effects.

The charts show the radiation effects of three nuclear weapons, similar to those fired by U.S. nuclear artillery. With small weapons, the area of radiation hazard is far larger than the area affected by blast. This changes with increases in weapon size, and above about 10 Kilotons the



COMPARISON OF 1-KT, 1-KT ER, AND 10-KT WEAPONS EFFECTS
(all distances given in thousands of feet)



L - Light

M - Moderate

S - Severe



BLAST

LL - Radiation



RADIATION

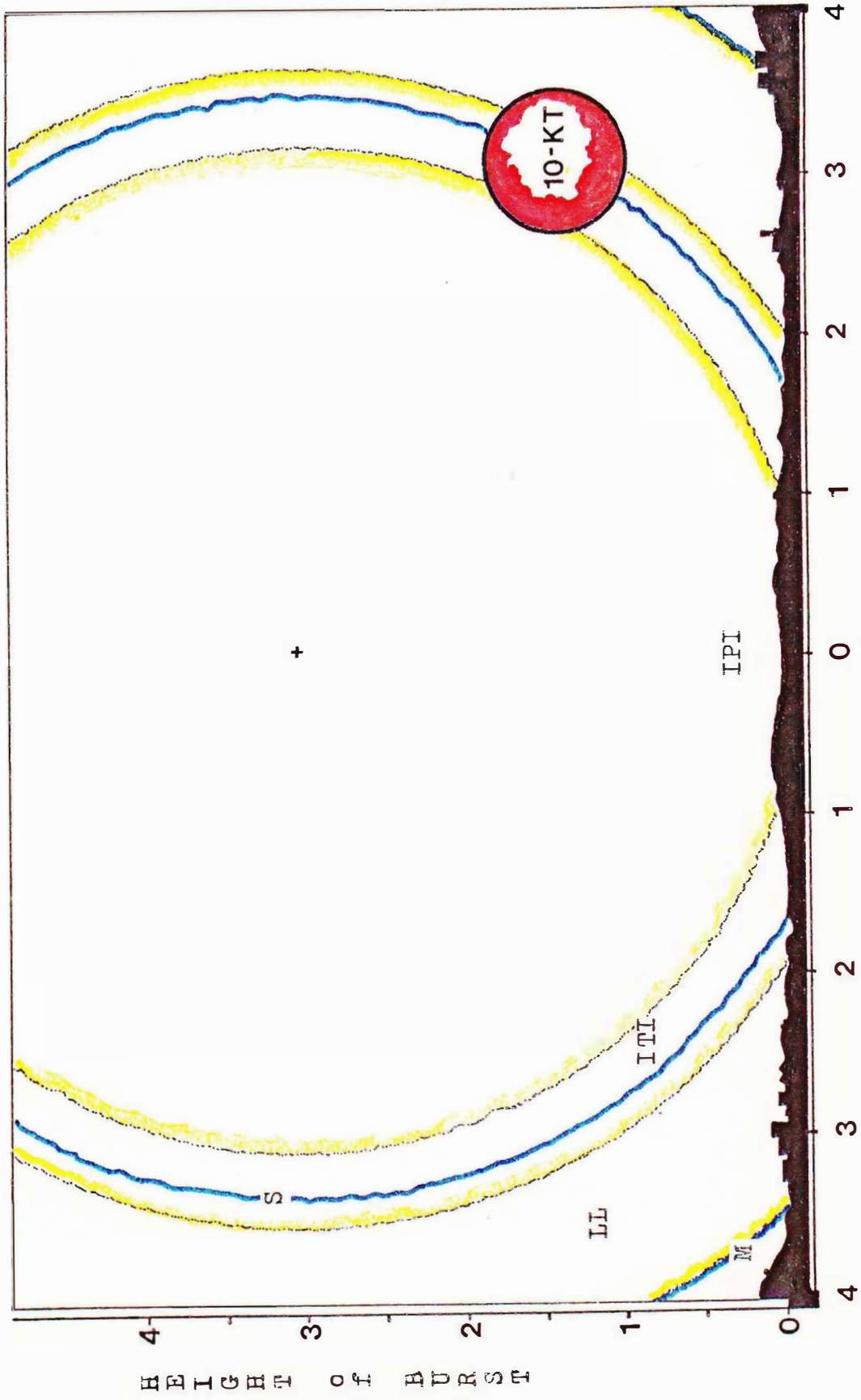
IPI - includes Immediate Permanent Incapacitation and Immediate Functional Impairment.

ITI - Immediate Permanent Functional Impairment.

COMPARISON OF 1-KT, 1-KT ER, AND 10-KT WEAPONS EFFECTS

(all distances given in thousands of feet)

Information taken from Cohen, p. 12.



COMPARISON OF 1-KT, 1-KT ER, AND 10-KT WEAPONS EFFECTS

(all distances given in thousands of feet)

area affected by blast exceeds that of radiation. The new 'Neutron Bomb,' or 'Enhanced Radiation (ER) Warhead' produces only a 1-Kiloton blast, but radiation comparable to that of a 10-Kiloton bomb. Note that the 1-Kiloton explosion shown here will produce deaths from radiation at up to about 2500 feet from the blast center, the 1-KT ER and the 10 KT, up to 3500 feet.

Besides the gruesome deaths and grievous illnesses caused by radiation in its immediate victims, there is a vastly increased likelihood of long-term genetic damage, birth defects, and cancer in the survivors' descendants. The full magnitude of this problem is unknown. However, it is expected to be large, and it is a major factor in the controversy over 'Enhanced Radiation' weapons, which are designed to produce a large amount of prompt radiation as their main lethal effect. On the other hand, Enhanced Radiation weapons leave little residual radiation. ER weapons therefore probably do little more long-term radiation damage than any other nuclear weapon.

It is important to realize that the absolute amounts and relative proportions of blast, thermal radiation, prompt nuclear radiation and residual radiation produced by a nuclear weapon can be varied to a great degree. The amount of blast produced can be varied from less than 1-KT to 1 MT, in the case of TNW, and can rise far beyond that

in strategic weapons. It is possible to design a weapon to allow it to be 'set' at a wide range of yields. The new B-77 air-dropped nuclear bomb, for instance, can be set by its operator to produce explosions ranging from "a few Kilotons to a Megaton."⁹ The 'Lance' missile warhead also has variable settings, although its maximum yield is only around 50 KT.¹⁰ This selectibility of blast power is true of many other nuclear weapons, both Soviet and American.

The ratio of prompt nuclear radiation to blast can also be manipulated to a very significant degree, and the particular kinds of radiation emitted can be varied. The warhead of the 'Spartan' Anti-Ballistic Missile (ABM) for example, was so configured as to produce a very high proportion of its energy as X-rays,¹¹ in order to detonate or disable incoming enemy warheads. The 'Neutron Bomb' is an example of a weapon designed to release a large proportion of its energy (some 80%)¹² in the form of highly lethal neutron and gamma-ray radiation.

Residual nuclear radiation, or 'fallout' can also be controlled to some extent. While the direction and speed of its travel will depend on weather conditions, the amount of radioactive debris and the duration of its radioactivity can be altered by details of weapon construction and use. A weapon which leaves a lot of residual or long-term radiation is referred to as being a 'dirty' weapon, while one leaving relatively little is called 'clean.' A warhead can be jacketed in various materials, such as Uranium 238 or

Cobalt, which, rather than being consumed in the explosions are made highly radioactive. This produces an extremely dirty weapon. Different jacketing materials produce effects of differing durations. A weapon exploded at ground level is also likely to produce a lot of fallout, and thus would be considered a 'dirty' weapon.

This variability of effect can be of great use to a military commander. Generally he will want to use the smallest possible weapon to do the job at hand, in order to minimize 'collateral damage.' Collateral damage is damage to areas surrounding the actual target itself. Since NATO forces are theoretically geared to fighting a defensive battle, and therefore expect to fight on NATO territory, damage to such collateral areas is to be avoided as much as possible. Different targets may also require different weapons effects. Tanks, for instance, are relatively immune to any but the most severe blast effects, but their crews are quite vulnerable to lethal radiation which can penetrate their vehicles with ease.^{13*} 'Enhanced Radiation' weapons therefore are especially appropriate to this sort of target. The reduced blast associated with ER warheads means less collateral damage to property, as well.

Weapons which produce a lot of fallout also have special uses. A battlefield commander may wish to make certain locations or wide areas impenetrable to the enemy by means of fallout. He may thus be able to bar the enemy from certain positions which he is not able to hold with his own

forces. He can cut off certain routes of advance, and 'canalize' enemy forces into making attacks on strongly held positions. Certain important enemy facilities, like ports and airfields, can be made uninhabitable for varying periods. Conversely, he may wish to use a very 'clean' weapon on certain targets, perhaps to enable his own troops to quickly occupy the target area, perhaps to (again) lessen collateral damage. Thus residual radiation effect is an area where versatility is important.

In political terms, collateral damage is probably the most important thing to consider when looking at TNW war-head design. From a potential aggressor's point of view, a weapon which does less damage to the defender using it is a weapon more likely to be used. This may increase the deterrent value of that weapon. On the other hand, some argue that a nuclear weapon which causes less collateral damage is a weapon that lowers the nuclear threshold, meaning that it will be used at a lower level of crisis than would a more self-destructive weapon. This is an interesting theoretical problem, and will be discussed in Chapter IV. It suffices to point out here that there are good reasons for supposing that versatility in a weapon's design may increase, or may decrease deterrence, and that it may, or may not, lower the nuclear threshold. This is the sort of uncertainty on which the reader will have to decide his own position.

Aside from the specific applications of TNW discussed

above, the use or the mere threat of use of TNW on the battlefield may have some important repercussions on general military tactics. As Otto Heilbrunn argued in his influential book Conventional Warfare in the Nuclear Age, (1965),¹⁴ the fear of nuclear strikes may prevent military forces from concentrating to any large degree, and this may sharply inhibit offensive action. Large troop or equipment concentrations are an inviting target for a nuclear weapon. If dispersed tactics are developed and used by both sides, it may vastly increase the area of the front any given unit may be required to attack or defend, and this may reduce the number of troops needed by the defender. On the other hand, dispersed tactics may imply the elimination of the 'front' as it has been known in the past, and the widening of the combat area to include, in the case of a NATO vs. Warsaw Pact conflict, most of the territory of Europe. This, in turn, would increase the number of troops needed. TNW are generally held to favor the defense, for it is often suggested that an attacker needs concentrations, and a troop ratio of about 3:1 to ensure success. This idea seems to provide a dubious basis for judgement, but for some reason it crops up often in the literature on TNW. German forces certainly did not so outnumber French in May, 1940. Napoleon's armies were consistently successful against more numerous forces. Huge numerical advantages did not bring victory to the Arabs in the various Arab-Israeli Wars, the Russians in the Crimean War, the Persians at

Marathon. Further, in modern mobile warfare the strategic defender is often the tactical attacker, and vice versa. Any statistical advantage favoring either attacker or defender therefore tends to be evened out on the battlefield.

One aspect of nuclear weapon detonation which may also relate to the question of whether TNW favor the offense or defense concerns communications systems. These systems are evidently highly vulnerable to certain radiation effects.

When the U.S. detonated a nuclear device with a yield of 1.4 megatons 250 miles above Johnston Island in September 1962, 'a number of satellites in low earth orbit at the time of the burst suffered severe electronic damage resulting in malfunction and early failure,' according to the U.S. Arms Control and Disarmament Agency (ACDA). Another unexpected effect of this and other high-altitude bursts was 'the blackout of high-frequency radio communications. Disruption of the ionosphere which reflects radio signals back to the earth by nuclear bursts over the Pacific...wiped out communications for hours at distances of up to 600 miles from the burst point,' ACDA reported.¹⁵

Large-scale communications breakdown might be a factor favoring the defender, as offensive operations generally require more in the way of high command guidance. However, these same communications breakdowns would lessen, perhaps eliminate, the ability of political leaders to control escalation and limit the conflict.

It is worth asking here whether NATO and Warsaw Pact forces have prepared to fight a tactical nuclear war, either in terms of training or of equipment other than

nuclear weapons. Soviet forces are generally credited with better anti-contamination clothing and equipment, and in training for its use. This equipment and training is equally applicable, however, to chemical or biological warfare, for which Soviet weapons stockpiles are greater than NATO's.¹⁶ Soviet battlefield tactics continue to emphasize massed forces, tank and artillery concentrations.¹⁷ Tactically, both sides appear to be preparing for a replay of World War II.¹⁸

Preparations for fighting a war using nuclear weapons on the battlefield probably should include preparations for huge losses in either equipment and supplies, or manpower, or both. Equipment stockpiles and supply dumps within the zone of nuclear weapons use are subject to rapid and complete destruction. Massed troop formations, such as the Soviets seem to envision, can also be expected to suffer devastating losses. Soviet forces are numerous enough to sustain extremely heavy losses in manpower, although the readiness and equipment levels of Soviet reserve forces may not be very high.¹⁹ Soviet logistical resupply capabilities have been notoriously poor in the past,²⁰ but seem to be undergoing rapid improvement of late.²¹ American reserves are scarce, but their equipment and training have been improving recently. The American Army is being increased in size from 13 to 16 divisions, but still will not nearly rival the Soviet Army, which contains some 168 divisions.²²

One fairly bright spot for American forces, however, is their relatively highly developed logistical resupply capability. American ground units maintain a high ratio of supply and logistical troops to combat forces. This may sacrifice some combat power, but gives American forces the ability to stay in the field much longer than their Soviet counterparts. American 'Strategic Logistical Forces', that is, long-range and heavy duty transportation capabilities, are unrivaled in the world.²³ American air transport is especially well developed, as was demonstrated in the massive resupply of Israel, by air, in the 1973 War. Western sea-transport, however, is increasingly vulnerable to the Soviet submarine fleet, and the sad state of the American Merchant Marine reduces the American ability to resupply Europe in a crisis. These logistical factors are of great significance even to a non-nuclear confrontation in Europe, and if Western logistical superiority allows NATO conventional forces to defend Europe successfully, this may aid in keeping the conflict non-nuclear.

Turning to the characteristics of nuclear weapon delivery systems, we must look at two important aspects, Accuracy and Range. The accuracy of nuclear weapons is usually described by the term 'Circular Error Probability' (CEP). This refers to the radius of the circle around the target within which the warhead is believed to have a 50%

chance of falling. The first generation of American ICBMs had a CEP of about 5 miles, meaning that they had a 50% chance of falling within 5 miles of their targets when fired from inter-continental distances.²⁴ Today's U.S. strategic missiles can count on CEPs measured in yards rather than miles. Their Russian counterparts, though improving, are still much less accurate.

Great accuracy in a nation's strategic weapons is a cause for alarm, for such super-accurate, long-range weapons are ideally suited to a pre-emptive, 'counterforce' strike against an adversary's own strategic weapons. Increasingly, these targets are being encased in fortified silos. Such fortified structures are called 'hardened' or 'hard' targets. In striking a hard target accuracy is of prime importance, for a small warhead delivered directly on target is far more effective than a much larger warhead which falls a little bit further away.²⁵ The deployment of super-accurate strategic missiles is therefore a matter of great political controversy. There is no such controversy over the need for accuracy in TNW, for these relatively short range weapons pose no threat to an enemy's strategic arsenal. Accuracy is desirable for military and political reasons, the foremost being the matter of collateral damage.

TNW are most often delivered by systems similar to or identical with those designed to deliver conventional explosives. 'Dual Capable' delivery systems, that is, systems capable of delivering either conventional or nuclear

explosives, include some artillery pieces, several Surface-to-Surface and Surface-to-Air Missiles (SSMs and SAMs, respectively), and various aircraft.²⁶

In recent years there have been tremendous advances in the accuracy of conventional weapons.²⁷ These advances are so great that such weapons have acquired a new name, 'Precision Guided Munitions' (PGMs for short), and writers refer to a 'PGM Revolution.'²⁸ Not only guided missiles but air-dropped bombs and even artillery shells are benefiting from the new technology. The new conventional PGMs use a wide variety of guidance systems. Some allow the operator to steer the weapon to its target, provided with information by a TV camera in the weapon's nose. Others, called 'fire-and-forget' munitions, can simply be 'told' what their targets are; their own internal computers are capable of recognizing and homing in on the assigned vehicle or installation. Some PGMs are guided by means of a wire stretched between the launcher and the weapon itself, some by radio control. Some laser-guided weapons are capable of recognizing their targets by means of laser beams, trained on the target by spotters miles from either target or launcher. The West is evidently far ahead of its rivals in the development of such munitions.^{29*}

The significance of this guidance 'revolution' to our subject of TNW is great. First of all, PGMs are a 'force multiplier.' Because the statistical likelihood of achieving a target 'kill' is so much higher with PGMs than with

ordinary munitions, much smaller forces can be assigned to do a particular job, thus freeing other forces for other jobs. A good example of this phenomenon would involve an air-strike against a vital bridge. Where formerly a large flight of attack bombers might have been required to provide an adequate statistical likelihood of destroying the bridge, with PGMs only 2 or 3 aircraft might be necessary to provide the same probability of success. This development may help to compensate for the numerical asymmetry between NATO and Warsaw Pact forces.³⁰ It increases NATO's relative ability to defend itself with conventional arms. It may therefore reduce the likelihood that TNW will have to be called upon to help defend NATO.

PGM technology also means that conventional explosives, guided with pin-point accuracy, can now be used to destroy some hard-to-hit targets which previously would have required either a massive ammunition expenditure or the use of a nuclear weapon. Again, this may reduce the need for TNW.

The application of PGM techniques to TNW systems themselves may have important implications. It means that smaller nuclear weapons may be used to destroy hard-to-hit targets. This means a reduction in collateral damage, and also a reduction in residual radiation, an important consideration if troops have to move through the target area in the course of subsequent operations. The use of smaller weapons or mininukes may also be of some use in keeping

the level of nuclear escalation down.

Unfortunately, it is uncertain whether currently deployed American TNW have benefitted from the recent advances in weapons guidance. Most U.S. TNW systems were developed in the 1950s and early 1960s, and there seems to be little evidence available to indicate that the weapons currently in position have been retro-fitted with more modern technology. 'Incremental improvement,' that is, the improvement of an existing weapon system to keep pace with advancing technology rather than simply the building of a new system, is not a general characteristic of American weapons development.³¹ It does happen, however, especially to aircraft and strategic weapons, which are expensive to buy but relatively easy to modify. Some TNW systems currently in place may have undergone such piecemeal improvement.³² Newer weapons which presumably utilize the new guidance technology are now being deployed, or are in development. The 'Lance' SSM, which became operational in 1972,³³ and the planned 'Neutron Bomb' Enhanced Radiation weapons are examples. New aircraft are also entering service, but many of the most prominent of these are not nuclear capable, or require expensive modifications to be made so. The new F-15 and F-16 fighters are apparently in this category.³⁴

Accuracy, then, is an important consideration, and in general Western forces strive towards improved accuracy in their TNW systems. There seems to be no question that

accuracy in such systems is a good idea.^{35*} It permits smaller weapons, more controlled use, and less collateral damage. Unfortunately, the accuracy of Russian TNW, or the lack thereof, is a source of some concern. Russian tactical nuclear weapon systems seem generally to be bigger, dirtier and a good deal less accurate than similar American weapons. ^{36*} It is possible that these characteristics of Russian TNW are caused simply by technical backwardness. It also may be taken as evidence that the Russians have a different idea as to the purpose of these weapons, for Russian TNW are best suited to the destruction of large, 'soft' targets, like cities. The Soviets do seem to assume, as does NATO, that any battle between the two will take place on NATO territory.³⁷ They therefore have considerably less concern for the problem of collateral damage. Nevertheless, if the capture of Western Europe were their goal, one would think that they would prefer to keep the prize as intact as possible. There are some indications that Soviet planners may be taking this into account, and that their TNW systems are changing accordingly.³⁸

In any case, the size and inaccuracy of Russian TNW means that, regardless of NATO's success at limiting collateral damage from their own weapons, Russian weapons will still make a large-scale tactical nuclear war an extremely destructive business. Soviet TNW therefore serve as a potent deterrent to any NATO introduction of nuclear arms to a conflict.^{39*}

Range is the second important aspect of a delivery system. American strategic missiles have tremendous range, and virtually no target in the world is beyond their reach. There is no insuperable physical need to maintain weapons of less than inter-continental range for tactical use, as weapons based in the Continental United States might theoretically be used to meet any tactical needs.⁴⁰ However, such use would be uneconomical, for ICBMs are very expensive, and it would also pose grave political problems.

First, any weapon with a strategic capability tends to be viewed as a strategic weapon. An enemy would not be likely to accept intercontinental weapons as being tactical in nature. If an enemy was to observe the launching of ICBMs during wartime or some political crisis, he would have no way of knowing whether he was to receive a strategic or a tactical blow.^{41*} He would certainly be under great temptation to launch his own strategic weapons immediately. Therefore, the maintenance of short-range weapons in the actual vicinity of the battle serves a political purpose, for a weapon which lacks the range to make a strategic strike lacks the capacity to pose a strategic threat.^{42*}

Similar political considerations are connected with the Strategic Arms Limitation Talks (SALT). American 'Forward Based Systems' (FBS), that is, short-range nuclear weapon systems stationed within range of the Soviet Union, have purposely been excluded from discussion at SALT by the American negotiators.⁴³ The Russians have acquiesced

in this despite indications that they consider FBS to be, in fact, strategic weapons.⁴⁴ Were the Americans to consider these FBS strategic, and if they agreed that they were thus subject to the numerical limitations of SALT, they would in effect be conceding nuclear superiority in Europe to the USSR. Russian short- and medium-range weapons in Europe pose no strategic threat to the continental U.S., and thus could be left in their current locations.^{45*}

Beyond these political considerations, there are purely military reasons for maintaining locally-based, short-range TNW in the actual area of a possible military conflict requiring their use. Once local commanders receive authorization to call in nuclear strikes, perhaps subject to some politically motivated restrictions on targeting or weapon yields, direct access to the weapons becomes important. Direct, local control of TNW will relieve the local commander of fears that his urgent nuclear needs will not be met by distant commanders of distant weapons, who are not likely to accord his particular needs sufficient priority. Possession of locally-controlled nuclear weapons may also be important to the psychological security of troops who are themselves subject to nuclear attack. Easy access to nuclear weapons enables local commanders to respond more quickly and selectively in rapidly shifting situations. Even if local commanders had guaranteed call on U.S.-based ICBMs, and even if accuracy and weapon yield were not a factor, the half-hour travel-time of such weapons precludes

use against rapidly moving targets like aircraft, tanks, or ships.

The third set of weapon characteristics to be considered are those of the weapon's launcher and launch systems. In this category we consider not only the launcher itself, but those features of the warhead and of the delivery vehicle which relate directly to the launchability of the weapon. This would include guidance and fuel systems.

The essential thing to consider about the launch system is 'survivability.' This rather ungrammatical term has gained wide acceptance, and usually refers to the capability of a weapon system to itself survive attack. In the scheme I use in this paper it also refers to the capability of the weapon system to survive all the other rigors of war. Therefore, I regard survivability as having three different levels. First, is the weapon capable of surviving lengthy periods at full alert without suffering serious mechanical deterioration, as during an extended crisis of the sort likely to precede a full-scale war? Second, is the weapon capable of surviving an actual attack? This is the property which is most often referred to as 'survivability.' Third, is the weapon capable of surviving a period of extended warfare, in an environment of shifting military lines and targets?^{46*}

Answers to these questions are important for two

reasons. First of all, a vulnerable weapon is politically destabilizing. Secondly, the survivability designed into a weapon may give important clues as to the intentions of its owner. Of course, this last is true of any aspect of any weapon, but when talking about TNW it is of particular interest.

We will examine each of the three levels of survivability, and the technological characteristics of existing weapons which are relevant. We will also relate these characteristics to the problems of political destabilization and strategic intentions.

Regarding the first level of survivability, the ability to survive extended alert periods without serious mechanical deterioration is probably no longer a major difficulty for the Superpowers. The design of the more modern TNW systems in their arsenals is such as to eliminate serious mechanical problems.⁴⁷ This is done in two ways, by increasing the ruggedness of the affected components, and by reducing preparation times so that a high state of readiness can be maintained without actually activating those parts of the weapon system which are vulnerable to deterioration. Guidance and fuel systems are particularly delicate and subject to breakdown. The Superpowers seem to have overcome this problem, through the development of less fragile guidance systems and of easily stored liquid and solid fuels.

For the smaller nuclear powers, however, this problem

may remain serious. This is because, first of all, their technology is generally behind that of the Superpowers. China's lags particularly. Secondly, because of the relatively small size and vulnerability of their nuclear forces, a far higher proportion of their available weapons must be kept in a high state of readiness. The easiest solution to the problem of rapid mechanical deterioration, placing weapons on alert in a staggered manner so that no large proportion is subject to wear at any given time, is not available to these small and often vulnerable nuclear forces. It may be vital, in the view of these smaller powers, that they be able to launch as quickly and as massively as possible in the event of a nuclear attack. This is especially true if they are committed to a Launch-on-Warning (LOW) strategy.⁴⁸ This makes for a politically instable situation, for the owner of weapons subject to severe mechanical deterioration during alert periods has a strong incentive to make a pre-emptive attack during periods of crisis which threaten war. He must maintain weapons at high readiness so as to be able to respond quickly in the event of attack. Otherwise he risks the loss of his entire nuclear retaliatory force to surprise. If a crisis extends for so long a time that his forces begin suffering losses from mechanical breakdown, he has a choice of either forfeiting the contest or of launching his weapons. Depending on the political stakes, a pre-emptive launch may be his only real choice.

The second level of survivability is the ability to

survive actual attack. A weapon which cannot survive attack is again a destabilizing element, for it provides an especially strong temptation to its owner to launch first during a political crisis. Also, a vulnerable weapon is an enticing target, perhaps tempting enough in a crisis to provoke an attack. These temptations are mutually reinforcing, for a perception on the part of one adversary that the other is tempted to strike first is itself a powerful inducement to strike first. Thomas Schelling, in his Strategy of Conflict, provides a fascinating discussion of this 'what if he thinks that I think he thinks that I think. . . ' sort of situation, and we shall look at it briefly ourselves in Chapter III.

A weapon may be made survivable to attack through two different methods. One is fortification, the other mobility. It is quite possible to encase a missile silo in enough reinforced concrete to enable it to withstand a nuclear blast, particularly if the attacker's weapon is not delivered with any great accuracy, and Russian nuclear weapons suffer from notoriously poor accuracy. The French, who have 18 land-based strategic missiles, have protected their missile silos in this manner.

This approach has its pitfalls, however. Increasing enemy missile accuracies make fortified weapons vulnerable.^{49*} Concrete-encased weapons are not easily moved, and thus may be subject to capture by enemy ground-forces. Nor is it practical to heavily fortify short-range battlefield

nuclear weapons, for these, to be useful, must be able to keep up with shifting battle-lines. Mobility provides some insurance against capture (the threat of which may by itself lead to launch of the weapons), and increases their battlefield applicability. It may also, through dispersal and concealment, provide a real ability to survive nuclear attack.^{50*} Concealment during peacetime poses problems, for it could cause dangerous suspicions, and may violate international arms control agreements.

However, as Colin Gray points out,⁵¹ many NATO TNW are "movable rather than mobile",^{52*} meaning that they are restricted to certain areas, such as major highways and rail-lines, where they are easily located and destroyed. They also require considerable preparation time before launch, during which they are immobile and vulnerable. Recent advances in 'Real-Time Target Acquisition Capabilities',^{53*} may make such weapons as easy to hit as fixed silos, and easier to destroy. Newer NATO systems, such as the French 'Pluton' and the U.S. 'Lance,' (and possibly 'Pershing') are truly mobile, however, and stand a good chance of survival, at least during initial attacks.

Mobility is also an important consideration in the third level of survivability, the ability to survive extended periods of warfare. To be considered survivable in this sense a weapon must be mobile, in order to keep pace with changing battle-lines. This makes it less liable to being overrun by enemy ground-forces, and able to keep up

with advancing friendly forces for which it is assigned a fire-support mission. A weapon designed for extended warfare should also have a reload capacity. The U.S. 'Lance' missile, as an example, normally travels in two highly mobile, tracked vehicles, one carrying the missile itself and the launcher mechanism, the other two reloads and a loading crane. It can travel quite a distance (450 km)⁵⁴ on one tank of gas, and can go virtually anywhere that other armored forces can. It is not particularly vulnerable to mechanical breakdown, and has a short preparation period. It can therefore be considered highly survivable in every respect.

Unfortunately, the 'Lance' SSM is an exception, and it is present in Europe in very small numbers. It is replacing earlier SSMS on considerably less than a one-to-one basis,⁵⁵ probably because of its expense.

The second key importance of all three levels of survivability in TNW launch systems relates to their intended use. Does the level of survivability designed into a weapon serve as a reliable indicator of its owner's intended strategy? It seems reasonable to assume that a weapon not designed to survive an attack is one designed to make a first strike. A weapon not designed to last through an extended and therefore probably limited war is presumably intended for a short, intense one. This same approach is applicable to other aspects of a weapon, such as range and accuracy, as when we considered Soviet TNW accuracy on

page 39.

When attempting to draw strategic conclusions from any aspect of weapon design, however, there are important reservations to keep in mind. First, there may be no clear strategy, and weapons may evolve in a strategic vacuum. Some would say this is the case with NATO TNW.⁵⁶ Secondly, even if a weapon is clearly designed with a particular strategy in mind, that strategy may have changed by the time a weapon system actually becomes operational. Weapon systems take a long time between initiation of design and actual deployment. A strategy, on the other hand, can change in as little time as it takes to spread the word to those responsible for its implementation.^{57*}

As an illustration of the convolutedness of this problem, consider that, in the absence of a clear strategy guiding weapons design, weapons design may guide strategy. A weapon whose design unintentionally suggests one kind of use may, in a crisis, force that use on planners who originally had very different ideas. Or, misinformation about an enemy's weapon design may lead to an erroneous interpretation of his strategy, which, in turn, may lead to the development of new weapons similarly open to misinterpretation by the enemy.

Confusion over the relationship of strategy and technology can lead to severe political problems. When policy announcements made for the benefit of an adversary seem to be contradicted by the technological realities of weapons

design, political distrust and suspicions may be aggravated. The reason for the divergence between announced policy and reality may be active duplicity, or it may simply be disagreement and confusion among policy makers. Nonetheless, the dichotomy between NATO claims that NATO TNW are purely defensive in nature, and their actual weapon design and deployment, evidently suggests to Soviet eyes an offensive intent. Similarly, Russian claims of peaceful intentions are quite unbelievable to many Westerners in view of their profoundly offensive armament and doctrines, not to mention the immense size of their forces. Yet, Russian policy may be shaped by the same sorts of confusion, disagreement, and bureaucratic irrationalities as shape NATO policy. In the absence of a deeper mutual understanding between these two adversaries, technological capabilities must remain the basis for planning.

Specific Weapon Systems

Keeping the above considerations in mind, we will now turn to an examination of the specific nuclear weapon systems assigned to tactical use in Europe. We will look at nuclear capable cannon and missiles, and at nuclear capable aircraft. Regarding aircraft, it is the characteristics of the delivery vehicle itself, rather than the nuclear weapons it delivers, in which we shall be most interested. Some comparisons of U.S., French, and Soviet nuclear weapon systems will be made. There is insufficient

information available about these systems to answer all the questions we have raised, but useful data can be gathered.

A look must also be taken at the indigenous strategic nuclear forces of Western Europe, that is, those of Britain and France. These weapons are an important factor in the nuclear balance in the European theater, and the Superpowers need to pay more attention to these forces than they seem to at present. Both Britain and France possess much greater strategic nuclear forces than does the People's Republic of China, yet their strength is often ignored, while China's evokes considerable nervousness and debate in both Washington and Moscow. Both Britain and France possess the technological means to threaten to, or to actually, turn any nuclear exchange into a world-wide catastrophe should they feel it to be in their national interests. When the policy-planners of either Superpower contemplate the feasibility of a nuclear exchange limited to the European theater, this indigenous European strategic nuclear capability must be taken into account.

There will be a short discussion in the text of the various weapon systems. More detailed information is given in the Tables, Charts, and Illustrations on pages 51 to 54.^{58*}

Nuclear artillery is virtually a monopoly of the United States, possibly because no one else wants it. There are some 700 nuclear capable artillery pieces assigned

Nation	Type of Missile	Range	Warhead	Number Available	First Year Operational
U.S.	SLBM Polaris A3	2880	3 X 200 KT	160	1964
U.S.	SLBM Poseidon C3	2880	10 X 50 KT	496	1971
France	SLBM M-1	1550	500 KT	32	1972
France	SLBM M-2	1900	500 KT	16	1974
France	SLBM M-20	3000	1 MT	16	1976
U.K.	SLBM Polaris A3	2880	3 X 200 KT	64	1967
USSR	SLBM Sark	350	MT Range	27	1961
USSR	SLBM Serb	750	MT Range	54	1964
USSR	SLBM Sawfly	1750	MT Range	544	1969
USSR	SLBM SS-N-8	4800	MT Range	220	1972
USSR	SLCM Shaddock	450	KT Range	312	1962

SUBMARINE LAUNCHED MISSILES

to U.S. and allied troops. These are the self-propelled M-110 8-inch Howitzer and the M-109 155 mm cannon. Towed versions of these weapons are also nuclear capable. They have an extremely limited range, about 10 miles, and fire a 1-2 KT atomic shell. Such limited range and weapon yield may be useful factors in controlling nuclear escalation. U.S. artillery is notably more accurate than Soviet, given modern PGM equipment.⁵⁹ There is no confirmed Soviet nuclear capable artillery.⁶⁰

SURFACE-TO-SURFACE MISSILES
(Not Counting U.S. and Soviet ICBMs)

Weapon	Owner Nation	Manufacturing Nation	Range (In Miles)	Warhead	Mobile?	Number Available	First Year Operational
Lance	U.S., U.K., Belgium	U.S.	75	50 KT Nuclear HE	Yes	72 in Europe	1972
Pershing 1-A	FRG, Italy, Netherlands, Israel	U.S.	450	60-400 KT	Yes	180	1962
Pluton	France	France	75	15-25 KT, HE	Yes	24	1974
Sergeant	FRG	U.S.	90	25 KT Nuclear HE	Yes	20	1960
Honest John	NATO	U.S.	25	100 KT Nuclear, HE	Yes	112 (All In Europe)	1953
SSBS S-2	France	France	1875 (MRBM)	150 KT	No	18	1971
SS-4	USSR	USSR	1200 (MRBM)	1 MT	No	500	1959
SS-5	USSR	USSR	2300 (MRBM)	1 MT	No	100	1961
Scud A	USSR, WP	USSR	50	KT Range HE	Yes		1957
Scud B	USSR, WP	USSR	185	KT Range HE	Yes	400	1965
Scaleboard	USSR	USSR	500	1 MT	Yes		1969
Frog 3-7	USSR	USSR	10-45	KT Range HE	Yes	600	1957-65

HE = High Explosive (conventional warhead) optional
Israel has no known nuclear warheads
Honest John is no longer used by U.S.

NUCLEAR CAPABLE AIRCRAFT IN EUROPE

Aircraft	Operated By	Total Operational Range (In Miles)	Speed (Mach. No.)	Number Available	First Year Operational
F-104	NATO	1300	2.2	a.	1958
F-105	U.S.	2100	2.25	a.	1960
F-111	U.S.	3800	2.5	66	1969
A-4 (Carrier)	U.S.	2065	0.9	a.	1956
A-5 (Carrier)	U.S.	3255	0.9	a.	1963
A-7 (Carrier)	U.S.	3400	0.9	a.	1968
Vulcan B-2	U.K.	4000	0.95	50	1960
Jaguar	U.K., Fr.	1000	1.1	192	1973
Buccaneer	U.K.	2000	0.95	70	1962
Mirage IV	France	2000	2.2	52	1964
F-4C J	U.S., U.K., F.R.G.	2300	2.4	a.	1962
F-4 (Carrier)	U.S.	2000	2.4	a.	1962
B-52	U.S.	12,500	0.95	387	1956
TU-16	USSR	4000	0.8	750	1955
TU-22	USSR	1400	1.5	a.	1962
TU-95	USSR	7800	0.78	100	1956
Mya-4	USSR	6050	0.87	35	1956
Backfire	USSR	3700/5500	2.5	65	1974
Ilyshin-28	USSR, Po.	2500	0.8	a.	1950
Sukhoi-7*	USSR, Po., Czech.	900	1.7	a.	1959
Sukhoi-17/20	USSR, Po.	1100	1.6	a.	1974
MiG-21	USSR	1150	2.2	a.	1970
MiG-23	USSR	1800	2.5	a.	1971

Total U.S.	3250
Total W. Eur.	287
Total W.P.	3445

Actual Combat Radius = 30-40% of distance listed under Total Operational Range. Speed and range will vary with payload. All Warsaw Pact (W.P.) aircraft listed are land-based.

Mach 1 = Speed of Sound

a. = Detailed Figures Unavailable

* Nuclear Capability Uncertain

Type	Owner Nation	Range (Miles)	Warhead	First Year Operational	Number Available
M-110 SP 8 in. How.	U.S., NATO	10	1-2 KT	1962	700
M-109 SP 155 mm How.	U.S., NATO	10	1-2 KT	1964	
M-55 8 in. How.	USSR	18	KT Range	1950's	?

NUCLEAR ARTILLERY

The U.S. also maintains about 300 Atomic Demolitions Munitions in Europe. These are essentially nuclear land mines intended for destroying mountain passes, transportation centers and other such assets of value to advancing enemy forces. None have ever been emplaced, and they may soon be withdrawn.⁶¹ These ADM's, too, seem to be an American monopoly.

Surface-to-Surface Missiles (SSMs), on the other hand, are a Soviet specialty, and there are perhaps as many as 2000 of them deployed in Soviet-controlled Central and Northern Europe. These missiles range from the obsolescent (but still operational) 'Frog-1' to the quite modern 'Frog-7.' They include mobile Medium Range Ballistic Missiles (MRBMs) capable of hitting any target in Europe, and which carry warheads of from 25 KT to a Megaton. Shorter-range Ballistic Missiles include 'Scud A' and 'Scud B,' and

'Scaleboard,' warhead sizes unknown, with ranges of 50 to 500 miles, roughly comparable to those of American SSMs.

American SSMs include the older 'Honest John' and 'Sergeant' Missiles, which are being phased out of U.S. forces in Europe, but retained by several allies. 'Pershing' and 'Lance' are newer. These weapons vary in mobility, some being towed, others traveling in trucks, others on tracked vehicles. Lance is fully mobile.^{62*} American SSMs generally carry smaller warheads than Soviet SSMs, although Pershing's warhead ranges between 100 and 400 KT. Lance may yield up to 50 KT, but will also be able to deliver the 'Neutron Bomb' (Enhanced Radiation Warhead) which has a yield of only about 1 KT. There are only a few hundred of these missile systems in Western Europe. The number of operational American SSMs has been declining in recent years. Many American-made SSMs remain in the arsenals of other NATO countries, however. These weapons may be nuclear capable, but their nuclear warheads are kept under American guard and control, usually nearby. The French manufacture a nuclear SSM for their own use, the 'Pluton.' This is the only non-American nuclear capable SSM in Western arsenals. These fully mobile weapons have a range of about 75 miles and a 15 kT warhead. France currently has 24 'Plutons' deployed, but plans to increase this number soon.⁶³ The French also maintain 18 land-based MRBMs, in hardened silos.

There are several nuclear capable American Surface-

to-Air missiles. Many of them are naval weapons, but the Nike-Hercules SAM is land-based. Nike is also useable in a Surface-to-Surface mode.

Aircraft capable of delivering nuclear ordnance are numerous on both sides, although the Soviets seem to be short of pilots trained in tactical nuclear delivery techniques.^{64*} These aircraft include (on the NATO side) American F-4 Phantoms, F-111s, F-105s, A-6s, and A-7s, British Vulcans and Buccaneers, French Mirage IVs, and the Anglo-French Jaguar. The new Anglo-German-Italian MRCA (Multi-Role Combat Aircraft) is probably nuclear-capable. These aircraft are distributed among NATO's 100 or so airfields, U.S. carriers at sea off of Europe, the one British aircraft carrier and two French carriers. They number over 1000 aircraft. They have operational ranges of between 1000 and 4000 miles, thus making them capable of strategic strikes against the USSR. They can carry a wide variety of nuclear ordnance, ranging from simple air-dropped bombs to precision-guided missiles to medium-range 'stand-off' missiles.

Soviet nuclear capable aircraft include various models of bombers and ground-support tactical aircraft, with ranges of up to 2500 miles. They also have the new 'Backfire' bomber, range 3,700 miles unrefueled.

Also assigned to NATO are some U.S. Poseidon Submarines, each of which carries 16 missiles. The United Kingdom has a number of Polaris-type submarines, which carry a total

of 64 missiles, each of which has a range of about 3000 miles. These British submarines are assigned to NATO, but London retains ultimate control. France has several missile subs, also totaling 64 missiles. These are entirely under French control, and can hit targets between 1500 and 3000 miles away.

The Soviets maintain a large number of land based MRBMs in the European part of Russia, and many SLBMs and SLCMs (Submarine Launched Cruise Missiles) in the seas around Europe.

Altogether, the Western allies maintain about 10,000 nuclear weapons in Europe, deliverable by a total of about 3,000 delivery systems.⁶⁵ This varies somewhat depending on the location of U.S., British and French nuclear-equipped naval forces. About 7,000 weapons are under American control, although a large proportion of these will be distributed to allied forces should the American President authorize their use. The other 3,000 are of British or French manufacture and ownership.

The Soviets probably have around 3,500 short- and medium-range nuclear weapons in Europe. Again, this number will vary depending on the location of Soviet nuclear-equipped naval vessels. In addition, a portion of Soviet Strategic weapons may be available for use in Europe. Soviet weapons are generally quite a bit larger than comparable Western weapons, so total megatonnage is probably about even. No nuclear weapons are held by Russia's War-

saw Pact allies, although some of these countries do have missiles which could be fitted with nuclear warheads.

Virtually all short-range nuclear capable weapons are capable of carrying conventional explosives as well. This is not true of Submarine Launched Ballistic Missiles, French MRBMs, or U.S. and Soviet ICBMs. The U.S. 'Lance' SSM does not presently have a conventional capability, but may soon acquire one.⁶⁶

We now have some idea of the nature of the nuclear weapons available for 'tactical' use in the European theater, and of their approximate numbers. We also have gained at least a general idea as to their military uses and implications in the event of a nuclear war confined to the geographical limits of non-Soviet Europe. In the next chapter we will consider some key theoretical concepts that will be of use in assessing the possibility of, and the reasons for, fighting such a war.

Footnotes to Chapter II

1. Laurence Martin, Arms and Strategy (New York: David McKay Company, Inc., 1973) p. 11.
2. Martin, p. 20.
3. Such individual warheads, carried in a group on one delivery vehicle, are called Multiple Re-entry Vehicles (MRV), or, if each is independently targetable, Multiple Independently-targetable Re-entry Vehicles (MIRV).
4. Martin, p. 12, and p. 20.
5. A one-Megaton warhead seems far too large a weapon to have any conceivable tactical use, but such weapons exist in the arsenals of both sides in Europe. These weapons could only be used for strikes against large, non-military targets like cities. It is still just barely possible that such strikes could be kept limited to targets in Europe, and thus keep the conflict limited to the European theater.
6. Martin, p. 13.
7. Martin, p. 12.
8. The following discussion is largely adapted from Arnold S. Warshawsky, "Radiation Battlefield Casualties -- Credible!" Military Review (May 1976), pp. 3-10. He includes an interesting discussion of specific ways in which radiation could be used on the battlefield. Also see S.T. Cohen, "Enhanced Radiation Warheads: Setting the Record Straight," Strategic Review (Winter 1978).
9. Erwin J. Bulban "Nuclear Bomb Delivery System Tested by USAF," Aviation Week and Space Technology (Jan. 9, 1978) pp. 12-16.
10. Barry K. Schneider, "30,000 U.S. Nuclear Weapons," Defense Monitor Vol. IV, number two, February 1975, p. 5.
11. Martin, p. 26.
12. Jorma K. Miettinen, "Enhanced radiation warfare," Bulletin of the Atomic Scientists, September 1977, p. 33.
13. Soviet armored vehicles are reputedly shielded against nuclear radiation effects, but to be really

effective against intense radiation such shielding would have to be either very heavy, as with lead shielding, or very bulky. Water or fuel tanks are quite effective insulators against neutron (but not gamma-ray) radiation, because of their high Hydrogen content. Hydrogen is a very effective absorber of neutrons. It seems doubtful that Soviet tanks, which are cramped for space to begin with, could be effectively shielded in this manner. For a discussion of Soviet Armored Vehicles which may touch on this matter, see Jane's Weapon Systems 1977, ed. R.T. Petty, (London: Jane's Yearbooks, 1977), and Jeffrey Record, Sizing Up the Soviet Army (Washington, D.C.: Brookings, 1975) pp. 23-29.

14. Otto Heilbrunn, Conventional Warfare in the Nuclear Age (New York: Frederick A. Praeger, Publishers, 1965)
15. Edgar Ulsamer, "DNA's Business: Thinking the Unthinkable," AIR FORCE Magazine, September 1976, p. 54.
16. Captain John H. Moore, USN (Ret.) "Questionable NATO Assumptions," Strategic Review (Winter 1977) p. 26.
17. This general conclusion is widely voiced, but for one discussion see Record's Sizing Up the Soviet Army. For a good discussion of the impact (or non-impact) of the 1973 Arab-Israeli War on Soviet tactics, see Adelphi Paper # 114, The Middle East and the International System: I, The Impact of the 1973 War (London: International Institute for Strategic Studies, 1975)
18. It seems a truism that armies are always ready for the last war, some would more cynically say the war before last.
19. See John Erickson, Soviet-Warsaw Pact Force Levels (Washington, D.C.: U.S. Strategic Institute, 1976) pp. 17-61.
20. See both works by Erickson (F.N. 19, 21) and William Schneider Jr. "Soviet General Purpose Forces" Military Review, (January 1978).
21. John Erickson, "The Ground Forces in Soviet Military Policy," Strategic Review (Winter 1978) pp. 64-79.
22. See Erickson, and Col. Irving Heymont, "Can Reserve Units Be Ready on Time?" Army (March 1978), pp. 23-26.
23. Brig. Gen. Winfield S. Scott, USA (Ret.), "A Strategic Logistics Force," Strategic Review (Fall 1976).
24. Martin, p. 22.

25. Laurence Martin illustrates this point very well, pp. 22-29.
26. See tables, pp.
27. James Digby, Precision Guided Weapons Adelphi Paper #128 (London: International Institute for Strategic Studies, 1975) .
28. "Smart Weapons: A Revolution in Arms and Tactics," Washington Post, 30 January, 1977, p. C1.
29. Record, p. 26.
30. This asymmetry is discussed in Chapter IV.
31. The Library of Congress Congressional Research Service, United States/Soviet Military Balance: A Frame of Reference for Congress (Washington, D.C., U.S. Government Printing Office, 1976) pp. 14-15. Also see John Ronald Fox, Arming America: How the U.S. Buys Weapons (Boston: Harvard University Press, 1974).
32. Jane's Weapon Systems 1977 points out some incremental improvements made in the 'Sergeant' missile's guidance system, and 'Pershing's' launch system, p. 53.
33. Jane's, p. 52.
34. U.S./Soviet Military Balance, p. 32.
35. This is not entirely true. Dr. Franz Gross seems to have some question about it. I have not, however, run across any such questions in my reading, and I have none myself. Dr. Gross' questions seem to be founded on the same objections to accuracy as are raised about strategic weapons, and I don't believe that they are applicable to TNW.
36. Jane's (p. 49) mentions a report that three Soviet 'Scud' missiles, with conventional warheads, were fired at Israeli forces in the Sinai during October 1973. All three appear to have missed.
37. Record, pp. 33-47.
38. Joseph D. Douglas, Jr., "Soviet Nuclear Strategy in Europe: A Selective Targeting Doctrine?" Strategic Review, (Fall, 1977) pp. 19-32.
39. However, a Soviet inability to reply to a very small-scale NATO nuclear attack in kind, that is, similarly limited weapons, may inhibit the Russians from replying at all. See discussion of 'Escalation Dominance'

in Chapter III.

40. Accuracy might be a problem, but with modern guidance systems this is less and less a factor.
41. Although the U.S., at least, seems to have the capability to track and identify the targets of incoming ICBMs (Dr. Franz Gross, conversation at the College of William and Mary, March 17, 1978), the time between warning, identification and impact seems so short as to allow decision-makers little time to discriminate between tactical and strategic ICBM use. If the receiving nation were already committed to a Launch-On-Warning (LOW) strategy, it seems probable he would have to launch his missiles before the distinction could be clearly made.
42. Some TNW systems possess sufficient range to make strategic strikes, but are slow and vulnerable enough to provide warning and a chance for a successful defense. Long-range, theater-based aircraft fall into this category. Some long-range SSMs, like 'Pershing,' may have too-long a range to be politically suitable to 'tactical' deployment in Europe. The Soviet 'Backfire' Bomber is another weapon unsuitable for purely tactical use because of its long range.
43. John Newhouse, Cold Dawn: The Story of SALT (New York: Holt, Rinehart and Winston, 1973) pp. 194-195.
44. Jeffrey Record, U.S. Nuclear Weapons in Europe (Washington, D.C., Brookings, 1974) p. 5.
45. In August 1975 the U.S. negotiators at the Mutual Force Reduction (MFR) talks, (sometimes called MBFR, Mutual Balanced Force Reduction), offered to withdraw 1000 U.S. TNW from Western Europe in return for a Soviet withdrawal of 1700 tanks from Eastern Europe. The Soviets did not respond to this offer.
46. A fourth level of survivability might be added. This would be the ability to avoid peacetime hazards, like accidental launch or detonation, theft by terrorists, theft by allies, unauthorized use by U.S. commanders, and so on. This is a very real problem, and concern about the possible theft of a nuclear weapon by terrorists is a prime reason why U.S. TNW are kept in such a very few (about 100) depots. Here they can be carefully guarded against terrorists, but they are therefore far more vulnerable to an enemy surprise attack.
- Modern nuclear weapons, however, are carefully designed to preclude unauthorized use. It is impossible to 'arm' them without knowing the necessary

codes, and each weapon has several locks requiring such codes. These are called Protective Action Links (PAL). Without being armed by the removal of these locks, a nuclear weapon is rather harmless. There have been numerous accidents where unarmed bombs have been dropped from planes, and at least one incident in which the conventional explosives used to 'trigger' the nuclear fuel in a bomb were detonated by fire. The bombs still didn't go off (Defense Monitor, February 1975, p. 9).

Another important safety feature of many nuclear weapons, particularly those stationed in allied nations and intended for their use, is the so-called 'Two-Key' system. Two individuals, often one U.S. and one an allied native, are required to arm the weapon. Each must know the proper codes, and the two must act simultaneously to remove the safety locks.

47. Justin Galen, "Theater Nuclear Balance, Part One: Recent Force Trends and Improvements." Armed Forces Journal (December 1977) p. 31.
48. A 'Launch-on-Warning' (LOW) strategy means that the defender will launch his own strategic weapons immediately upon warning of an incoming strategic attack. Such a strategy can be compelled by extreme vulnerability in one's own strategic forces. The opposite of a Launch-on-Warning strategy is called a 'Ride-Out' strategy, in which the attack is absorbed and damage is estimated before a decision is taken on exactly how to reply. Unless one's strategic weapons are very well protected, or so numerous as to guarantee that a large number will survive, a Ride-Out strategy may imply virtual surrender. U.S. policy is currently based on the Ride-Out idea, but this may change if Soviet strategic missiles continue to grow more accurate, and thus pose a real danger to U.S. land-based strategic forces. There is an interesting discussion of this problem in Ron Rosenbaum's "The Subterranean World of the Bomb," Harper's Magazine (March 1978), p. 103.
49. Also, a large nuclear power might be prepared to waste several low accuracy weapons in order to increase his chances of scoring a direct hit on the fortified silos of a smaller power. This is probably a popular nightmare among French strategic planners.
50. NATO's TNW launchers are fairly well dispersed, except for the aircraft, which are confined to NATO's approximately 100 airfields. The warheads for most nuclear weapons in Europe, however, are concentrated in a very small number of depots, again, about 100. At least, this was the case in 1975. Some dispersal

may have come about as a result of reforms initiated by James R. Schlesinger, Secretary of Defense under Gerald Ford. These depots, the location of which is presumably known to the Soviets, are highly vulnerable to attack. The weapons would theoretically be dispersed if war threatened, but this is questionable, as NATO leaders might regard such protective dispersal as too escalatory an action in crisis circumstances. See James R. Schlesinger, The Theater Nuclear Force Posture in Europe: A Report to the United States Congress in Compliance with Public Law 93-365 (Washington, D.C., U.S. Government Printing Office, 1975).

51. Colin S. Gray, "Theater Nuclear Weapons: Doctrines and Postures," World Politics (January 1976) p. 307.
52. Some confusion over the mobility of the Soviet missiles in Cuba in 1962 may have played a role in preventing an American air strike. The 'mobility' erroneously attributed to these 'movable' missiles may have increased their deterrent value greatly. See Graham T. Allison, Essence of Decision (Boston: Little, Brown and Company, 1971).
53. Meaning that it is possible to locate a target and relay that information to weapons operators with virtually no time-lag.
54. Jane's, p. 52.
55. Jeffrey Record discusses this economic limitation in U.S. Nuclear Weapons in Europe, pp. 35-36. Also see Miettinen, p. 35.
56. Justin Galen, "Theater Nuclear Balance Part Two: The NATO/Warsaw Pact Imbalance," Armed Forces Journal (January 1978) p. 22.
57. This is something of an oversimplification, as implementing a new strategy requires new contingency planning, development of new Standard Operating Procedures (SOPs), and other details. Nonetheless, it can be far faster to change strategies than to build new weapons.
58. All the following detailed information is compiled from
 1. Jane's Weapon Systems 1977
 2. International Institute of Strategic Studies (IISS) The Military Balance 1976-77 (London, IISS, 1976).
 3. Jeffrey Record U.S. Nuclear Weapons in Europe.
 4. Justin Galen, Parts I and II.
 5. Laurence Martin, Arms and Strategy.
 6. Congressional Research Services United States/Soviet Military Balance.

59. Record, Sizing Up the Soviet Army, p. 26.
60. There is widespread speculation that the Soviets are deploying a 203 mm nuclear artillery round, but there seems to be no hard data on this. Aviation Week and Space Technology, NATO: The New Challenge (New York: McGraw-Hill, 1977) p. 25.
61. Miettinen, p. 36.
62. Some versions of the vehicle can even be dropped into the launch zone by parachute. Jane's, p. 52.
63. French Parliament, Law No. 76-531, Report on the Program for Military Expenditures and Equipment for the Armed Forces for the 1977-1982 Period, June 19, 1976, p. 29.
64. Although the Soviets have a large number of nuclear capable aircraft, they have only about 350 pilots trained in tactical nuclear delivery techniques. Such training is apparently standard in the U.S. and some NATO air forces. See U.S./Soviet Military Balance, p. 5. This information is attributed to the Defense Intelligence Agency, and dated January 15, 1976.
65. The Military Balance, p. 103.
66. Jane's, p. 52.

CHAPTER III
STRATEGIC THEORY and THEATER NUCLEAR WAR

Introduction to the Chapter

A great deal of thinking has been done since 1945 about the implications of nuclear weapons for international politics and strategy. A considerable body of strategic theory has evolved. Much of this theory is concerned with either fighting or preventing a nuclear war. The nuclear conflicts which have been envisaged by theorists vary widely in scope, ranging from the use of a single nuclear weapon to world-incinerating strategic nuclear war. Nuclear wars may possibly be kept beneath the all-out level although this is a matter of much debate. One variety of 'Limited Nuclear Option' often discussed is a war limited to the geographic confines of non-Soviet Europe,^{1*} and that is the topic of this paper.²

Strategic theory is far too rich, diverse and complex a field to be covered in the space available here. The purpose of this chapter is to introduce a few key concepts, demonstrate their interrelationships, and consider their meaning for the two basic questions which underlie the debate over tactical nuclear weapons: Can a nuclear war be limited?; If so, is it wise to attempt such limitation?

We will begin by discussing three basic concepts, 'Deterrence,' 'Thresholds,' and 'Escalation Dominance.' Various other minor but useful terms will be introduced. We then construct a model of a conflict, using these concepts. Finally, we discuss the possibility and desirability of achieving limitations on the use of nuclear weapons

in a nuclear conflict.

Definitions

'Deterrence' is the central concept in Western defense policy, and possibly in Russia's as well.^{3*} Funk and Wagnall's Dictionary defines the word 'deter' as: "To prevent from acting or proceeding by the consideration of something, as danger, difficulty, or the like, which countervails the motive for acting; literally, to frighten away; as 'deterred' from crime by fear of punishment." While one nation may wish to deter another from actions of a political or economic nature, and use threats of political, economic or even moral sanctions to accomplish this, 'deterrence' in this paper means deterrence of military attack by the threat of countervailing military power.

A deterrence policy is built upon the assumption that external rivals would, in the absence of some threat of damage to themselves, feel encouraged to engage in aggressive behavior. In the light of historical experience, it could easily be argued that the Soviet Union and the West each are justified, if not necessarily correct, in making that assumption about the other. Deterrence is thus essentially a defensive policy, but it may come to entail aggressive elements. In the context of U.S.-Soviet relations, the Vietnam War can be seen as part of a defensive American policy intended to deter the Soviet Union from expansionist adventures. From the standpoint of the Vietnamese, however, it was sheer aggression. The immense

build-up of Soviet military power in Central Europe may be primarily intended to deter an attack by the Western Powers, but insofar as it is used to exert psychological pressure on issues not directly related to the defense of the Soviet Union, it is an aggressive policy.

Theorists have identified two basic forms of deterrence.⁴ These have been labeled 'Deterrence by Reprisal' and 'Deterrence by Denial.' The two differ mainly in the nature of the threat on which they are based.

Reprisal deterrence is based on a threat to somehow 'punish' an aggressor for hostile acts. The punishment may not be directly related to the offense. The American policy of 'Massive Retaliation,' announced in the 1950s, is an excellent example of a reprisal strategy. The United States threatened to respond to acts of Communist aggression anywhere, and of any kind, with strategic nuclear attacks on the Soviet Union. The U.S. would "depend primarily," said American Secretary of State John Foster Dulles, "upon a great capacity to retaliate instantly by means and at places of our choosing."⁵ The flaw in this strategy lies in the fact that one cannot reply to every level of attack with nuclear weapons. Minor border incidents, political subversion, even actual invasion may not be seen as justifiable grounds for nuclear punishment, especially if such punishment is likely to provoke a nuclear counter-reprisal. As the Soviet Union acquired a sizeable nuclear arsenal of its own, 'Massive Retaliation' lost whatever

credibility it may once have had.

The second variety of deterrence, 'Denial,' is based on a threat to deny an enemy the object of his attack. The defender will wish to demonstrate to the attacker that he cannot achieve his objective at a price he is willing to pay. If the objective of an expected attack is a piece of territory, for instance, the defender will have to demonstrate the capacity to successfully defend that piece of territory. The defender need not be able to actually defeat the aggressor's forces, but merely be able to inflict greater losses than the objective is worth. A policy of maintaining forces only sufficient to inflict unacceptable damage, rather than to achieve superiority, is called a policy of 'sufficiency.' This is the current policy of the United States with regard to strategic nuclear weapons.

When it became evident that Massive Retaliation, a purely reprisal strategy, had fatal flaws, a denial approach was tried. The West would provide sufficient conventional forces to deny the Soviets the possibility of a successful invasion of Western Europe.^{6*} A strong nuclear force would remain to deter nuclear attacks. Thus, as long as the conflict remained conventional, Western strategy would be purely one of denial. The nuclear reprisal element remained, but would not be used against anything less than a nuclear attack.

It quickly became clear, however, that the West was quite unable, or unwilling, to make the sacrifices of money

and manpower which would be necessary to provide a credible denial deterrent conventional force. There thus developed a 'gap' in the West's defenses. Nuclear weapons would be used to punish a nuclear attack. Conventional forces would be able to contain minor conventional attacks, but would not be sufficient to prevent a large-scale invasion. What would be the American reply to an attack too great to defend against with available conventional forces, but not great enough to justify escalation to strategic nuclear weapons? It was suggested that nuclear weapons be used in a denial strategy, that is, to contain an attack without escalating to strategic nuclear war. This is the origin of tactical nuclear weapons. It was hoped that they would plug the gap between the West's conventional and strategic nuclear deterrent forces. This is the basis of NATO's current strategy, 'Flexible Response,' and NATO bases its defenses on what is termed the 'NATO Triad': conventional forces, tactical nuclear weapons, and strategic nuclear weapons.⁷ This wide variety of military options is intended to allow NATO to reply successfully to any level of conventional or TNW attack without having to escalate to strategic weapons.

In essence, 'Flexible Response' is a combination of denial and reprisal strategies. NATO claims that it will not accept defeat and occupation by Warsaw Pact forces. To whatever extent possible NATO will attempt to deny enemy forces their objectives, and will, if pressed, employ tactical nuclear weapons in that denial attempt. If that

fails, or if the destruction becomes too great to sustain, NATO will reply with strategic nuclear weapons. Even a strategic strike on the Soviet Union might be intended as an extension of denial, in that the intent is not punishment but rather the destruction of the Soviets' ability to continue their attack. At that level, however, there is little to distinguish between denial and reprisal in a practical sense.

One problem with a strategy containing both denial and reprisal elements is that there is an inherent conflict between the two. If one maintains forces capable of denying an enemy certain objectives, one is signalling to that enemy an unwillingness to employ nuclear reprisal against certain levels and kinds of attack. The greater the defender's 'warfighting capability' the greater his presumed unwillingness to use his nuclear reprisal forces. Conversely, the smaller the defender's warfighting capability, the higher must be his willingness to use reprisal. The larger the conventional forces the U.S. assigns to defend NATO, the greater the American reluctance to use nuclear weapons in that defense appears to be. The more effective a tactical nuclear weapons posture appears, the greater seems the fear to use strategic weapons. This conflict is inescapable, and it requires that force levels be set as closely as possible to the actual levels of denial and reprisal deterrence desired. Otherwise a gap will appear in the structure of deterrence.

The combined strategy solution involves a number of uncertainties. What constitutes an unacceptable level of damage? This will vary with the political objectives which are at stake. What is a level of military preparation sufficient to deter an attack? Again, this will vary. Most crucial for our purposes is the uncertainty involved in speaking of an attack on a scale "great enough to justify escalation to strategic nuclear weapons." This is the problem of the 'nuclear threshold.'

At what point of political or military crisis does the use of nuclear weapons become an attractive option to one or both sides? Is there only one threshold, below which warfare is waged with conventional weapons, and above which all-out strategic nuclear war is the only option? Are there instead several possible thresholds, clear dividing lines between various levels of nuclear conflict?⁸

Before discussing this matter of thresholds, which is central to the debate over tactical nuclear weapons, we ought first to consider another concept, 'Escalation Dominance.' An understanding of this concept may make the discussion of thresholds easier.

A nation has escalation dominance when it has the option of raising the level of a conflict from one where it is disadvantaged to one where it can prevail. A change in the level of conflict does not mean only a change in its intensity. It can mean a change in the very nature of the conflict itself. If a conventional war is escalated

to the nuclear level, for instance, a whole new set of factors becomes operational. Let us take the extremely hypothetical case of a dispute between Great Britain and West Germany which threatens war. The latter is today the greatest conventional power in non-Soviet Europe, but it is totally lacking in indigenously controlled nuclear arms. Great Britain is rather weak conventionally, yet it is the World's third greatest nuclear power. As long as the threat of conflict seemed limited to a conventional level, Germany would prevail. The moment the conflict threatened to become nuclear, however, Britain would gain the upper hand. Therefore, in this simple scheme, where there are only two levels of conflict, Britain holds escalation dominance.

In reality, of course, there are many levels of conflict. Proxy war and direct confrontation are on different levels. Guerrilla wars and wars fought by regular forces are also on different levels. A nation which holds a winning advantage at one level may be helpless at another. Many different factors can affect nations' abilities to achieve escalation dominance. One set of factors is the size, quality, and kind of military forces that the adversaries possess. Our example of Great Britain and Germany provides one illustration of this. Another, and often more important factor is political will. The stakes in any given conflict will often be valued differently by different participants, and one participant may not be willing

to suffer as much to achieve his ends as another. For example, if one nation is willing to accept defeat in a proxy war rather than to become a direct participant, then a threat by an adversary to escalate to direct conflict may bestow escalation dominance on that adversary. This is true even if the adversary is militarily inferior, for he possesses the will to fight which his opponent lacks. In the Vietnamese War, the vastly superior military might of the United States could not be effectively brought to bear on North Vietnam, partially because the American people did not place a high enough value on victory there, partially because the U.S. Government was unwilling to risk direct war with China.⁹ To draw again on the Anglo-German example, if Britain were for any reason unwilling to use its nuclear arsenal, Germany would retain dominance at the conventional level of conflict which had already been established. Escalation dominance will go to the side which is willing to raise the conflict to the higher level, and which has superiority at that level.

Between the various levels of conventional conflict there are sometimes clear and easily distinguished lines, or thresholds. In a proxy conflict, for example, it is quite acceptable for one or both sides to contribute supplies, equipment and advisors. The commitment of actual combat troops is a clear signal that the conflict has moved to a new level of direct confrontation. There is also a clear distinction between conventional and nuclear war.

Are there further thresholds, clear dividing lines between distinguishably different levels of nuclear conflict?

Many people would say no.¹⁰ According to their view there is only one threshold involving nuclear weapons. Once a single nuclear shot is fired escalation to all-out strategic nuclear war is inevitable. Given the lack of trust and communications between the adversaries, and the fear of being struck by a massive strategic nuclear attack, all-out war becomes the only option. Escalation may not be instantaneous, but it will be very rapid. Expectations like this feed upon themselves, and such prophecies may be self-fulfilling. If this view were to be accepted by all of the world's strategic planners, or even a large percentage of them, it would be true. Such a situation has the effect of keeping the nuclear threshold extremely high, but also insures that, once it is broken, the ultimate form of nuclear disaster is a certainty. The slightest nuclear accident might set off a nuclear holocaust.

The one-threshold view is based on an expectation of non-existent trust and communication between the adversaries. However, because total nuclear war is not conceivably in anyone's best interest, the adversaries will share a common bond in their desire to avoid mutual incineration. Fear of mutual annihilation would provide a strong incentive to keep a nuclear war, once begun, as limited as possible.¹¹ Communications between the opponents are unlikely to be completely cut off. Even if direct and full commu-

nication were nonexistent, tacit forms of communication would remain. Therefore, it is not unrealistic to suppose that some form of trust and communication will exist, and this provides the possibility of nuclear war limitation.

Defining the limits and keeping within them poses a taxing problem. How is it possible to set clear limits to the use of nuclear weapons? If full and unlimited communication exists between the adversaries, and there is a minimum of trust between them, limits may be set virtually anywhere. Use may be limited to one A-bomb per day, to weapons of less than 10 kilotons, or of less than 20 miles' range, or to targets in certain well defined regions.

Far more likely, however, is a state of very limited or even nonexistent direct communications. In that case, what is called for is a form of tacit bargaining. Thomas C. Schelling, in his book The Strategy of Conflict (1960), provides a fascinating discussion of precisely this sort of situation. Schelling demonstrates various ways in which 'players' deprived of direct communications can agree on common actions or goals. He makes several very interesting points. First of all:

the problem of limiting warfare involves not a continuous range of possibilities from most favorable to least favorable to either side; it is a lumpy, discrete world that is better able to recognize qualitative than quantitative differences, that is embarrassed by the multiplicity of choices, and that forces both sides to accept some dictation from the elements themselves.¹²

Where in the sort of situation we are discussing are

there clear, qualitative differences that each side could reasonably be expected to recognize independently? There are several possibilities, but the most obvious one is that of national boundaries. Each side could very easily hit on the solution of not striking the other's home territory. Would this militarily favor one side or the other? Probably it would favor the side which had assembled the most destructive nuclear arsenal within the geographically limited area of free nuclear weapons' fire.^{13*}

There are other possible lines of demarcation. Cities of any size might be excluded from target lists. Use might be restricted to targets that were military and only military. Use might be confined to the immediate area of the front lines, although extensive use of nuclear weapons in this way might quickly eliminate any recognizable 'front.' There are certain technical features of nuclear weapons which may suggest guidelines for limitation. Although nuclear weapons' yields vary among a nearly infinite number of possibilities, the size of the Hiroshima bomb, about 15 KT, is widely recognized by nuclear weapons experts as a standard for comparison. Such weapons are called 'Nominal Bombs.' 15 KT is therefore a possible technical dividing line. The sort of criteria used to establish limitations might vary depending on exactly who on each side was making the decisions. Politicians might be expected to use targeting criteria, military men military or technical criteria.

A lot might also depend on the nature of the initial

strike. If only nuclear artillery were used, with its extremely short range and low yield, that might establish quite low limits. The Medium Range Ballistic Missile attack on the Warsaw railway center, mentioned in Chapter I, would establish somewhat higher limits. A one-Megaton ICBM warhead deposited on Red Square in Moscow would establish no limits at all.

Schelling develops another idea that has very interesting implications. He demonstrates various ways in which it might be in the interests of one 'player' to restrict communications partly or wholly to the 'tacit bargaining' level.

When agreements must be reached with incomplete communication, the participants must be ready to allow the situation itself to exercise substantial constraint over the outcome; specifically, a solution that discriminates against one party or the other may be the only one on which their expectations can be coordinated.¹⁴

In a situation of full communication it is doubtful whether any agreement on nuclear limitations could be reached which gave either side a substantial advantage. The Soviets would be unlikely to adhere to an explicit agreement which limited nuclear use to weapons with which only the West was well supplied. If communications were to be restricted, on the other hand, then it is conceivable that the West could establish limits for nuclear weapons use that gave it a distinct advantage.

Thus it is possible, or at least conceivable, that there are thresholds between various levels of nuclear

war, and that the one-threshold view is not necessarily correct. Taking any particular position on the question of the nuclear threshold requires making certain decisions which are based on moral or political grounds rather than simply on what is possible. One must decide what sort of provocation, if any, will justify the use of nuclear weapons. Is the prospect of Russian occupation of Western Europe sufficiently horrible to justify a nuclear response? Is the imminent occupation by an enemy of the United States itself sufficiently provocative? Is it more moral to kill a million of the aggressor's people than to allow him to kill a million, or a hundred thousand, or one, of the innocent defender's? Taking the Russian point of view, is the imminent destruction of socialism in one country by encircling capitalist vultures a good reason to launch a nuclear attack? Better dead than Red?

While it is certainly desirable to set the initial nuclear threshold as high as possible, and the one-threshold view may accomplish this, it also seems advisable to attempt to limit the ill effects of any actual breach of that threshold. If that can be done without a substantial lowering of the initial threshold, all the better. Unfortunately, limiting the after-effects of nuclear weapons use inevitably carries with it some danger of increasing the likelihood that they will actually be used. Some acceptable middle ground may be attainable, however.

In order to demonstrate the interrelationships between

all the theoretical concepts we have discussed thus far, let us examine a model of a conflict which escalates from mere political tension, through the initial failure of deterrence, to conventional and finally nuclear war.

A Model

For the purposes of the following discussion we will postulate the existence of only two nuclear powers, 'A' and 'B,' each of which has a different concept of the nuclear threshold, and each of which has developed its nuclear weapons technology and arsenal in such a way as to provide a rather different set of nuclear options. 'A' and 'B' represent roughly the United States and the Soviet Union, but they are simplified and idealized to facilitate illustration of various concepts. The existence of third, fourth, and fifth nuclear powers, a serious problem in reality, is ignored here. Between 'A' and 'B' lies a zone of conflict (i.e., Europe) in which each has vital interests, but which each values less than his own territory.

Political tension between 'A' and 'B' has reached a peak. Perceiving 'A's' conventional forces to be no match for his own, and 'A's' willingness to use his substantial nuclear arsenal as doubtful, 'B' launches an invasion of the contested territory. 'A's' policy of deterrence by denial has failed. It remains to be seen whether 'B's' perception of 'A's' weakness is correct.

'A' has several options. If he shares 'B's' percep-

tion of his own conventional weakness he may simply concede the contest and allow his allies to be overrun. He may instead rush to his allies' defense. It is possible that, together, 'A' and his allies will be able to contain and even throw back 'B's' forces. It is conceivable, but unlikely, that they will then launch an invasion of 'B's' territory, or that of his allies. Stalemate is achieved and a settlement is negotiated on the basis of 'A's' demonstrated strength and resolve. Deterrence is reestablished and strengthened.

In the event that 'A's' forces are unable to contain 'B's' however, a different situation will emerge. There are now several additional possible outcomes. 'A' might not consider defeat, or at least partial defeat, as a threat to his vital interests. He may still be willing to negotiate a peace which leaves 'B' in the position of substantial victor. 'B' may also be willing to settle for less than total victory, either because his own war-aims have already been achieved, or because he now regards ultimate long-term victory to be assured. A negotiated settlement will ensue.

However, 'A' may not be willing to concede defeat, or at least, not on available terms. 'B' may not be willing to settle for less than total victory, or may not be aware of 'A's' willingness to settle for partial defeat. In this case 'A' may elect to continue the conventional struggle in hopes of wearing down 'B,' or in hopes of buying time until his own ultimately greater industrial and population bases

can turn the tide. If he sees neither of these as rational possibilities, and if he is unable to concede defeat, he may threaten to escalate to nuclear weapons. This may be a genuine threat or a bluff. In either case, we have now reached the nuclear threshold.

'B' may call 'A's' bluff by continuing his advance. He may back down in the face of 'A's' threat, and negotiate. He may also decide to launch a pre-emptive nuclear attack of his own.

A lot will now depend on the preconceptions of each power regarding the nuclear threshold. 'A' has long prepared for the possibility of fighting a limited nuclear war, and has evolved doctrines, contingency plans and weapons well-suited to that purpose. He is also very well prepared for an all-out nuclear exchange. 'B' has long claimed that all-out nuclear war is the only option. Nonetheless, he is at least partially prepared for a limited nuclear exchange. We have a wide variety of possible outcomes.

'A' may assume that 'B's' single-threshold strategy is fixed. Finding the prospect of mutual annihilation less attractive than defeat, 'A' concedes victory to 'B,' and no nuclear strike is launched. 'B' has achieved escalation dominance at the conventional level, and kept it. He has achieved victory, and may credit himself with having had the more effective strategy. In 'B's' view, 'A's' attempt to limit nuclear war betrayed his weakness and lack of will.

On the other hand, if 'A' finds the prospect of defeat truly unbearable and still believes 'B's' strategy to be inflexible, he may decide that a limited nuclear attack is a futile gesture of self-restraint. Accordingly, 'A' launches a massive nuclear attack on 'B.' If 'B' replies in kind, both lose everything. 'B's' inflexible 'single-threshold' fixation is to blame.

'A' may, however, decide that it is still worthwhile to launch a limited attack, hoping that 'B' will see the error of his ways in time to avoid mutual disaster. 'A' therefore fires a single 'warning shot' to demonstrate his resolve. 'B' may respond massively, as he has continually warned he would. 'A' replies in kind, and again we have mutual annihilation.

Then again, 'B's' leaders, suddenly faced with the real thing, may back down in the face of 'A's' challenge. Backing down may entail a retreat to the status-quo ante-bellum,¹⁵ or merely a withdrawal to negotiating terms 'A' can accept, even though it may still mean at least partial victory for 'B.' 'B' may also reply with a limited nuclear attack of his own. A nuclear threshold has now been passed, and the immediate results are less than totally catastrophic. 'B' has conceded the possibility of at least one level of limited nuclear war.

'A' may be able to utilize tacit bargaining techniques to achieve limitations which distinctly favor him. This might be accomplished in a variety of ways. 'A' might

simply announce unilaterally that he would limit himself to weapons of less than five kilotons' yield and twenty miles' range, and further state that he would regard use by 'B' of heavier or longer-range weapons as dangerously escalatory. 'A' would then refuse to discuss the matter further. Given 'B's' inferiority in short-range, low-yield nuclear weapons, he would face the choice of either accepting inferiority, or of breaking the new nuclear threshold which 'A' has set. In doing so he would face the renewed threat of mutual annihilation, before which he has already retreated once. 'A' has, in this scenario, achieved escalation dominance. If 'B' is unwilling to attempt to regain dominance through further escalation, he must either admit defeat, or continue to fight under the new, disadvantageous balance of forces. The likelihood now is that the conflict will be terminated along lines favorable to 'A,' and 'A' will owe his victory to his more realistic appraisal of 'B's' response to the threat of mutual annihilation. He also owes something to his own more flexible arsenal of TNW.

Of course, 'B' may decide to risk further escalation to a level of conflict to which his own arsenal is better suited. In doing so he may succeed in establishing a new, higher but still controllable nuclear threshold, or else all-out nuclear war will erupt and engulf both adversaries. This last of all possible outcomes is neither significantly better nor worse than what would have occurred had 'B'

followed his original policy and replied to 'A's' initial, limited strike with his entire nuclear arsenal.

The ability to achieve a limitation of nuclear weapons use in a conflict already begun will be dependent upon a number of variable factors: The different values placed by different participants on each of the possible outcomes of the conflict; The pre-conceptions of each participant regarding nuclear thresholds and regarding the other's view of nuclear thresholds; The ability and willingness of each participant to negotiate, either explicitly or tacitly; The differences between the participant's arsenals of nuclear weapons designed for limited war.

In each of these factors flexibility is a major consideration. Inflexibility over war-aims or previous strategic conceptions may bring disaster if it brings an inability to react to the imminent threat of mutual annihilation with some sort of moderating action. This will require termination or limitation of the conflict. Inflexibility in negotiation can make agreement impossible. Inflexibility in weapon design (and in the tactical doctrines to go with it) can be a fatal weakness for the less flexible party. Extreme lack of technical options could make limitation impossible. If one desires to retain the possibility of post-first-use limitation of nuclear warfare, flexibility in all these areas should be a prime goal.

On the other hand, if one believes in the one-threshold view, or wishes others to believe it, flexibility is

a bad idea. In this view, fear of ultimate annihilation will be sufficient to deter dangerous breaches of the peace. A flexible posture on nuclear weapons use weakens this ultimate form of deterrence. There must be no question about the inevitability of mutual annihilation should nuclear weapons ever be used again.

The location and number of the nuclear threshold (s) are purely psychological in nature. If everyone agreed that there was only one threshold, beyond which total destruction lay, it would be true. Nuclear war would be highly unlikely, but if it came, it would destroy civilization, if not human life itself.¹⁶ If, on the contrary, everyone believed in multiple nuclear thresholds, and if the different levels of nuclear conflict were clearly mapped out, it seems likely that the barriers against limited use of nuclear arms would be low. The threshold against all-out war might move up, down, or remain at the same level of political or military crisis. There would exist a graduated scale of possible nuclear disasters, but ultimate disaster might yet be staved off.

What we have in actuality, however, is a state of uncertainty. No one knows whether there is one threshold or many, although some find it expedient to claim the truth to be in one view or the other. In many ways this is the ideal situation. With uncertainty the barriers against first use remain as high as ever, for no one can be sure that a single use will not provoke the most extreme form of escalation. Once that barrier is broken, though, there

are still options, straws at which leaders can grab, short of all-out strategic war. Uncertainty is emotionally unsatisfying, for the human mind, like nature, abhors a vacuum. Uncertainty is preferable to certainty in this case, however, for certainty with regard to nuclear war, short of total disarmament, could only come at the too-high price of actual experience. Therefore, the preservation of both views is necessary, one to keep deterrence at the highest possible level, the other to provide options short of total disaster should deterrence fail.

The very possibility of limitation may increase the chance of nuclear war somewhat. Perhaps it is a chance worth taking. Perhaps not.

1. By 'non-Soviet Europe' I mean all of Europe outside the actual boundaries of the USSR.
2. There are a wide variety of 'Limited Nuclear Options' possible. For one good discussion of these see Benjamin S. Lambeth, Selective Nuclear Options in American and Soviet Strategic Policy (Santa Monica, Cal.: Rand Corporation, 1976).
3. Deterrence is clearly important to both Soviet and American defense policies, but it is at least questionable whether the Soviets place as much emphasis upon it as the Americans do. 'War-winning' and 'Damage Limitation' are evidently very important concepts to the Russians, while they play a much less significant role for the Americans.
4. There are various formulations of deterrence theory. I am not consciously following any one particular theorist in this paper, although Thomas C. Schelling has certainly been a strong influence. See Thomas C. Schelling, The Strategy of Conflict (New York: Oxford University Press, 1960). Also see Wolfgang Heisenberg, The Alliance and Europe: Part I: Crisis Stability in Europe and Theater Nuclear Weapons Adelphi Paper #96 (London: International Institute for Strategic Studies, 1973).
5. Quoted in Alexander L. George and Richard Smoke, Deterrence in American Foreign Policy: Theory and Practice (New York: Columbia University Press, 1974) p. 29.
6. The so-called 'Lisbon Goals' prepared for NATO in 1952 called for 96 divisions to be maintained by the West in Europe. This goal was never remotely approached, and NATO therefore elected to establish stocks of nuclear weapons. This decision was made in 1957. NATO Facts and Figures, 1975, (Brussels: NATO Information Directorate, 1975) pp. 105-106.
7. NATO Handbook, February 1976, (Brussels: NATO Information Directorate, 1976) p. 30. Do not confuse this NATO Triad with the American Strategic Triad: Bombers, Missiles, and Submarines.
8. See the 16-step 'escalation ladder' discussed in Herman Kahn, Thinking the Unthinkable (New York: Horizon Press, 1962) p. 135. Kahn was an early and important nuclear strategist, and his book is valuable reading for anyone interested in strategic theory.

9. Lach, Donald Frederick, and Wehrle, Edmund S. International Politics in East Asia Since World War II. New York: Praeger, 1975.
10. Examples of this kind of thinking are not too difficult to come by. The Bulletin of the Atomic Scientists seems to maintain the one-threshold view as an editorial policy. See Bernard T. Feld's editorials of each issue. For a specific example, see Jorma K. Miettinen "Enhanced Radiation Warfare," Bulletin of the Atomic Scientists (September 1977). The Center for Defense Information (CDI) also seems to hold this view as a matter of policy. See CDI's Defense Monitor (February 1975), which contains subheads like 'Any Nuclear War Likely to be Total.'
11. It probably is not politically feasible to explicitly negotiate limits or levels of nuclear conflict prior to the outbreak of hostilities. At least, not publicly. Nor would it be wise, for no such agreement could be entirely trustworthy, and it might seriously lower the initial nuclear threshold.
12. Schelling, p. 77.
13. A decision by the Superpowers not to strike directly at each other would probably have to include also a decision not to strike at any of the lesser nuclear powers. Britain and France particularly possess sizeable independent strategic nuclear forces, and would hardly be likely to wait until American territory came under fire to retaliate for nuclear attacks against themselves. It seems likely that any NATO nuclear attack directly on the Soviet Union would provoke a Soviet attack directly on the United States.
Such a situation does entail some advantages for NATO, for Britain and France would then provide valuable 'nuclear sanctuaries' for NATO forces. Soviet ground forces, to be in a position to attack NATO, would have to cross territory open to Western nuclear fire. American supplies and reinforcements could be safely built up in the French and British sanctuaries, and there either await attack or advance into the free-fire zone.
14. Schelling, p. 75.
15. 'Situation before the War.'
16. See U.S. Arms Control and Disarmament Agency, World-wide Effects of Nuclear War. . .Some Perspectives (Washington, D.C.: U.S. Government Printing Office, no date given, but after 1974.)

CHAPTER IV
TACTICAL NUCLEAR WEAPONS
and
NATO

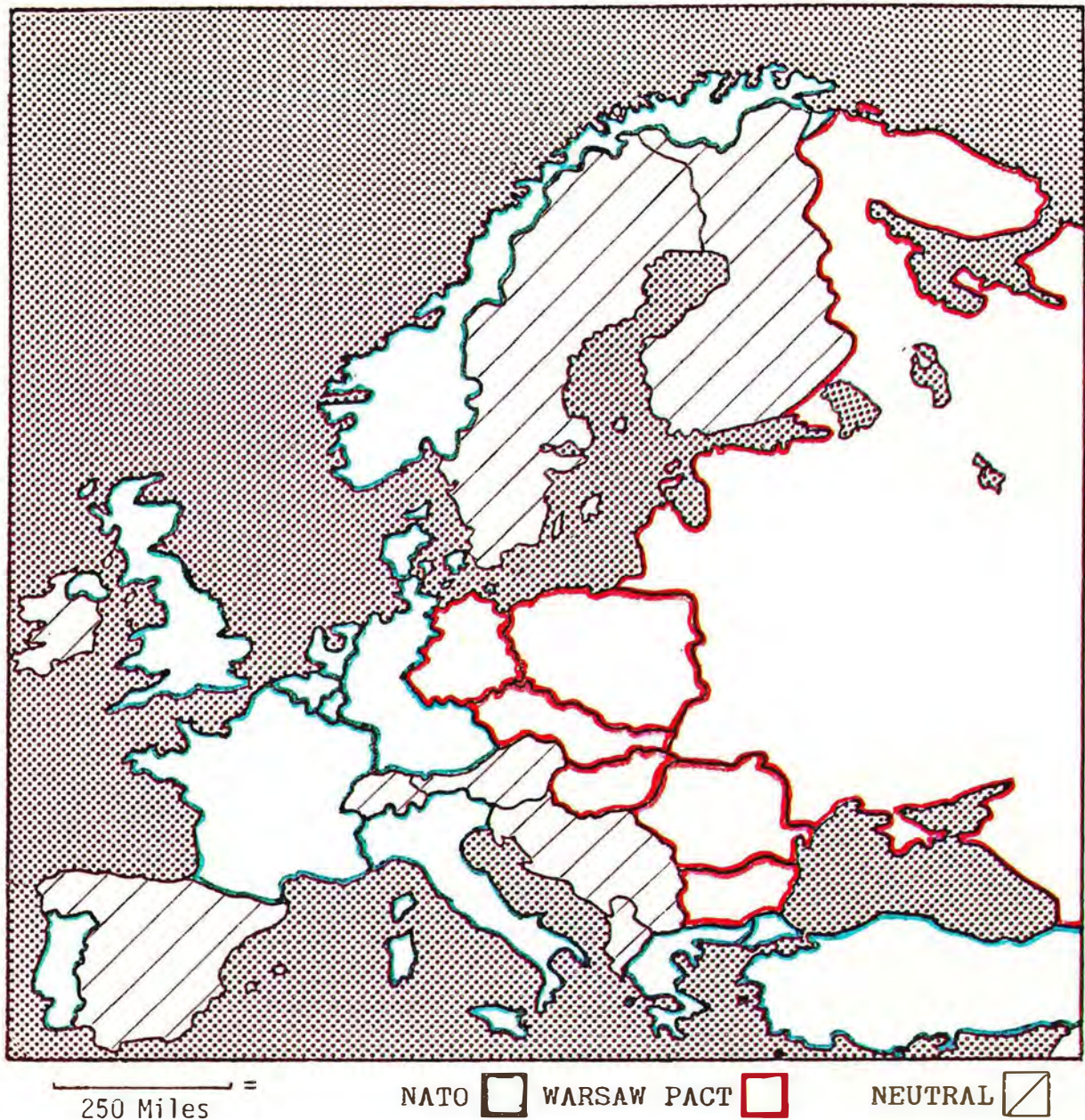
In this chapter we explore the role of TNW in the North Atlantic Treaty Organization (NATO). After examining the key strategic problems which caused tension within the alliance, we turn to a consideration of the East-West military balance. While no detailed assessment of that balance will be attempted here, major difficulties in making such an assessment will be considered.

The Alliance

The North Atlantic Treaty Organization came into being in August of 1949. The twelve original signatories were Belgium, Canada, Denmark, France, Iceland, Italy, Luxembourg, the Netherlands, Norway, Portugal, the United Kingdom, and the United States of America. Turkey and Greece joined the organization in 1952, and in 1955 West Germany also joined, making for a total of fifteen member nations.

The alliance has proven very stable, and it remains today the principle basis for American foreign and defense policies. There is, however, an inherent conflict between American and European strategic views, and NATO defense policy is essentially an attempt at a compromise between the two. An understanding of this inherent conflict, and of the ambiguous nature of its resolution, is important for an understanding of the tactical nuclear weapons issue.

The key differences in American and European strategic



perceptions are the results of geography, and while changes in technology may serve to alter the impact of that geography somewhat, it is doubtful that allies geographically separated by the Atlantic Ocean will ever view the threat from Soviet Eurasia in quite the same light.

For the Europeans, war in Europe would mean disaster, the third in a century. This remains true whether the war is conventional or nuclear in nature.^{1*} Given the size of

the forces involved and the destructive power of modern conventional weapons, even a limited war means utter destruction for the territory in which it is to be fought, and in Europe that probably means Germany and the Low Countries. The Europeans stand to gain little and lose much from any such war, and thus have little motivation to fight a war limited in such a way that the Superpowers may remain relatively unscathed. They therefore prefer a nuclear 'reprisal' deterrent strategy, for any serious attempt at 'denial' would mean the virtual destruction of Europe.

In the American view, Europe is the front line of defense for the continental United States itself. Although historically the American policy against any single-power domination of Europe is related to the centuries-old British struggle against first Spanish, then French, Russian, and German Imperial aspirations, it seems a valid policy for today as well. The fall of Western Europe into Soviet hands would pose an intolerable threat to American security. American independence would not last long were the Soviets to control the immense human, commercial and industrial resources of Western Europe. Russian control of Europe would also mean Russian control of the natural resources of the Middle East, vital to the U.S. and to her other great ally, Japan. An interim peace which deprived America of her allies in Europe and Japan would be but a breathing space before ultimate American defeat.

However, there is little point to the Americans fighting a war in Europe if that war were to be automatically

extended to America itself. The U.S. therefore would prefer a strategy of denial, for strategic nuclear reprisal against the Soviet Union would automatically lead to Soviet nuclear attacks on the U.S. Given this simultaneous need of America to both defend Western Europe, and to avoid nuclear attacks upon itself, the Americans face something of a dilemma. The West Europeans must be convinced that the U.S. will not allow them to be overrun, while at the same time the U.S. must assure itself that the means by which it defends Europe will not provoke nuclear attacks on America. Given further the apparent inability of the NATO nations to provide sufficient conventional forces to contain for long a full-scale conventional attack,² America needs to find a way to use nuclear weapons as a deterrent, and if deterrence fails, as an actual means of stopping Soviet forces, without triggering strategic war. Tactical nuclear weapons are designed and deployed for just that purpose.

As Colin Gray puts it:

The basic political test for any TNW doctrine lies in the requirements that it provide for sufficient battlefield and near-battlefield use so as to persuade Americans that a theater nuclear war might (just) remain limited to that theater; and that it provide for sufficient off-battlefield use for the purpose (explicitly, at least) of effecting deterrence-through-the-fear-of-further-escalation, so that Europeans are (reasonably) confident that no theater nuclear war could remain limited to that theater. Restated very directly, Europeans do not wish to be defended by extensive TNW use, and Americans do not wish their territory to face an immediate nuclear risk in the

event of any clash of arms involving NATO and Warsaw Pact forces. This fundamental difference of interests is quite incapable of analytical resolution.³

Soviet statements make it questionable whether they would allow any nuclear war to remain limited, and the strong independent strategic forces of France and Great Britain make it doubtful whether they would allow what would be in effect strategic strikes upon them by the Soviets without replying in kind. France has long been committed to a policy of Massive Retaliation, although her recent deployment of the tactical nuclear 'Pluton' throws that policy into some doubt. Great Britain usually echoes the U.S. and official NATO policy of 'flexible response,' but her conventional forces are notably weak, her strategic nuclear forces conspicuously strong.

It is therefore incumbent upon the Americans to provide adequate conventional forces to stave off the need to use TNW for as long as possible. As America is unable to defend Europe conventionally by itself, European conventional forces must be obtained. Europe only provides conventional forces because it is believed that they are necessary to convince the Americans to provide guarantees of nuclear support. The argument comes full circle.

In this situation there can be no clear policy or doctrine with regard to NATO's TNW use. Any position definite enough to satisfy one set of vital interests would thoroughly alienate the other. NATO policy with regard to tactical nuclear weapons is therefore highly am-

biguous. To again quote Colin Gray, "The best doctrine tends to be the least doctrine; in other words, we agree that we will do what seems to be most appropriate at the time."⁴

This is not necessarily a bad situation. If the requisite flexibility in strategic conceptions, negotiating posture, and technical options is present at the time of crisis it can be, in fact, the ideal stance. Uncertainty with regard to the nuclear threshold is, as the last chapter concluded, the best of many unhappy alternatives, for it keeps the level of deterrence high, and yet holds out the possibility of conflict limitation. Technical flexibility is certainly present in NATO's TNW arsenal. NATO's strategic and diplomatic flexibility, however, are unknown quantities.

NATO has developed a policy of flexibility and uncertainty into a general strategy, 'Flexible Response':

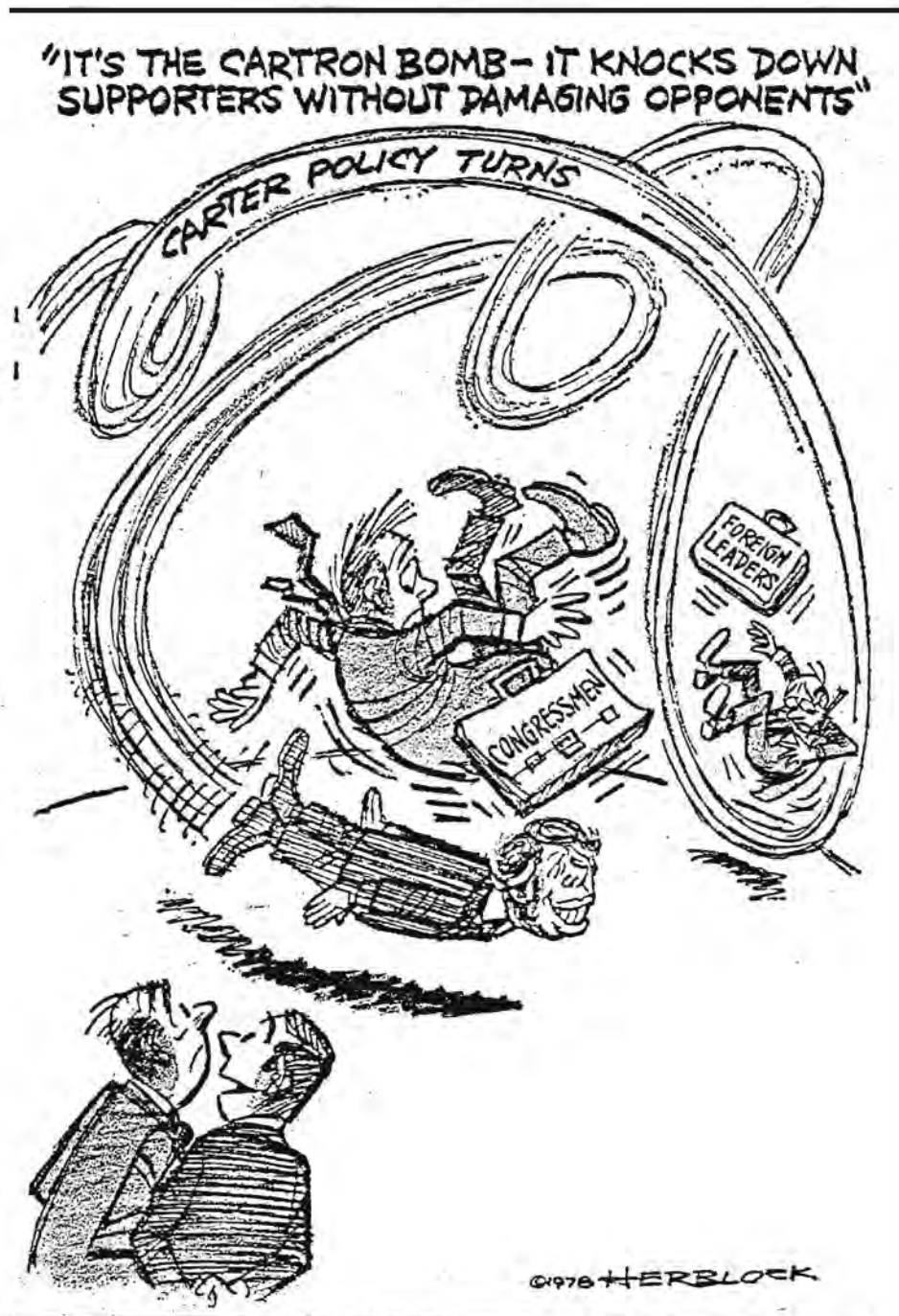
The basis of this concept is that NATO should be able to deter, and (if deterrence fails) to counter, military aggression of any kind; and that this can be secured only through a wide range of forces equipped with a well-balanced mixture of conventional, tactical nuclear, and strategic nuclear weapons. The purpose of this balance of forces, while retaining the principle of forward defence,⁵ is to permit a flexible range of responses combining two main capabilities: to meet any aggression by direct defence at a level judged to be appropriate to defeat the attack, and to be able to 'escalate' the level, deliberately under political control, if defence at the level first selected is not effective. An aggressor must be convinced of NATO's readiness to use nuclear weapons if necessary; but he must be uncertain regarding the timing

or the circumstances in which they would be used. In this connection, however, selective and limited tactical use of nuclear weapons could not be deferred until NATO's conventional defences were completely defeated; first, it would probably be neither feasible nor effective to use the nuclear weapons; the enemy would already have advanced too far and there would be a danger of hitting friendly troops or the civilian population. And secondly, our own forces would be in no condition to exploit and drive home the advantage gained by the use of the weapons. Under the new strategic concept of flexibility in response,⁶ with its increased emphasis on the need to be prepared for attacks of varying scales in any region of the NATO area, the aim is that NATO should have available a considerable sea, land, and air conventional combat potential, supported by nuclear weapons for tactical use, over and above the strategic nuclear forces. All these forces must be well organized and prepared for immediate employment. NATO's readiness posture and its capacity to reinforce, deploy, and mobilize in time of tension and crisis are the foundations of 'controlled escalation.'⁷

Thus the inherent conflicts between the American and the European strategic views have been, if not solved, at least minimized. Neither these inherent differences nor the relatively minor political squabbles within the alliance seems to seriously threaten the cohesiveness of the alliance.^{8*}

Nonetheless, there are internal problems which do directly relate to the TNW issue. The current confusion over the 'Neutron Bomb' is one. The fundamental difficulties over the Neutron Bomb are political, and relate to domestic divisions within individual NATO countries, particularly Germany. Although the European governments, Germany's included,^{9*} evidently wish to have the Enhanced

Radiation nuclear warheads produced and deployed, they would prefer for the United States to take full responsibility for the decision. In that way the allied governments can avoid the onus of introducing a weapon seen in some domestic circles as grossly immoral.¹⁰ President Carter, on the other hand, has indicated that he will not deploy the



Washington Post, April 7, 1978.

weapon unless the NATO allies expressly approve it. Carter's apparent vacillation has confused and upset NATO leaders,¹¹ and his poor timing has caused considerable friction. Under heavy U.S. pressure West Germany had finally decided to expressly endorse production of the weapon (though carefully hedging about its actual deployment).¹² The New York Times then released a story claiming Carter had decided to forego the 'Neutron Bomb' altogether.¹³ Evidently dismayed by the resultant outcry, Carter decided merely to delay the final decision, the question is now as far from final resolution as ever, and there has been much embarrassment all around.

The Military Balance

The two opposing European alliance systems are each military giants, and Europe is the scene of the greatest concentration of military forces and firepower the World has ever seen. Both possess immense conventional, tactical nuclear, and strategic nuclear forces.

Owing to the SALT negotiations, the strategic nuclear balance seems essentially stable, and functionally equal.¹⁴ In tactical nuclear forces also there is a rough parity, although there are several important dissimilarities in the opposing forces. With the strategic and tactical nuclear balance so even, conventional forces assume greater significance than in the recent past, and so some assessment of the conventional military balance is called for. The TNW arsenals of the two alliances have already been

examined, in Chapter II. Although any detailed analysis of the conventional balance of forces in Europe lies outside of the scope of this paper, we shall examine some of the difficulties which arise in making any meaningful assessment. These include matters of quality as well as quantity, technological prowess, questions about the suitability of various tactical doctrines, and matters of political will.

The table on page 102 gives some raw statistics on the opposing military forces. However, these figures can be misleading, as NATO and Warsaw Pact armies are structured very differently, and there are serious questions with regard to relative troop readiness levels, political reliability, and technological capabilities. It is amazing how one can use identical figures to prove the overwhelming superiority of either side.^{15*}

A writer wishing to stress the strength of the Pact will often give troop figures in terms of the number of divisions on each side. On that basis, the Pact has a three-to-one superiority in Central and Northern Europe, with 152 Pact divisions facing 53 NATO.¹⁶ Conversely, a writer wishing to point out NATO's actually threatening, aggressive stance may choose for his example the Southern Flank, where 575,000 NATO troops face 345,000 Warsaw Pact forces. However, the NATO tally includes the Italian Army,¹⁷ all of which is stationed in Italy and thus is very far from the likely scene of fighting. Returning to

COMPARISON OF NATO AND WARSAW PACT FORCE LEVELS

	NATO	WARSAW PACT
Total Active Military Manpower	4.9 million	5.6 million
Total Reserve Military Manpower*	5.5 million	8.7 million
Total Number of Divisions	24 (U.S.)	168 (USSR)
Average Manpower per Division	16,500	9740
Number of Armored Divisions	14	62
Tanks per Armored Division	324 (U.S.)	350
Total Number of Tanks (in Europe)	10,000	40,000
Total Number of Helicopters	9,000	2,000
Armored Personnel Carriers	22,000 (U.S.)	40,000 (USSR)
Artillery Pieces	6,000 (U.S.)	20,000 (USSR)
Total Number of Tactical Aircraft	5000 (U.S.)	10,000 (USSR)
Total Number of Naval Warships	about 1000	about 530
Major Surface Warships		228
Aircraft Carriers	17	0
Submarines:		
Nuclear Powered	103 (U.S.)	figures unavailable
Conventional Powered	11 (U.S.)	185
Nuclear Missile Boats	49 (NATO)	62
Attack Submarines	73 (U.S.)	253
Total Submarines	114 (U.S. only)	315 (USSR only)

*(standing reserves only)

the Central Front, and wishing to show an essential equality of forces, he can count NATO as having 625,000 troops, the Pact 895,000. In terms of actual combat troops, the Russian advantage is far greater than that would indicate, however, as NATO divisions have a much lower proportion of combat troops to logistical and support troops. (This is called a low 'teeth to tail' ratio.) This same disparity, however, may be viewed as a NATO advantage in a long, drawn out war, for Russian forces lack the endurance, in terms of capacity to fight an intense, drawn out battle, expending huge amounts of supplies and ammunition, which U.S. forces have.

In airpower, numbers may again be deceiving. A writer can honestly list NATO airpower under 'Air Forces in Europe,' and thus leave out the numerous U.S.-based air squadrons earmarked for NATO, which can be on the scene in mere hours or days. A simple ratio of total combat aircraft will be misleading, for huge numbers of Soviet aircraft are not suitable for offensive use. Some 2,600 interceptors¹⁸ are assigned to Soviet home air defense, and these are not easily adapted to aggressive purposes. Soviet aircraft and pilot training are generally of lower quality than are NATO's, and this has been amply demonstrated in both the Arab-Israeli Wars^{19*} and Vietnam. In the latter case, the U.S. versus Communist aerial combat kill ratio was two-to-one in favor of the Americans. This ratio was considered something of an embarrassment to U.S. airmen, who attributed

their 'poor' two-to-one score to faulty tactics, since revised.²⁰ Soviet air capabilities have been steadily improving, but new Western aircraft like the F-14, F-15, F-16, and F-18, along with improved air munitions, represent a quantum leap in combat aircraft performances. Western airmen seem generally satisfied with the numerical balance, but are concerned by the relative vulnerability of NATO's few airfields, and by the increase in Soviet numbers in just the last few years. Soviet increases, coupled with American decreases, have brought the balance from 5800 U.S. and 3250 Soviet tactical aircraft in 1965, to 5000 U.S. and 5250 Soviet in 1975.²¹

Western combat aircraft are highly versatile, and most are capable of performing a wide variety of missions. Soviet aircraft are less so, although there have been recent increases in the numbers of Soviet multi-role aircraft.²² The Western advantage here means among other things that Western air forces can turn from an air-superiority contest, once won, to ground support roles, with a minimum of confusion and expense.

At sea, the Soviet fleet is formidable, but vulnerable.²³ In total numbers of ships it is the largest in the World, although in manpower it ranks behind the U.S. Most of its vessels are for coastal defense, but it does have a very large 'blue water' Ocean-going component. The Soviet submarine fleet is the largest in the World, and poses a serious threat to U.S. sealift capability in time

of war. The USSR possesses no true aircraft carriers. Soviet ships are notable for their heavy armament, even small craft being studded with a wide variety of weapons. By comparison most U.S. ships look almost unarmed. In ship-to-ship missiles the USSR has long held an edge, although this has diminished recently with U.S. deployment of the 'Harpoon' missile. Soviet amphibious capacity is relatively large, not so much because it has grown but because U.S. amphibious forces have shrunk.²⁴ In terms of ships alone the Soviet Union might pose an extremely serious threat to U.S. control of the seas. However, there are two major factors mitigating this Soviet naval threat, one political, one geographic.

The political factor is that America is by no means alone at Sea. American naval commentators frequently forget that our allies in Europe, especially France and Britain, still maintain quite large and modern navies. Altogether the European NATO navies contribute some 550 combat vessels to the naval balance.²⁵ France has two aircraft carriers, Britain one. (The U.S. itself has 14.)^{26*} Other U.S. allies have significant naval forces. Japan's 'Maritime Self-Defense Force' is a small but first-class navy. Even Australia has an aircraft carrier in its fleet.

The geographical factor may be even more important. Soviet naval forces are separated by wide distances, and essentially confined to four areas: The Black Sea; the Baltic; the Arctic; and the Sea of Japan. Access to the

open Ocean is only available through narrow waterways, all of them controlled by U.S. allies. Furthermore, the lack of world-wide port facilities and bases²⁷ keeps the bulk of the Soviet Navy in these restricted areas most of the time. Their nuclear missile submarines spend far more time in their home ports than do U.S. subs, an average of only about one-quarter of the force being out on patrol at any one time. Usually 50% of the American strategic missile submarine force is on patrol. The Soviet need to disperse their fleet and to get it out into the open Ocean before the start of war should provide a very important warning signal to the West.

This does not eliminate the Soviet naval threat. Especially in close quarters like the Mediterranean, Soviet naval forces pose a great danger to NATO forces. Strong Soviet forces in the Arctic and Baltic may make it very difficult for NATO to reinforce Norway in the event of war there. The Soviet submarine threat to Western shipping may imperil effective re-supply of Europe by the U.S.

Regarding the quality and training of personnel, the picture is fuzzy. All Soviet students receive basic military training in school. Nonetheless, the readiness of many divisions is very low,²⁸ while the readiness of U.S. forces in Europe has been rising since the end of the Vietnam War, especially under the stewardship of Gen. Alexander Haig, present American 'Supreme Allied Commander, Europe' (SACEUR). Toward the end of the war in Vietnam,

American forces in Europe were thoroughly unready for combat, demoralized by the losing war, drugs, and racial antagonisms among the troops. Today, these same forces are reported as being largely combat-ready, well-supplied and equipped, and officered by an officer corps which has considerable combat experience.^{29*} This last may be an important factor, for the Soviets have not fought a real war since 1945. Historically, Russian armies have risen to great heights in the face of adversity and then stagnated into ruin during periods of extended peace.^{30*}

The political reliability of the Soviet Union's East European allies is also questionable. Membership in the Soviet dominated Warsaw Pact (formed May 14, 1955) is not entirely voluntary for the six junior allies, Poland, Czechoslovakia, Hungary, Romania, Bulgaria, and East Germany. Hungary attempted to leave the organization in 1956, and was only convinced to remain with some difficulty, i.e., by a Soviet invasion. The Soviets also felt obliged to invade Czechoslovakia in 1968, although the Czechs denied any desire to desert the Pact.³¹ Albania, originally an alliance member, quit in September 1968, and has since distressed the Soviet leadership with its intense ideological criticism. Yugoslavia established its identity as an independent communist state in 1948, and provides a handy role-model for Eastern Europeans weary of the heavy hand of the Soviet Union.

Nonetheless, short of major war or revolution, the

31 divisions of the East European allies remain firmly under Soviet control.

Another matter of debate is the heavy Soviet reliance on the tank. There is considerable evidence to indicate that the tank is losing its primacy on the battlefield to the individual infantryman.^{32*} Modern weaponry gives that infantryman the firepower and accuracy to destroy anything that the Soviets can put in the field, as well as low-flying aircraft. As one commentator has said, "if it moves, if it's made of iron, or if it emits,³³ we can kill it." The offensive mobility which has been a dominant military fact of life since the beginning of World War II may be losing its place on the battlefield, and the defense regaining the upper hand. This could lead to a situation like that of World War I, where tactics emphasizing mobility and the offensive met their defeat in the machine gun and barbed wire. This is a source of hot dispute, however.³⁴

One important factor to keep in mind when assessing the East-West military balance is the long-term superiority of the West in military potential. The population of the NATO nations alone (counting the U.S., but not her non-NATO allies) is twice that of the Soviet Union, and their industrial base four times the size of the Warsaw Pact's. Soviet victory, if it comes at all, will have to come quickly. The Soviets therefore rely on a short-war strategy, 'Blitzkrieg', massive armored attacks, and will strive

for the rapid capture of Western Europe. This will supposedly eliminate the American will to fight.^{35*}

NATO, insofar as it is prepared for a purely conventional war, hopes for a long one. This explains NATO's emphasis on logistical endurance and re-supply capabilities. NATO's 'forward defense' strategy, however, is seriously flawed. This policy calls for stopping the enemy at or near the borders of Western Europe, and is motivated by political considerations. NATO does not possess sufficient forces to adequately defend the several hundred miles of border it shares with the Warsaw Pact. This concept of 'forward defense' may be designed merely for domestic consumption in the West, for other NATO tactical concepts are not well-suited to the sort of static defense it envisions. Alexander Haig speaks in terms of 'mobile defense,' and 'shoot-move-shoot.'³⁶ These are tactics that require a lot of ground and a deep front. The only way NATO can acquire the room is either to pre-emptively invade Eastern Europe, which is unlikely, or to draw Soviet forces fairly deeply into NATO territory. Also, the West-German Army maintains a 'Territorial Defense Force'³⁷ of some 500,000 men, heavily equipped with anti-tank and anti-aircraft equipment, and this is ideally suited to a defense-in-depth rather than to the linear defense implicit in the 'forward defense' strategy. These territorial troops in their fortified positions provide local strong-points around which NATO mobile forces could build their 'mobile defense.'

On the other hand, 'forward defense' may in fact be the actual intention of NATO, or, if it isn't, prior public commitment may actually force it on NATO in the event of war. 'Forward defense' is an attempt to protect all of West Europe from Soviet occupation, and as Frederick the Great said, "He who tries to defend everything defends nothing."³⁸ A linear defense can easily be overwhelmed by local enemy concentrations. Once penetrated, the thin line of defensive forces can easily be surrounded, cut-off, and defeated. Therefore, the 'defense-in-depth' concept, and the Territorial Forces of the West German Army are probably the best basis for the conventional defense of NATO. This, however, is politically unpalatable, for it envisions warfare over a wide area of Europe, and the use of built-up urban centers as defensive strong points. As an operational concept, it would contribute to European fears that America is willing to fight to the last European.

Another matter which occupies NATO planners is the matter of warning time. How much warning can NATO expect to have of an impending Soviet attack? Guesstimates range from none at all to 48 days. The no-warning-time theorists³⁹ maintain that Soviet standing forces in Eastern Europe are sufficiently strong and ready to launch an attack from a 'standing start,' that is, with no visible special preparations. At the other extreme,⁴⁰ some believe that Soviet peacetime standards of readiness, in terms of unit manning levels, supplies, and equipment, are so low that the neces-

sary preparations for an invasion would take months. After surveying the situation, I myself lean towards the latter position. Certainly the truth lies in between the two extremes. Each is based on a 'worst-case' analysis, and no rational commander would undertake operations based on such extreme predictions.

General Haig believes that NATO can count on a minimum warning-time of eight days.⁴¹ This is long enough, he believes, to mobilize available NATO forces, move them from their peacetime positions to their war-time deployments,⁴² disperse vulnerable TNW stockpiles and aircraft, and begin the shipment of U.S.-based troops, aircraft, and supplies. Valuable warning signs will include full mobilization of normally understrength Russian units, dispersal of aircraft, and particularly dispersal of the Soviet fleet, normally concentrated in the Baltic, Arctic, and Black seas. This expectation seems reasonable.

The problem is that NATO leaders might prove reluctant to utilize any available warning-time, for fear of escalating political tensions. The fear that any warning time might prove useless for such political reasons seems justifiable. In the case of the Soviet invasion of Czechoslovakia in 1968, for instance, not only was the NATO Command forbidden to prepare for the possibility of a larger conflict, but readiness levels were actually ordered to be reduced!⁴³ Similar action at a time of real Soviet-Western crisis could be fatal to NATO. Stalin's refusal to believe

the overwhelming evidence of impending Nazi attack in 1941 gives an example of what can happen in such a situation.

Americans are sometimes accused of having a 'Pearl Harbor Complex,' that is, an irrationally strong fear of being surprised. Certainly the American experience of underestimating Japan prior to World War II has left scars, and possibly led to present over-estimations of Soviet military capabilities. Nonetheless, by any standards those Soviet capabilities are very great. The Soviets themselves seem quite satisfied with the balance of forces in Europe, and the failure of attempts at mutual reductions is evidence of this.⁴⁴ Whether or not Soviet capabilities include the capacity for true surprise attack is an important question, and any position one might wish to take regarding NATO readiness ought to include a position on this issue.

There are other problems related to the military balance in Europe, but these examples should indicate the complexity of making a useful assessment. When taking a position on NATO's ability to defend itself with conventional forces, matters of quantity and quality must be considered. The historical pattern of Soviet military development suggests certain possibilities about their current military competence, but these suggestions should not be taken too far. Soviet and NATO tactical doctrines are open to question, and the matter of long-war versus short-war involves not only military and industrial capabilities but political will, particularly that of the United States.

These and other problems should be taken into account in assessing NATO's conventional capabilities. Generally, the stronger NATO's conventional forces, the less likely NATO is to use nuclear weapons, for there is little question that NATO will indeed use nuclear weapons before it will accept defeat and occupation by the Soviet Union. Both overestimation and underestimation of true NATO conventional capabilities is dangerous. Overestimation may lead to an unjustified and dangerous overconfidence, and may inhibit proper planning for TNW use out of the belief that nuclear weapons will not be necessary. Underestimation can sap NATO morale, and may lead, in the event of war, to the premature use of nuclear arms.

My own, rather unorthodox view is that the balance of forces between NATO and the Warsaw Pact is currently roughly even. However, a serious erosion of NATO's position is being caused by a Soviet build-up which began in the mid-sixties and is continuing unabated, and by Western military budgets which have consistently been declining, in 'real' dollars, over the same period. Predictions of a Soviet walk-over of NATO seem unrealistic, and a purely conventional conflict between the two would be a real contest, at least as long as NATO remains on the defensive. NATO forces clearly are not adequate for a true offensive against the East. On that basis, neither side would be justified in expecting a quick or easy victory. That in itself may constitute a NATO advantage, for given the superior indus-

trial and population bases of NATO, time is very much on the side of the West.

However, Soviet strength is growing, and they may prove overconfident. Even a conventional war victorious for NATO would be a large-scale disaster for Europe. Therefore there is room for a considerable increase in NATO forces, in order to strengthen deterrence. There are limits to the deterrent value of increased conventional forces, and care should be taken not to equip NATO with so much strength as to pose a credible offensive threat. The Soviets have certain vulnerabilities which must be respected, chiefly their difficulties in maintaining their hold on their East European 'allies,' and the threat which they perceive as emanating from China. By some odd quirk of History it seems that nearly all of Russia's neighbors are either its servants or its enemies, and legitimate Soviet security concerns must be recognized.

Footnotes to Chapter IV

1. War-games have been fought using simulated nuclear weapons. Two of the most publicized such wargames were Sagebrush, held in the southern United States, and Carte Blanche, held in West Germany. In Sagebrush, military commanders ordered tactical 'interdiction' strikes as much as 1100 miles behind enemy lines. In Carte Blanche, in which, as the name suggests, nuclear weapons were used without significant limitations being imposed, 335 weapons were used, resulting in a theoretical 5.2 million casualties, 1.7 of them fatalities. This exceeds Germany's losses in World War II, and only took a very few days to accomplish. Other consequences included "a rapid breakdown of any semblance of order or control on the battlefield."
 However, both of these exercises took place using simulations of the far larger, more inaccurate and dirtier TNW of the 1950s period. Whether similar casualties could be expected using the most modern TNW, including the Enhanced Radiation weapons currently the subject of so much controversy, is unknown. See Lawrence Martin, Arms and Strategy (New York: David McKay Company, Inc., 1973) pp. 131-142.
2. Most assessments of the NATO/Warsaw Pact conventional balance are rather pessimistic. In this they differ somewhat from my own assessment (see page 113). See the bibliography for works specifically on the East-West military balance.
3. Colin S. Gray, "Theater Nuclear Weapons: Doctrines and Postures," World Politics (January 1976), p. 301-302.
4. Colin S. Gray, p. 302.
5. The concept of 'forward defense' is discussed later in this chapter, p. 109.
6. 'Flexible Response' was adopted as official NATO policy in December, 1967. NATO Information Directorate, NATO Facts and Figures (Brussels: NATO Information Directorate, 1975) p. 108.
7. NATO Facts and Figures, p. 106.
8. Other important strains in the alliance include American fears about possible communist participation in the Governments of France and Italy; the Greco-Turkish dispute, which has resulted in a U.S. cut-off of military aid to Turkey in response to the Turkish invasion of Cyprus in 1974; the Anglo-Icelandic fishing rights dispute (currently dormant); and the general problem

of French nationalism. The latter has repeatedly caused strains, and in 1966 De Gaulle withdrew France from the unified military command, and threw all official NATO personnel off of French territory. France nevertheless remains for practical purposes an important member of the alliance. See Carl H. Amme, Jr., NATO Without France: A Strategic Appraisal (Stanford: Hoover Institution on War, Revolution and Peace, 1967), and Wolf Mendl, Deterrence and Persuasion: French Nuclear Armament in the Context of National Policy, 1945-1969 (New York: Praeger, 1970).

9. The Netherlands' Parliament, however, recently voted to condemn 'Neutron' weapons.
Norway does not allow nuclear weapons to be stored on its territory in peacetime, and has been fairly neutral on the 'Neutron Bomb' issue. However, in a letter to me from the Royal Norwegian Embassy, Lt. Col. Ketilsson of the Norwegian Army told me that Norway has "a clear understanding of the fact that this weapon system constitutes a strengthening of the nuclear defense of Europe." (Letter dated 3 March 1973)
10. German domestic opposition to certain varieties of nuclear weapons has been strong. One leading figure of Germany's Social Democratic Party, Egon Bahr, referred to the 'Neutron Bomb' as evidence of "perverted thinking." He has since, however, called for use of the weapon as a bargaining chip in disarmament negotiations with the Soviet Union. "Neutron Weapons Controversy Leaves NATO Confused," Washington Post (April 6, 1973) p. A5.
Some of the opposition is downright irrational. Germany turned down the idea of purchasing an American-made anti-tank shell, proven extremely effective, because it contained Uranium. The Uranium was present only because its great density makes it excellent for armor-piercing shells. The weapon was clearly non-nuclear, and the Uranium used was not of a weapons grade variety, nor did it pose any radiation hazard. Armed Forces Journal (September 1977).
11. See Michael Getler and Ronald Koven, "Europeans View Carter as Weak, Unskilled Leader," Washington Post (April 10, 1973) p. A1.
12. Walter Pincus, "Bonn Backs Producing Neutron Arms," Washington Post (April 5, 1973) p. A1.
13. New York Times (April 4, 1978) p. 1.
14. Whether SALT does indeed leave the U.S. in a position of strategic equality with the Soviet Union is a matter of intense controversy. However, it is outside the

scope of this paper to debate that issue.

15. The military statistics used in this section and in the chart are compiled from John Erickson, Soviet-Warsaw Pact Force Levels, (Washington, D.C.: United States Strategic Institute, 1976), Gen. George S. Brown, USAF, United States Military Posture for FY 1978 (Washington, D.C.: U.S. Government Printing Office, 1977), and Library of Congress Congressional Research Service, United States/Soviet Military Balance (Washington, D.C.: U.S. Government Printing Office, 1976). This particular set of statistics has been chosen at random from a wide variety of possible statistical sets. Statistics available vary widely, and it is rarely certain exactly what any given number refers to. The statistics I've used here are simply for illustration purposes, and the interested reader should check other sources for a more comprehensive view.
16. United States/Soviet Military Balance. It is uncertain exactly which portions of Europe are included in each geographical division, and this scheme of North, Central, and Southern Europe is useful for manipulating figures to produce desired results. The justification for using this system is that the NATO command is divided up geographically in this manner, but the military implications of statistics so figured are unclear.
17. No offense to the Italian Army intended.
18. Erickson, p. 43.
19. Not only Soviet Trained Pilots, and Soviet-designed aircraft and tactics, but even actual Russian pilots flew in these conflicts, and thus the poor performance of Communist air forces against the Americans may be considered meaningful to the NATO/Warsaw Pact balance.
20. See Dana Drenkowski, "The Tragedy of Operation 'Linebacker II,'" Armed Forces Journal (July 1977). Also Aviation Week and Space Technology special reports NATO: The New Challenge (1977) and Tactical Air Command: Modernization and Management (1973)
21. United States/Soviet Military Balance, p. 44-45.
22. NATO: The New Challenge, p. 15.
23. For interesting discussions of and information on the Soviet Fleet see Erickson, pp. 52-64, and Edward Wegener, The Soviet Naval Offensive (Annapolis: United States Naval Institute, 1975).

24. United States/Soviet Military Balance, pp. 6, 44.
25. Brown, p. 39.
26. These figures are for large, multi-purpose Attack Aircraft Carriers. If we count smaller, specialized craft, like Anti-Submarine Warfare (ASW) Carriers, there are 21 U.S., 3 Soviet.
27. USSR naval strategic considerations may be the driving force behind their involvement in the Horn of Africa, and elsewhere on that continent.
28. See Erickson for a detailed discussion of Soviet unit readiness.
29. U.S. officers trained in Vietnam, however, were not properly indoctrinated for a war in Europe. Re-training, and correcting many tactical concepts inappropriate to Europe may not be easy, and the difficulties may limit the U.S. advantage of a combat-experienced officer corps.
30. Examples of the sharp rise and fall of Soviet military competence can be found in the sharp rise under Peter the Great (died 1725), and in the Napoleonic Wars, in which initial Russian setbacks were avenged, and Russia emerged as the land 'Superpower' of early 19th Century Europe, only to be exposed as backward and over-rated in the Crimean War (1853-56). The Russo-Japanese War of 1904-1905 also exposed unexpected Russian military incompetence, as did World War I, the Russo-Finnish War of 1939-40, and the opening campaigns of the 'Great Patriotic War' of 1941-45. I don't point this out to suggest that the Soviet Army is either incompetent or backward, but rather to place it into some kind of perspective. In America today we seem only to remember the Red 'steamroller' that crushed Nazi Germany in 1945. We should remember that the Germany Russia defeated in 1945 was one that had been pounded into rubble by the U.S. and British air forces, and that was simultaneously being invaded from the West. Germany, or the major part of it, is our ally today, and the evidence is that the Russians still greatly fear the Germans. For an interesting analysis of this German factor, although it includes a very alarming view of the Soviet Army, see Col. Trevor N. Dupuy, "The Current Implications of German Military Excellence," Strategic Review (Fall, 1976).
31. Gen. James H. Polk, "Reflections On the Czechoslovakian Invasion, 1968," Strategic Review (Winter 1977).
32. Western anti-tank weapons are extremely effective. During the 1973 Middle-East War at least one Israeli

officer was rather disturbed at the effectiveness of the U.S. 'Maverick,' an air-launched anti-tank missile. Israel is highly dependent on captured Soviet equipment, which it repairs and modifies for its own use. Evidently the 'Maverick' destroyed Soviet-made tanks so thoroughly that they couldn't be re-used. (Some 2200 tanks, on both sides, were destroyed in the short October War.) James Digby, Precision Guided Weapons Adelphi Paper #123 (London: International Institute for Strategic Studies, 1975) p. 9.

33. "Smart Weapons: A Revolution in Arms and Tactics," Washington Post (30 January) 1977, p. C1.
34. See Col. Edward D. Atkeson, "Is the Soviet Army Obsolete?," Army (May 1974). For the opposite view, see Lt. Col. Michael J. Hatcher, "The Tank is Alive and Well," Military Review (February 1978).
35. This is similar to Japanese assumptions about the United States in 1941. They did not prove accurate, and U.S. interests in Europe today are far greater than they were in the areas threatened by Japan in the early 1940s.
36. See NATO: The New Challenge.
37. Lt. Col. William O. Staudenmaier, "Territorial Defense: An Ace in the Hole for NATO," Army (February 1978).
38. I've been unable to locate this particular quote. However, Frederick the Great said so many different things during his long career, it seems safe to assume he said this, too. See Frederick the Great on the Art of War, translated by Jay Luvaas (New York: The Free Press, 1966).
39. A prominent short-or-no warning-time theorist is Senator Sam Nunn. See Sam Nunn "Deterring War in Europe -- Some Basic Assumptions Need Revising," NATO Review (February, 1977).
40. See Les Aspin, "A Surprise Attack On NATO: Refocusing the Debate," NATO Review (August 1977).
41. The U.S. Department of Defense assumes, for planning purposes, 23 days warning time. Sam Nunn, p. 6.
42. Although it is often pointed out that U.S. forces in Germany are not ideally positioned to meet a sudden Soviet attack, this 'maldeployment' also exists on the Soviet side. See Les Aspin, p. 9.
43. See Polk, p. 36.

44. The Soviets have insisted on equal percentage cuts, which would retain their current predominance in numbers. NATO wants larger Soviet cuts than NATO cuts, in order to even the balance. The issue turns on the interpretation of the word 'Balanced' in Mutual Balanced Force Reduction.

CHAPTER V
CONCLUSIONS

In the preceding chapters we have attempted to provide the basic factual and conceptual information necessary to an understanding of the many facets of the tactical nuclear weapons controversy. In many instances, particularly in the discussion of NATO, we have raised more questions than we have answered. This is unavoidable, partially because of time and space limitations, and partially because the main object of this paper has been to enable the reader to make judgements "consistent with his own value system." Particularly with regard to NATO, the individual has a far wider range of possible interpretations to choose from than we could possibly touch on here. For those interested in further investigation, the bibliography lists a wide variety of works on NATO, and on the other areas we have discussed.

However, while I have tried to be as objective as possible in the main body of this paper, despite my best efforts a certain set of rather debatable positions has defined itself. The reader should be aware of my rather jaundiced view of the Soviet Union. I have also stated that uncertainty is the best position to take on the question of nuclear thresholds, not simply because I like to sit on fences, but rather because it offers certain real advantages, by keeping the nuclear threshold high while simultaneously holding out the possibility that nuclear war, if it comes, will not be the world-incinerating holocaust it could be. My rather optimistic assessment of

NATO's military strength is subject to change on short notice, and I advise the reader to do some investigation on his own before accepting it.

With those caveats made, let us return to the set of questions raised on pages 9 to 11 of the introductory chapter: Are these (tactical nuclear) weapons in fact a substitute for larger (NATO) conventional forces?; Do the political roles these weapons play interfere with their military and deterrence functions?; Do their current dispositions offer the optimum value as a deterrent to Soviet Aggression?; Do they instead pose a provocative threat, or an enticingly vulnerable target, encouraging that aggression?; If deterrence fails, are these weapons properly designed and deployed to provide NATO forces with a real war-fighting and war-winning capability?; If not, why not? Can TNW actually be used? That is, is it practicable to fight a war using nuclear weapons in support of conventional air sea and ground forces?; Can such a war be fought with any semblance of tactical and political control?; Can we expect any outcome remotely resembling traditional concepts of victory, defeat, or even stalemate?

To what extent do theoretical development, actual policy, and the nature of the weapons coincide? That is, have either the policies or the weapons been designed in accord with the theoretical rationales which are behind their existence in the first place?; If policy, theory, and the characteristics of the weapons do not entirely co-

incide, to what extent is this lack of consistency the result of inherent features of the political and strategic situation in which the United States today finds itself? To what extent can improvement reasonably be expected?

The questions in the first group are largely technical in nature, and the second group largely relates to the overall world view of the person answering the questions. I shall provide my own tentative conclusions in each category.

NATO's TNW clearly provided a substitute for larger conventional forces when they were first deployed (in the mid 1950s), for the Soviets possessed no adequate answer to them. The weapons could then have been used against enemy forces in enemy territory, and NATO would not have had to destroy its own assets to defend itself. With the advent of a sizeable Soviet TNW capability, however, this ceased to be the case. NATO's existing conventional forces were just as vulnerable as the Soviets'. The possible deployment of Enhanced Radiation weapons may again make TNW an effective substitute for conventional forces, for they can be used against invaders on NATO's own territory without destroying it. They are essentially defensive weapons, relatively ineffective against troops dug into defensive positions, but highly potent against troops in that blatantly offensive weapon, the tank. As such, they may continue to provide NATO forces with an edge even if the Soviets develop and deploy 'neutron' weapons of their own.

The major political role of U.S. TNW, other than their purely deterrent function, is to convince the Europeans of the American commitment to their defense, if necessary by nuclear means. To the extent that some nuclear weapons are kept on station in Europe long after they have become obsolete, or even become counterproductive to U.S. hopes of war limitation as a result of their great size and inaccuracy,¹ yes, this political role does interfere with TNW's proper military and deterrence roles. U.S. sensitivity to European anxieties on this point seems a trifle exaggerated, and there actually should be little difficulty involved in removing the less appropriate and obsolescent nuclear weapons from the NATO arsenals, especially if they are quickly replaced with newer, more modern weapons, not necessarily including the 'Neutron Bomb.'

The political controversies which have erupted in both Europe and America over TNW seldom relate to their military or deterrence functions. Objections are usually highly moralistic in tone, and are often irrational in their desire to punish the defender as much as the aggressor. Such attitudes, often bolstered by Soviet propaganda, have been highly effective in rousing opposition to certain weapons with a very high military and deterrent value. The 'Neutron Bomb' controversy is a case in point.

In general the current dispositions of Western TNW do offer the optimum value as a deterrent to Soviet aggression. They provide the wide range of technical flex-

ibility necessary to wage limited nuclear war. The launchers (except aircraft) are well dispersed, and most lack sufficient range to pose an overly provocative strategic threat to the Soviet Union. The concentration of TNW warheads in a few easily destroyed depots, however, does provide a tempting target, and a NATO fear of unduly escalating a political crisis may inhibit their proper dispersal in time to protect them. Long-range Forward Based Systems (FBS), like 'Pershing' and the F-111, may be inappropriate in their present positions, posing an undue strategic threat to the USSR, and one which is not regulated by SALT.

NATO TNW do not necessarily provide NATO forces with a real war-winning capability, but they do provide the means by which NATO can attempt to control a conflict through a policy of limited use, and by pursuing 'escalation dominance.'

Given a willingness on each side to limit a nuclear conflict, it seems clear that TNW can be used for military purposes on the battlefield. Tactics can be evolved around their unique effects. The unknown extent of communications breakdown caused by widespread nuclear weapons detonation may severely inhibit battlefield tactical control. The effects on overall political control are basically incalculable, and limitation of communications may serve either to inhibit escalation or to accelerate it.

Victory and defeat, or stalemate, are still possible outcomes of a theater-limited nuclear war. It seems cer-

tain that the victors in any such war in Europe will not be the Europeans. Whether the Europeans will accept that situation is unknown. Britain and France would surely not allow strategic attacks upon themselves to go unavenged. Whether they would undertake strategic war on behalf of their non-nuclear allies is uncertain, as is the reaction of the Soviet Union to an exclusively European strategic strike upon itself.

The relationship of theory to policy and to weapons development is not purely one of cause and effect. Theory evolves in response to changes in policy and weapons technology, and vice versa. In terms of deterrence theory the policies of each Superpower seem quite well thought-out, and neither is so threatened or threatening as to make nuclear war likely. The long-range Forward Based Systems the U.S. maintains in Europe may be an exception, for they are not entirely in accord with the essentially denial deterrent strategy of 'flexible response' which is official NATO doctrine. However, NATO doctrine does still call for a strategic reprisal capability, and thus some strategic forces are required. Whether FBS are meant for that purpose and should be included in SALT is debatable, but since they have in fact been excluded we might assume that that issue has been, for practical purposes, resolved. Russia's own very long-range SSM's and aircraft also pose a strategic threat to the increasingly formidable nuclear powers of France and Great Britain, and if Western FBS

are to be limited, so should these long-range Soviet systems.

These difficulties are an inevitable outgrowth of the complexities of the political and strategic situation in which the United States and the Soviet Union find themselves today. Given their mistrust of each other, their mutual interests in Europe, and their very different political systems and values, some conflict is inevitable. Adding to that the aspirations of the independent Western Powers, particularly the nuclear powers of France and Great Britain, the situation becomes impossibly complex, and no consistency or total agreement among the various parties is possible. Any strategic solution entirely acceptable to any one party is likely to be entirely unacceptable to one or more of the others. Only in uncertainty and ambiguity can the various parties find the minimum level of security needed to promote political and strategic stability. As Henry Kissinger long ago pointed out, in the International System, total security for one nation means total insecurity for everyone else. Only in mutual insecurity do we find stability, and with it peace.

Footnotes to Chapter V

1. Jeffrey Record discusses this problem (touched on only briefly in my first chapter) in U.S. Nuclear Weapons in Europe (Washington, D.C.: Brookings, 1974).
2. For a good, compact examination of Kissinger's views, particularly this one, see Stephen R. Graubard, Kissinger: Portrait of a Mind (New York: W.W. Norton & Company, Inc., 1974).

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