

O<sub>n</sub>

Thermonuclear

War

HERMAN KAHN

With a new introduction by Evan Jones

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## INTRODUCTION TO THE TRANSACTION EDITION

*On Thermonuclear War* was controversial when published and remains so today. It is iconoclastic; worse, it is interdisciplinary. Finally (to the horror of many of its critics), it is calm and compellingly reasonable. This book was widely read on both sides of the Iron Curtain, and the result was serious revision in both Western and Soviet strategy and doctrine. It brought rationality to the public nuclear debate at a time when hysteria on all sides was the norm. As a result, both sides were better able to avoid disaster during the Cold War. Although developed from a Cold War perspective, the strategic concepts still apply: strategic defense, local animosities, and the usual balance-of-power issues are still very much with us.

Kahn's stated purpose in writing this book was simply: "avoiding disaster and buying time, without specifying the use of this time." By the late 1950s, with both sides H-bomb-armed, both reason and time were in short supply. We have all heard the analogies: two scorpions trapped in a bottle; a bee who must die if it stings even once; two men up to their waists in gasoline, arguing over who has the most matches; international suicide. In 1955, fifty-two Nobel laureates signed the Mainu Declaration that any nation unwilling to denounce force as a final resort would "cease to exist." Many thought that further study into the matter was not only counterproductive, but immoral. And, at that, official public policy regarding the use of nuclear weapons left much to be desired: "Nuclear Tripwire," "Massive Retaliation," and what later became known as Mutual Assured Destruction ("MAD").

Kahn, a military analyst at Rand since 1948, understood that a defense based on that sort of inconceivable presumption was morally questionable and not credible. One European critic bitterly observed that in order to defend Europe, America had promised to commit murder-suicide: "We urge you to break this promise." And, partly as a result of this book (and its "sequels"), official policy came to rely more and more on the doctrine of "flexible response." Kahn's "counterforce plus avoidance" theory of threatening military targets while avoiding civilian centers quietly came to reality over the next three decades.

Contemporary critics excoriated *On Thermonuclear War* as a "how-to" book: "how to fight a nuclear war; how to win it; how to get away with it."

## INTRODUCTION TO THE TRANSACTION EDITION

Yet it should be obvious to any impartial reader that Kahn is actually demonstrating how to avoid it; how to limit it; how to end it (or win it without firing a shot).

This book was the first to make sense of nuclear weapons. Originally created from a series of lectures, it provides insight into how policymakers consider such issues. One may agree with Kahn or disagree with him on specific issues, but he has clearly defined the terrain of the argument. He also looks at other weapons of mass destruction such as biological and chemical, and the history of its past use.

Kahn has been compared (unfavorably) with Machiavelli, but the Clausewitz analogy is more apt. The problems of defense in the modern world are unprecedentedly complex. He carefully examined the principle of how a nation can take up an essentially defensive posture in an environment dominated by inherently offensive weapons. He reminds us that defense via deterrence can be a subtle notion. Even the *Peace Catalog* (1984 edition) dryly observed that *On Thermonuclear War* is “still the best introduction to the if-we-do-this-they’ll-do-that school of strategic analysis.”

The Cold War is over. Despite crises ranging from Berlin to Cuba, the West won a decisive victory without the use of a single nuclear weapon on either side. But the nuclear genie is out of the bottle, and the lessons and principles developed in *On Thermonuclear War* apply as much to today’s China, Russia, Iran, and North Korea as they did to the Soviets.

Evan Jones

## FOREWORD

IN THE ANALYSIS of military problems since the war, the contribution of civilians has been unprecedentedly large in volume and high in quality. Herman Kahn's book clearly demonstrates the chief reason for this phenomenon. The problems of defense have become inordinately complex, and their solution is not susceptible to the rules of thumb, often called principles, which the military derived from past experience. For stating and solving these problems, all the analytical techniques are required which the disciplines of social science, history, and mathematics have evolved. These techniques are not nearly adequate, but they are the best we have, and we must employ them if we do not want to base judgment and policy to an excessive degree on vague reasoning and sheer guesswork. Indeed, *On Thermonuclear War* is as remarkable for its sophisticated exercises in method as it is for the substantive solutions and proposals it offers. Without his masterly command of method, it would have been impossible for Herman Kahn to examine such an extraordinary range of interrelated problems and, compared with the extant literature, do it so exhaustively.

Since these are lectures in book form, some of the informality of the original presentation—of its style and organization—has been preserved. The step-by-step presentation of extremely complex problems will be appreciated by the reader as long as he refrains from evaluating particular points out of the unfolding context. Initially some readers may boggle at the unfamiliar idiom, which is hard-hitting and subtle, colorful and dispassionate, professional and as inevitably personal as are the different styles of, for example, Morgenstern and Brodie. Finally, it may be worth saying that, though the subject matter raises profound moral issues, this is not a book about the moral aspects of military problems.

Most of the research for this book was done at The RAND Corporation. It was written largely while the author was a Visiting Research Associate at the Center of International Studies. We were glad to support this venture and to sponsor its publication. Herman Kahn's presence at the Center was for many of us a great learning experience. This book opens this experience to many others.

KLAUS KNORR

Center of International Studies  
Princeton University  
May 23, 1960



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## PREFACE

MEN AND GOVERNMENTS have long lived with the painful problem of choice. Even those with courage to make hard choices and the willingness to choose resolutely between good and evil, redemption and damnation, joy and sorrow, have never been able to insure the final result. The final outcome of benevolent, informed, and intelligent decisions may turn out to be disastrous. But choices must be made; dies must be cast. So it is with the most dramatic "choices" open to the free world in our day: arms control, peaceful coexistence, rearmament, dynamic rollback, appeasement, Soviet domination, thermonuclear war, or whatever shifting alternatives seem most appealing or least unpalatable from year to year.

The above "hard choices" are in sharp contrast to the vision of material progress held everywhere. In the United States and Western Europe poverty as a general economic problem has in the main been eliminated. There remain depressed areas (parts of Italy and Greece, for example), and there are many social and welfare problems (i.e., the Negro or migrant in parts of our nation, or the widowed family, or the aged and the sick), but the basic economic problem of providing the necessities seems to have been largely solved. Of course, people are still interested in improving their lot. In fact, there is much intense debate as to whether we should buckle down and double our wealth every ten years (6 per cent annual increase) or take it easy and double our wealth every twenty or forty years. But the current and future reality of vast military power concentrated in the hands of several unpredictable countries, accompanied by the past reality of expansionist doctrine in the communist nations, has brought Americans and Europeans face to face with the sobering thought that this triumph of material progress and human security may be reversed. We can choose among several courses of action. We have to be resolute and hopeful in our actions. And we have to be prepared for the possibility that we have chosen wrongly or that events may nevertheless continue to unfold in a thoroughly relentless way in spite of our choices.

This book examines the military side of what may be the major problem that faces civilization, comparing some of the alternatives that seem available and some of the implications in these choices. Even here I have not been as comprehensive, for reasons of space, as I would have liked to be. I have mostly restricted the discussion to



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the deterrence and waging of thermonuclear "Central Wars" between the United States and the Soviet Union, touching only lightly on Limited War and related alliance problems.

The lectures that form the body of the book were initially delivered in March 1959 at Princeton University to acquaint my colleagues at The Center of International Studies and some invited guests with certain aspects of thermonuclear war that are often overlooked. The lectures have been given in eleven other places in substantially the form in which they appear here. Less extensive presentations have also been given in more places and times than I care to remember. More than 5,000 persons with special interest in the subject, some of them highly qualified experts, have heard some portion or other of the material, and many of them have commented on it to the author in public and in correspondence. In spite of the fact that the material has been extensively thought out and talked over, I have approached publication with some hesitation. Much of the material in the lectures came out of "completed" study projects, but this book can be considered to contain more suggestions for work to be done than exposition of work completed.

If the book had had to wait until all the ideas in it could be thought through and set down with the great care that they really deserve, it would have been several years or longer before I could have had it ready for publication—particularly considering the pressure of other work. Barring a large increase in the research effort, it would be even longer before all of the researchable material was investigated. As it was, I kept an anxious publisher waiting almost a year while I carried a draft of the manuscript with me on airplanes and railroads.

I have preserved some of the style of the lectures throughout, at the risk of offending those who dislike occasional verbalisms in print, in order to feel freer in occasionally advancing tentative or speculative notions.

The major quality that distinguishes this book from most of the other works in this field is the adoption of the Systems Analysis point of view—the use of quantitative analysis where possible, and the setting up of a clear line of demarcation showing where quantitative analysis was not found relevant in whole or in part. Where data were not available or where they remain classified, I have tried to set forth the basic formulation of how such calculations are made or could be made. The techniques and philosophy are quite similar to those of the Operations Analyst, but due to the breadth of the problems and

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the resulting increased uncertainties the role of mathematics and lengthy computations is subordinated almost (but not quite) to the vanishing point, while a careful description of what the world is like gains much attention. For this reason, it has seemed possible to write for an audience that includes laymen without making any important technical concessions.

It is necessary to be quantitative. For example, in describing the aftermath of a war it is not particularly illuminating to use words such as "intolerable," "catastrophic," "total destruction," "annihilating retaliation," and so on. These words might be reasonable if it were really true that in a modern war the *total* target system would be "overkilled" by factors of five or ten. It would then be fruitless to calculate or describe the exact degree of overkill. But as we shall see, the facts do not lead in this direction. It is therefore important to get a "feel" for what the levels of damage might really be under various circumstances.

Some people appear to be very suspicious of calculations—and correctly so. I have written extensively elsewhere \* on how quantitative analyses can lead either wittingly or unwittingly to error, but that does not mean that nonquantitative analyses are any less misleading. There is another reason for using numbers. The only way in which we can communicate even intuitive notions with any accuracy is to use quantitative measures. This may have the unfortunate effect of giving an appearance of great certainty, but I have taken care to use such words as "could," "may," "might," "should," "about," "neighborhood of," and so on, with some frequency. More than this I cannot do, for it would be unreasonable to be deliberately vague just because some readers will be vague.

I am convinced that whether or not the book is widely read in the United States and Europe, it will be read by some Russians at least, and it will be taken into account by some Soviet military planners. Whether this is a good or a bad thing I can hardly know, for it is important that the United States and Russia have certain views in common about strategic military problems. If this book can contribute to molding and creating a common background, it may be constructive. Nevertheless, a book of this character presents a certain danger. In the present world, where so much depends upon deterrence (which is, after all, a psychological phenomenon), and where

\* Herman Kahn and Irwin Mann, *Techniques of Systems Analysis*, The Rand Corporation, Research Memorandum RM-1829-1, June 1957; and *Ten Common Pitfalls*, Research Memorandum RM-1937, July 17, 1957.

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the Soviets' failure to exploit weaknesses in our posture may be due to inertia or innate conservatism, any book that treats deterrence objectively may encourage the Soviets toward experiment.

On the other hand, it is important for us to realize that certain problems exist, so that we can consider them before they reach the crisis stage; in some cases we must do so years before. *This book is dedicated to the goal of anticipating, avoiding, and alleviating crises.* I hope that it will stimulate interest in this goal among all those who are in a position to contribute to an understanding of the world's military and quasi-military problems. Also, I have long felt that there are many at universities and elsewhere who could contribute but do not, perhaps because they feel the problems are futile or uninteresting or so veiled in classified data that nothing can be done by those who have only the open literature available to them. Perhaps this book will help open some academic doors. I hope so.

There are also untapped intellectual resources among the ranks of those idealists who are deeply concerned but tend resolutely to close their minds to the nature and existence of military problems. I know of few people who believe that Western security problems will be solved by purely military preparations, but I believe that it is equally unlikely that a successful prescription will fail to involve adequate and well-designed military establishments. To the extent that certain idealists are willing to come to grips with the real world, their suggestions and programs are much more likely to prove helpful. To the extent that they are unwilling to do this I would conjecture that they are likely to do as much harm as good, but this kind of judgment is so uncertain that I advance it more as a warning than as a criticism.

I have a firm belief that unless we have more serious and sober thought on various facets of the strategic problem than seems to be typical of most discussion today, both classified and unclassified, we are not going to reach the year 2000—and maybe not even the year 1965—without a cataclysm of some sort, and that this cataclysm will prove a lot more cataclysmic than it needs to be. It is with the hope of decreasing the probability of catastrophe and alleviating the consequences of thermonuclear war if it comes that I offer these pages to all with the interest—and the courage—to read them.

HERMAN KAHN

Princeton, New Jersey  
June 10, 1960

## ACKNOWLEDGMENTS

THE CONCEPTS on which these three lectures are based originated in work done under the auspices of The RAND Corporation and continued at The Center of International Studies at Princeton University while I was on leave of absence from RAND. While many of the things that I discuss grew out of studies done by The RAND Corporation, the presentation and synthesis are my own. I accept full responsibility for them. However, I owe a tremendous debt to many friends and colleagues—so many that it would be impossible for me to identify them all. I will content myself with mentioning some of the major debts. In particular, I owe a good deal to early work done by E. J. Barlow and J. F. Digby in air defense, by Bernard Brodie in the general field of strategic planning, by Jack Hirshleifer on civil defense, and by Albert Wohlstetter, Frederic Hoffman, and H. S. Rowen on survival of strategic forces. Much of Lecture I, parts of Lecture II, and the Appendix derive from joint effort devoted to a RAND Corporation civil defense study which I led. This study is reported in RAND Report R-322-RC, *A Report on a Study of Non-Military Defense*, July 1, 1958. Because so much of the book is based on the findings of this study, I would like to repeat here some remarks that prefaced the report on that study:

*The study . . . [was] supported by The RAND Corporation as part of its program of RAND-sponsored research. In addition to its work for the United States Air Force and other government agencies, the Corporation regularly sponsors, with its own funds, research projects in areas of importance to national security and public welfare. RAND-sponsored research is considered to be fundamentally the responsibility of the individuals involved in the project, and the conclusions of such projects are not necessarily endorsed by the Corporation. Such studies are published in the hope that they may contribute to wider understanding of important national problems.*

This study of nonmilitary defense was initiated, directed, and formulated in its central features by Herman Kahn. Particular parts of the study were the responsibility of the following individuals, approximately in the order the subjects are mentioned in this report: Leon Gouré, foreign policy implications; Irwin Mann, improvised fallout shelters and other inexpensive measures; Robert Panero (from the staff of Guy B. Panero Engineers), mines and deep rock shelters; John O'Sullivan, conventional shelters and costs of complete shelter systems; Fred Iklé, strategic evacuation and social problems; Maj. Gen. Frank Ross, USA, ret., tactical evacuation; Leonard Berkovitz, performance of shelter systems under hypothetical attacks; Harold H. Mitchell, M.D., medical effects of radiation; Jerald

## ACKNOWLEDGMENTS

Hill, long-term fallout problems; Joseph Carrier, food and agriculture; Paul Clark, economic recuperation after a 50-city attack; Norman Hanunian, heavier attacks and industrial shelters; Col. George Reinhardt, USA, ret., "starter set" and recuperation stockpiles; Harry Rowen, interactions with active offense; Philip Dadant, interactions with active defense; Richard Moorsteen, Soviet nonmilitary defense capabilities. This summary report was drafted by Paul Clark.

A number of people in government agencies have been helpful in furnishing information and orientation. While it would be impossible to list them all, the assistance of the following should be acknowledged: Federal Civil Defense Administration—John Devaney, Gerald Gallagher, Jack Greene, Ralph Spears, Benjamin Taylor; Federal Reserve Board—Roland Robinson; Naval Radiological Defense Laboratory—Walmer Strobe, Paul Tompkins; Office of Defense Mobilization—Joseph Coker, Brig. Gen. Harold Huglin, USAF, Burke Horton, Vincent Rock, Charles Sullivan; Science Advisory Committee—Spurgeon Keeney. Of course, none of the above is responsible for any portion of the study.

This report is unclassified, and no part of it depends on the use of classified information. In particular the hypothetical attacks considered in evaluating various nonmilitary defense measures should not be construed as statements of enemy offense capability or of U.S. defense capability. They are simply hypotheses about threats that appear conceivable sometime in the future and that provide a measure of the possible role of nonmilitary defense systems. Moreover, this report has been written as a summary statement for general distribution; technical aspects of the study are not presented in full detail.

I went to the Center of International Studies in February 1959 and spent several months there preparing these lectures. I then spent about half my remaining months at the Center rewriting, revising, and amplifying the lectures for eventual publication and for oral delivery. It would have been impossible for me to have done this task under such pressure of time if I had not had the help, advice, and encouragement of Klaus Knorr, Associate Director of the Center, and I would like to express my gratitude to him at this point.

An early version of the manuscript was read by Bernard Brodie, Daniel Ellsberg, and William Kaufmann—all of whom made helpful comments. Parts of this book (roughly pages 144–153 on "Doomsday Machines," pages 226–231 on the various ways war can start, and some brief excerpts from World Wars III to VII) appeared as an article in a special issue on Arms Control of *Daedalus* (Fall 1960) and benefited greatly from many comments by Donald G. Brennan, the special editor of this issue. I would also like to thank Marvin Lavin, Sidney G. Winter, Jr., and William Bowen for their helpful comments on Lecture I and Gordon A. Craig for his comments on

#### ACKNOWLEDGMENTS

World Wars I and II in Lecture III. My thanks go also to Robert N. Grosse and his colleagues in the cost analysis section of The RAND Corporation for supplying almost all the statistical data used in the various figures. Lastly, I would like to express my appreciation to Gordon Hubel of Princeton University Press, not only for his essential contribution to the editing of the manuscript, but for possessing the exact mixture of tolerance and stern disciplinarianism that is so helpful in getting a book out of a reluctant author.

Finally and most important, I would like to thank Vaughn D. Bornet for his editing and suggestions on the language and substance of the book and Hubert L. Moshin for handling so many of the administrative and technical details of formulating and presenting the lectures and writing the book.

It should not be necessary for me to state that the discussions in this book do not necessarily reflect the opinions of any of the people or organizations that I have mentioned.

HERMAN KAHN



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LECTURE I

THE NATURE AND FEASIBILITY OF  
THERMONUCLEAR WAR





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## CHAPTER I

# ALTERNATIVE NATIONAL STRATEGIES

### *Introduction*

ON July 16, 1960 the world entered the sixteenth year of the nuclear era. Yet we are increasingly aware that after living with nuclear bombs for fifteen years we still have a great deal to learn about the possible effects of a nuclear war. We have even more to learn about conducting international relations in a world in which force tends to be both increasingly more available and increasingly more dangerous to use, and therefore in practice increasingly unusable. As a result of this continuous secular change in the basic structure of the international situation, foreign and defense policies formulated early in the nuclear era badly need review and reformulation.

In considering these basic foreign and defense policies it is desirable to distinguish many different military postures and the corresponding possible strategies for both the United States and the Soviet Union. This treatment of thermonuclear warfare will mostly concern itself with four typical possible postures, which I will call Finite Deterrence, Counterforce as Insurance, Preattack Mobilization Base, and Credible First Strike Capability respectively. I will discuss the possibilities and implications of these postures from the point of view of the Soviet Union and the United States. While there is no reason why the two most powerful nations should have similar views, I will not initially dwell on possible asymmetries, deferring discussion of the separate national problems. A number of typical basic postures (important concepts italicized for emphasis) are listed in Table 1, roughly in order of increasing ability to wage general war.

Probably the most valuable thing that the Executive Office could do to improve over-all defense planning would be to select one of these postures and the corresponding strategies, or possibly some clearly defined alternative not on the list, and let the Office of Civil and Defense Mobilization, the Department of Defense, and the Department of State know its decision. The decision could then be debated at the proper level, and it would not be necessary to conduct a philosophical debate at the staff level, on what business

THE NATURE AND FEASIBILITY OF WAR

the Department of Defense should be in every time somebody brought up a technical question on Air Defense, Command and Control, and so on. National debates should be conducted at the national level where feasibility, desirability, and possible consequences can be discussed responsibly and from proper points of view. It is not possible to do this even at the level of a senior but technical advisory group attached to Departments or even to the



TABLE 1

ALTERNATIVE NATIONAL POSTURES <sup>a</sup>

1. Internal Police Force plus "World Government"
2. *Minimum Deterrence* plus *Limited War* plus *Arms Control*
3. Add insurance to the *Minimum Deterrent*:
  - (a) for reliability (*Finite Deterrence*)
  - (b) against unreliability (*Counterforce as Insurance*)
  - (c) against a change in policy (*Preattack Mobilization Base*)
4. Add *Credible First Strike Capability*
5. "Splendid" First Strike and no Limited War Capability
6. Dreams

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<sup>a</sup> I am indebted to Richard B. Foster of Stanford Research Institute for the suggestion to make a list of this sort. He has used a somewhat different breakdown in some unpublished investigations on the actual strategic views held by U.S. decision makers.



Executive Office, much less at lower staff levels. Advisory groups and agency and departmental staffs should be mainly concerned with implementing the general policy and reporting back to their superiors on cost, performance, and feasibility. In actual practice the great national debate on what business the Department of Defense should be in often occurs at the advisory group or relatively low staff levels, and important projects whose approval or disapproval may set crucial constraints on over-all policy are approved or rejected on the basis of some very narrow and parochial views of what this over-all national policy ought to be; sometimes the effects on over-all national policy are not even examined. All of this could be eliminated if the big decisions were consciously formulated, debated, and then decided at the proper level rather than treated as a number of fragmented issues to be treated on an ad hoc basis.

In this first chapter I will consider the postures in Table 1 from an over-all point of view, deferring details to later chapters. In this discussion I will define certain widely used terms in a manner that disagrees with some (but not all) usage. In general, I feel it is better to do this than to invent some completely new word or term, and I will normally continue this practice throughout the book. One of the most important things that could be done to facilitate discussion of defense problems would be to create a vocabulary that is both small enough and simple enough to be learned, precise enough to communicate, and large enough so that all of the important ideas that are contending can be comfortably and easily described. One of my major objectives in writing this book is to facilitate the creation of such a vocabulary.

### *1. Internal Police Force plus "World Government"*

There seems to be little point in discussing the view that finds a solution in a totally disarmed world. Neither our own emotional desires nor the fact that there are many earnest proponents for this policy should sway us toward a position that ignores some of the basic realities. It has probably always been impractical to imagine a completely disarmed world, and the introduction of the thermo-nuclear bomb has added a special dimension to this impracticality. Given the large nuclear stockpiles in the Soviet Union, the United States, and the British Isles, it would be child's play for one of these nations to hide completely hundreds of these bombs. Even if some caches were found, one could not be sure that these were not decoys to allay suspicions, and yet there would be a great loathness to cancel the agreement just because "a few malcontents had conspired against the peace." The violator would then have an incredible advantage if the agreement ever broke down and the arms race started again. This surely means that even if all nations should one day agree to total nuclear disarmament, we must presume that there would be the hiding of some nuclear weapons or components as a hedge against the other side doing so. An international arrangement for banishing war through disarmament will not call for total disarmament but will almost undoubtedly include provisions for enforcement that cannot be successfully overturned by a small, hidden force. Otherwise, it would be hopelessly unstable. Even if the problem of what we may call the "clandestine cache" were solv-

able, the writer still is of the belief that one could not disarm the world totally and expect it to remain disarmed. But the problem of the clandestine nuclear cache in itself makes total disarmament especially infeasible.

While total disarmament can be ruled out as an immediate possibility, one can conceive of some sort of international authority which might have a monopoly of war-making capability. Such a postulated international authority would have to have enough power to be able to overwhelm any nation that had reserved hidden destructive potential. An international agency with a near-monopoly of force might come from any of the following possibilities (listed in order of apparent probability rather than desirability): (1) a Soviet or U.S. dominated world arising most likely out of war; (2) some other kind of postwar organization; (3) an S.U.-U.S. combination which is in effect a world government, though it may not openly be called that; (4) some of the NATO nations and China added to the above combination as influential, if not equal partners; (5) the Haves against the Have Nots, most likely without exploitation, but with stringent arms control in which authority and responsibility are roughly proportioned to military and economic development and, perhaps, with aid to underdeveloped nations; (6) a sort of World Federal state where power is proportioned to sovereignty and population as in the U.S. Congress. However, it is most doubtful in the absence of a crisis or war that a world government can be set up in the next decade. There are to date no serious proposals along such lines.<sup>1</sup> Certainly the official suggestions occasionally put out by the Soviet and U.S. governments are not to be taken seriously as possible solutions.

While it may seem high time to spell out practical proposals for world government, no such attempt will be made in this book. While

<sup>1</sup> The most serious recent attempt to describe a possible world government is given in the book, *World Peace Through World Law* (Harvard University Press, Cambridge, 1958), by Grenville Clark and Louis B. Sohn. One problem with proposals such as those in the Clark-Sohn book is the same problem that many of the white colonists in Africa have in trying to deal with African independence movements. If independence is granted, they are not sufficiently protected from the new government; if only limited sovereignty is granted the nonwhite population gets to be very unhappy at the attempt to maintain the unsatisfactory *status quo*. It is worth noting in this connection that it is easier to be a hero than a saint. It really would not be difficult to find thousands of Westerners willing to give up their lives for a world government of a satisfactory sort but one would find very few willing to accept Chinese or Indian standards of living, or any appreciable risk of this occurring, for either themselves or their families. Similarly, the underdeveloped nations are going to resent any real or fancied hindrances to their working out their salvation.

I believe that even a poor world government might be preferable to an uncontrolled arms race, I also believe that the practical difficulties are so large that it is a digression to dwell on such possibilities as a possible solution for the problems of the sixties. And the problems of the sixties are important! About the only way "world government" and other long-run considerations affect the kind of analysis done here is the avoidance of otherwise desirable short-term measures that might seriously hinder or foreclose desirable long-term possibilities. Even this modest ambition toward shaping the seventies is difficult to realize because there are controversies over where we want to be, as well as how to get there. However, there seems to be some consensus on what we are trying to avoid even if we cannot agree on what we are for. This book will concentrate on the problem of avoiding disaster and buying time, without specifying the use of this time. This seeming unconcern for long-term objectives will distress some readers, but some of our immediate problems must be understood more clearly than in the past if we are to control the direction in which we are going. It is the hallmark of the amateur and dilettante that he has almost no interest in how to get to his particular utopia. Perhaps this is because the practical job of finding a path may be more difficult than the job of designing the goal.<sup>2</sup> Let us consider, then, some of the practical military alternatives that we face in the 1960-1975 time period.

## 2. *Minimum Deterrence plus Limited War plus Arms Control*

This view, or the modest variant of it called Finite Deterrence, is probably the most widely held view in the West of what is a desirable and feasible strategic posture. Among the adherents to this position can be found most intellectuals interested in military affairs, staff people in the federal government, civilians who seek to qualify as "military experts" (including scientists and technicians), many military planners in the three services, and the vast majority of

<sup>2</sup> One of my amateur friends has pointed out that "It is the hallmark of the expert professional that he doesn't care where he is going as long as he proceeds competently." This seems to be a reasonable charge against this book, but I still believe that the limited focus of this book is valuable. Of those readers who are most interested in long-term goals, very few will have ever seen much discussion of the military problem as a "military problem" or the interactions of military calculations, or the lack of them, with policy. Some of these readers will deny the existence of such interactions. Just as it would do the "militarists" some good to be exposed to utopian thinking, it will do the "utopians" even more good to be exposed to some military thinking.

foreign and domestic lay analysts. What, then, is meant by Minimum Deterrence?

The notion is dramatic: It is that no nation whose decision makers are sane would attack another nation which was armed with a sufficiently large number of thermonuclear bombs. Thus all a nation that is so armed has to worry about is insanity, irresponsibility, accident, and miscalculation. Even such a sober expert as General Maxwell Taylor expressed this view as follows:

The avoidance of deliberate general atomic war should not be too difficult since its unremunerative character must be clear to the potential adversaries. Although actual stockpile sizes are closely guarded secrets, a nation need only feel reasonably sure that an opponent has some high-yield weapons, no matter how indefinite their exact number, to be impressed with the possible consequences of attacking him.<sup>3</sup>

The above was written in 1956 but is quoted in a book he published in 1959. It is only fair to add that General Taylor's views have changed and, as expressed in the book, now show much more concern with the problem of deterring general war than this quotation would indicate. He also mentions that it was very difficult for him to change his views and take the problem of deterrence seriously. It is even more difficult for laymen who do not have access to the same information to achieve this feat.

In general, the believers in Minimum Deterrence seem to view the deterrence of a rational enemy as almost a simple philosophical consequence of the *existence* of thermonuclear bombs. They argue that the decision to initiate thermonuclear war is such a momentous one—the risks are so great—that it is unlikely that such a decision will be affected by the relatively minor details of each side's military posture. One is tempted to call this "the layman's view," since people holding it show only the slightest interest in such matters as the status of the alert forces, holes in the warning networks, the range of the bombers, reliability of missiles, the degree of protection offered by current arrangements for hardening, dispersal, and concealment, and the multitude of other questions that bother sober students of the problem of retaliation. Nevertheless, the Minimum Deterrence view is held by such a surprisingly large number of experts that it may be gratuitously insulting to call it a layman's view.

An extreme form of the Minimum Deterrence theory is the view

\* Maxwell D. Taylor, *The Uncertain Trumpet*, Harper & Brothers, New York, 1959, p. 184.

that the current strategic forces of the United States and the Soviet Union, if used, will automatically result in world annihilation or at least mutual homicide. In 1955, fifty-two Nobel laureates signed a statement (the Mainau Declaration) which included the following: "All nations must come to the decision to renounce force as a final resort of policy. If they are not prepared to do this they will *cease to exist*." There is a beautiful simplicity about this statement. It does not differentiate between attacker and defender, belligerent and neutral, Northern and Southern Hemisphere, but simply says *all* nations. It does not talk about degree of damage but simply says *cease to exist*.

Everybody recognizes that statements such as the above are sometimes no more than rhetoric. If this were all there is to it one would not worry. But belief follows language as much as the other way round. Contemporary phrases, used by both experts and laymen in describing war, expressions like "balance of terror," "thermonuclear stalemate," "suicidal war," "mutual annihilation," "inescapable end of civilization," "destruction of all life," "end of history," "live together or die together," and "nobody wins a suicide pact," indicate a widespread inclination to believe that thermonuclear war would eventuate in mutual annihilation as the result of almost any plausible turn of military events. The view of the phrasemakers is reinforced by the use of deterrence analogies, such as two people on a single keg of dynamite—each with a button, two scorpions in a bottle, two heads on a single chopping block, or the bee that dies when it stings.

Popular literature has picked up the idea of ultimacy. An example is Neville Shute's interesting but badly researched book *On the Beach*, which presumes and describes the total extinction of humanity as a result of all-encompassing and inescapable atmospheric radioactivity coming from a thermonuclear war. Many shorter pieces have been written along similar lines. Western (but not Soviet) reviewers and critics have almost uniformly taken the theme of world destruction seriously. These Westerners and their readers do not consider it a fantastic notion that nuclear war would mean the inevitable end of the world. The world annihilation possibility is considered to be a sober and accurate appraisal of the destructive power of existing weapons systems.

Not all agree, of course. In fact, some "diehards" are tempted to dismiss such a statement as the Mainau Declaration as an extremist



expression of some left wing or radical scientists. This is too strong a denial. A cursory examination of the names of the signers indicates that this hypothesis does not seem tenable for a majority of them. The Nobel laureates who authored the "cease to exist" statement probably had more than rhetoric and literature in mind. Many of them had either made calculations or seen calculations (or at least thought they had) which indicated to them that world annihilation or some practical equivalent was a reasonably sober estimate of the results of nuclear war. Most of the signers would be willing to go before a technical audience with a defense of the "end of history" position as a sober estimate—and the believers in recovery and recuperation would often have some difficulty in documenting their side of the case. It is important to realize that there are "experts" who believe in world annihilation and who hold strongly to this view, experts who can and will argue their position vehemently, quantitatively, and often persuasively.

The automatic mutual annihilation view is not unique to the West. As we will see in Lecture III, Malenkov publicly introduced it to the Soviet Union several years ago, apparently arguing in the now-classical fashion that with nuclear war entailing the end of civilization, the capitalists would not attack; the Soviet Union, he said, could afford to reduce investment in heavy industry and military products and concentrate on consumer goods. A different view seems to have been held by Khrushchev and the Soviet military. They agreed that war would be horrible, but at the same time they argued that this was no reason for the Soviet Union to drop its guard; given sufficient preparations only the capitalists would be destroyed. With some important modifications their views seem to have prevailed.

*Why do reasonably sober and knowledgeable people hold some version of this view of automatic mutual annihilation?* In this first lecture, I will try to describe some of the data and calculations that have given rise to these cataclysmic expectations and explain why the situation is not, at least for the immediate future, as they describe it.

A thermonuclear war is quite likely to be an *unprecedented catastrophe* for the defender. Depending on the military course of events, it may or may not be an unprecedented catastrophe for the attacker, and for some neutrals as well. But an "unprecedented" catastrophe can be a far cry from an "unlimited" one. Most important of all, sober study shows that *the limits on the magnitude of the*

*catastrophe seem to be closely dependent on what kinds of preparations have been made, and on how the war is started and fought.*

While the notions in the above paragraph may strike some readers as being obvious, I must repeat that they are by no means so. The very existence of the irreconcilable group predicting total catastrophe is proof. One can divide military thinkers into two classes: those who believe that any war would result in no less than mutual annihilation, and those who feel this is not necessarily so or even that it is in all likelihood wrong. The latter group is probably correct, at least for the military capabilities that are likely to be available in the next decade or so. Yet on the whole they have not done very much "homework" to prove their point. The total disaster group has done a great deal of homework. This could mean that the first group is likely for a time to win many an argument on this question.

This concept of mutual homicide, sure and certain, has in many ways been peculiarly comforting to those holding it. It makes plausible the conviction that when governments are informed of the terrible consequences of a nuclear war they will realize there could be no victors. There would be no sense to such a war. Would a sane leader ever start such a cataclysm? Of course not. The expected violence of war would deter him. Those who hold this comforting concept may even get angry at anyone who ventures to assay estimates of the precise degree of risk which a "successful" attacker might actually face.

The mutual homicide theory yields other comforts. If one grants that each side will utterly destroy the other, one must also grant that expensive preparations to reduce casualties, lessen damage, and facilitate postwar recuperation are useless. Can we not spare ourselves the financial burden of such preparations? The "logic" has sometimes been carried further, some arguing that modern weapons are so enormously destructive that only a few are needed to deter the enemy. Therefore, the argument goes, war can be deterred with much smaller forces than in the past; in any case we certainly do not need more.

The view from this plateau is attractive to many groups who are determined on disarmament and certain types of arms control. For them, the Minimum Deterrence notion implies a certain kind of automatic stability which makes it safe to be casual about both agreements and possible violations. One must concede that the very concept of Minimum Deterrence implies that the two nations in-

volved have in effect signed a reliable nonaggression treaty with their populations as hostages to insure adherence to this treaty; the only strategic problem that seems to be left is an accidental or unauthorized violation of this nonaggression "treaty." It is such possibilities that are the subject of arms control negotiations.

The mutual annihilation view is also comforting to many idealistic individuals, particularly to those who have an intrinsic abhorrence of any use of force. The bizarreness of a war in which both sides expect to get annihilated confirms their intuition that this whole business of military preparations is silly: a stupid and dangerous game which we ought to discourage nations—our own country, at least—from playing. At the same time these idealists can afford to scoff at attempts to reduce casualties from, say, 100 million to 50 million Americans, reflecting that the situation is hopeless anyway and that the only Respectable Cause is the total elimination of war. They regard programs other than their own as foolish or sinister and designed to cause people discomfort by making it sound plausible that there really is a national security problem toward the relief of which considerable amounts of money, energy, and intelligence need to be allocated.

Among those who take the view that Minimum Deterrence is a desirable, feasible, or the only possible strategic goal are many who nevertheless seek to add a Limited War capability. They recognize that *even if the United States and the Soviet Union cannot wage all-out war against each other this does not mean that the role of force will be entirely eliminated*. There may still be many disputes between the two nations—disputes which may tempt one side to use force on a small scale. If the only counter the other nation has is to commit suicide by starting a thermonuclear war, that nation most likely will not act. Therefore, one needs Limited War capabilities to meet limited provocations. Those who adhere to the Minimum Deterrence theory often feel that the "nonaggression treaty" of mutual deterrence is so binding and so stable it is impossible to provoke the other side to violate it by anything less than an all-out attack. Seen in this perspective, cannot one safely use the most extreme forms of violence in a limited war?

We must expand on this point. Some of those who feel strongly that it is easy to make deterrence reliable suggest using the threat of limited or controlled nuclear retaliation to "regulate" Soviet be-

havior. An extreme form of this notion might go as follows: If the Soviets threaten to take over Berlin, the U.S. could threaten to blow up a major Soviet city in retaliation, perhaps after warning the inhabitants to evacuate it. In their anger and distress the Soviets would then blow up one U.S. city in exchange. We would be enraged in turn, but because we would want to stop the tit-for-tat exchange, we would call a halt after warning the Soviets that any similar aggressions in the future would also result in a city exchange. However angry both of us would be, we would not start an all-out war, according to this argument, because suicide is not a rational way of expressing one's anger. It would be in the interests of both to stop the exchange at this point. By then, from the Soviet point of view, the taking of Berlin would seem unprofitable, since the loss of the Soviet city would appear more costly than the value of Berlin plus the destruction of a U.S. city. We have gained through making it clear to the Soviets that similar future actions would be equally unprofitable. On the other hand, by destroying a U.S. city, the Soviets have made it clear that we should not lightly use controlled thermonuclear retaliation as a tactic. While the whole idea sounds bizarre, concepts like this are bound to be a logical consequence of a world in which all-out war has been made to seem *rationally infeasible*, but one in which we feel it is necessary to punish or limit the other side's provocations. The timid *or sober* may feel that Minimum Deterrence might be strained to the breaking point by such acts; for them there must be caution on the types and levels of violence to accompany limited war or limited provocations.

### 3. *Three Kinds of Insurance*

The next view of what could result in a satisfactory strategic capability adds several kinds of "insurance" to the simple Minimum Deterrence position.<sup>4</sup> There are at least three kinds of insurance which a survival-conscious person might wish to add, the first being *Insurance for Reliability*. We will label the view that *worries about the details* of obtaining a "punishing" retaliation, but does not want any more strategic capability than this, the *Finite Deterrence*

<sup>4</sup>The addition is meant in terms of the capability of the force that is being procured; the entire force may be redesigned to get some appropriately modified version of the original capability (possibly at a reduced level) and the new insurance one.

strategy.<sup>5</sup> In many ways, and with some inconsistencies, this is the official U.S. view. The believers in Finite Deterrence do not quite accept the idea that reliable deterrence can be obtained simply by stocking thermonuclear bombs and having a weapon system which could deliver these bombs in peacetime. They notice that when the problem of retaliation is studied, rather than asserted, it is difficult to retaliate effectively, since the enemy can do many things to prevent, hinder, or negate retaliation. Evaluation of the effectiveness of retaliation must bear in mind that the Russians can strike *at a time and with tactics of their choosing*. We will strike back, no doubt, but with *a damaged and not fully coordinated force* which must conduct its operations in the *postattack environment*. The Soviets may use *blackmail threats to intimidate our postattack tactics*. Under these conditions, the Russian defense system is likely to be *alerted*. Indeed, if the strike has been preceded by a tense period, their active defense forces would long since have been *augmented*, and their cities may be at least partially *evacuated*.

Any of the considerations referred to by italicized words can change the effectiveness of a retaliatory strike by an order of magnitude. Yet almost all of them are ignored in most discussions of the effectiveness of our deterrent force. Sometimes they are even relegated to the position of unimportant "technical details." They are far more than this. The possibilities indicated by the italicized words will be discussed at some length in Lecture II. I only want to mention here that the believer in Finite Deterrence is somewhat aware of these problems; he wants to have ready more than the bare minimum force that *might* be able to retaliate effectively (the Minimum Deterrence position). The advocate of Finite Deterrence wants enough forces to cover *all* contingencies. He may even want mixed forces, considering that it may be possible for a clever enemy to discover an unexpected countermeasure against a single kind of force no matter how large. Thus he may well want different types of missiles, bombers, strategic submarines, aircraft carriers, and so forth. In addition, sober advocates of Finite Deterrence wish to have the various weapons systems so deployed and operated that they will

<sup>5</sup> Originally, Minimum Deterrence and Finite Deterrence meant the same thing. The word "Minimum" was coined by some Polaris enthusiasts who argued we needed very little to deter the Soviets. Because the word "Minimum" carried a connotation of gambling with the nation's security for budgetary reasons, it was changed to "Finite" (which had the connotation of wanting enough and no more and also suggested that the opponents wanted an infinite or at least an unreasonable amount).

have a guaranteed capability, even in a crisis in which the enemy has taken extraordinary measures to negate the capability. They want these forces dispersed, protected, and alert; the arrangements for command, control, and communications must be able to withstand degradation by both peacetime and wartime tactics of the enemy. These sober believers in Finite Deterrence tend to insist on an objective capability as opposed to one that is only "psychological." And even those believers in Finite Deterrence who would be satisfied with a façade yearn for an impressive-looking façade. One might characterize the Finite Deterrence position as an expert version of the Minimum Deterrence position, held by an expert who wants to look good to other experts.

The notion of Finite Deterrence is therefore not as dramatic as the notion of Minimum Deterrence. The believer in Finite Deterrence is willing to concede that it takes some effort to guarantee Mutual Homicide, that it is not automatic. However, the notion of Finite Deterrence is still dramatic, since most followers of this doctrine believe that *the advent of thermonuclear bombs has changed the character of an all-out war in such a way that if both opponents are prepared the old-fashioned distinctions between victory, stalemate, and defeat no longer have much meaning*. It was once believed that if one country had forces twice as large as those of another country, the first country was the stronger. Those who believe in Finite Deterrence challenge this view. Sometimes they rest their case on this idea: the only purpose of strategic forces is to deter rather than to fight; once one has the ability to damage seriously, say, 10 or 20 enemy cities, this is enough force to deter, and therefore enough force. More often, backers of Finite Deterrence take a more extreme position. They argue that you can do no more than kill somebody once, to overkill by a factor of ten is no more desirable than overkilling by a factor of two—it is simply a waste of effort. They also usually argue that with some thought it should be easy to design strategic systems that can overkill, even in retaliation. Once we procure the limited (i.e., finite) forces required to do this job we have enough strategic forces and do not need any more—no matter what the enemy does.

In the year 1960 I believe that even adherents to an extreme Minimum Deterrence position tended to agree, under pressure, that the nation should buy whatever insurance is needed to make retaliation at least "look" potentially reliable and effective. In this sense,

the orthodox Minimum Deterrence School is no longer as respectable as might once have been inferred from the remarks of the most enthusiastic proponents of a defense built solely around small Minuteman and Polaris systems. Most of the more sober analysts have come to talk about *Finite* Deterrence, by which they mean having a generous adequacy for deterrence, but that is all they want for the general war. Specifically, they often tend to be against any counterforce capability, (The word "counterforce" includes not only an active counterforce that can destroy or damage the enemy's force on the ground, but also other methods of countering the opponent's force, such as Active and Passive Defense).<sup>6</sup>

Some believers in Finite Deterrence are against counterforce as a useless diversion of forces; others would not even be interested in having any counterforce even if it were free, because they consider it destabilizing. They notice at least one circumstance in which an enemy is likely to attack even if he is worried about the retaliatory destruction that he will suffer. This circumstance occurs when he believes his attack is pre-emptive, that by striking first he is only forestalling an attack being launched on him. Most believers in Finite Deterrence are so convinced of the efficacy of their deterrence that they believe such an idea could only arise as a result of miscalculation, since no rational man could order an attack against an enemy who has made at least moderate preparations to ward it off. However, they recognize that if both forces are in a condition of super alert it may be easy to have such a misunderstanding. Or equally likely, there is the problem that Thomas Schelling of Harvard (and RAND) has called "the reciprocal fear of surprise attack," where each side imputes to the other aggressive intentions and misreads purely defensive preparations as being offensive. There are unfortunately many postures possible in which a disastrous train of self-confirming actions and counteractions could be set into motion.

<sup>6</sup>The word "counterforce" is usually used to apply to an ability to destroy the enemy on the ground. It is true that the best *counter* against an unprotected SAC base is a bomb on the base. But the best counter against a hidden missile may be a shelter; the best counter against a bomber carrying many bombs may be active defense; the best counter against the enemy destroying our cities may be the use of retaliatory threats; the best counter against fallout-type attacks is shelters plus anti-contamination. I will use the term Counterforce as Insurance to cover all of the above—indeed to include anything which might counter the use or effectiveness of the enemy's force. While many of my colleagues object to my using the term counterforce in this manner, the new term has the important virtue of discouraging parochial attitudes. It emphasizes that any method of countering the enemy's force may be useful, and that the allocation between the different methods should be made by objective considerations and not by slogans or outworn doctrine.

ALTERNATIVE NATIONAL STRATEGIES

In order to prevent this from occurring, some believers in Finite Deterrence think it is important for us to disabuse ourselves of the idea that there can be any circumstance in which it makes sense to attack the Soviet Union, and they want us to adopt a posture which makes it clear to the Soviets that we are so disabused. As part of this posture we should make as few preparations as possible to alleviate the effects of the war or protect ourselves from a Soviet retaliatory strike. This will convince the Soviets that we do not intend to attack them except in retaliation; they will then be able to relax and not be trigger-happy. As one (partial) adherent to Finite Deterrence, Oskar Morgenstern, explained: "In order to preserve a nuclear stalemate under conditions of nuclear plenty it is necessary for *both* sides to possess invulnerable retaliatory forces. . . . it is in the interest of the United States for Russia to have an invulnerable retaliatory force and vice versa [i.e., one may wish to strengthen the enemy's retaliatory capability and weaken one's 'Counterforce as Insurance']."<sup>7</sup>

Many who accept the Finite Deterrence view have another reason for not defending or protecting anything but the retaliatory capability; they see no need for programs to protect people and property, because they think it is not feasible to protect either people or property. These people often argue that it does not matter whether one dies immediately from blast, heat, or radiation, or dies later from the effects of radioactivity, disease, or starvation—as long as one is going to die. And they go on to assert that modern war is so horrible that everyone or almost everyone will be killed immediately—or will eventually be destroyed by one of the aftereffects.

A surprisingly large number of official military experts and planners seem to hold views, at least unconsciously, which are really a variation of the Finite Deterrence view that the only purpose of the strategic forces is to deter. This is illustrated by the following apocryphal quotation:



TABLE 2

ONE PROFESSIONAL'S VIEW OF HIS PROFESSION

"If these buttons are ever pressed, they have *completely failed* in their purpose! The equipment is useful only if it is not used."

—General Aphorism



<sup>7</sup> *The Question of National Defense*, New York, Random House, 1959, pp. 74, 76.



Even though the above statement may be intended to be rhetoric rather than policy, it is far from innocuous. If one were to deduce the beliefs of some policy makers from the decisions they make, he would find that in a rather high percentage of cases the planners seem to care less about what happens after the buttons are pressed than they do about looking "presentable" before the event. They show slight interest in maintaining an appreciable operational capability on the second day of the war; if deterrence should fail, they, as well as many scientists, could not be less interested in the details of what happens—so long as the retaliatory strike is launched.

It is my contention that failure to launch an effective retaliatory attack is only the first of many possible failures. Even if one retaliates successfully, there can ensue significant and meaningful failures. These will occur one after another if the attitude exemplified in the above quotation becomes too universal in either the making or execution of policy. And even Deterrence Only advocates should realize that there are subtle but important differences between a posture which is to be a façade to impress the enemy and one which is supposed to have an objective capability.

*Insurance Against Unreliability.* Some of the proponents of Finite Deterrence do not have an antipathy toward all forms of counterforce. They are willing to insure against unreliability. That is, even though deterrence has been made as reliable as they think it can be made, they realize that it may still fail; for example, from accident, human irrationality, miscalculation, or unauthorized behavior. Given this nonzero probability of a war, they find it difficult not to go through the motions of doing "something" to mitigate its effects. Even totally convinced "mutual annihilation" decision makers may be unwilling to admit openly that there are no preparations to alleviate the consequences of a war. It is difficult for any government to look at its people and say in effect, "We can no longer protect you in a war. We have no answer to blackmail except a counter-blackmail threat, and we have no preparations to deal with accidental war except trying to make it so dreadful that everybody will be careful in advance."

A façade of being able to alleviate may also be useful in international relations. It reassures one's allies about one's resolve and induces uncertainty and (hopefully) fear in the enemy. Even if it were true that both sides in the cold war conflict were unwilling to risk a thermonuclear war over any issue that could arise between

them, it would weaken their diplomatic strength to admit this openly since the admitting power would be conceding that the other power could always get its way by staking a little more.

Some decision makers who accept the Finite Deterrence view are willing to pay for insurance against unreliability for more than political or psychological reasons. Even those who hold that war means mutual annihilation are sometimes willing for us to act beyond their beliefs—or fears. While this is inconsistent, it is not necessarily irrational. They understand that paper calculations can be wrong and are willing to hedge against this possibility. Sometimes these decision makers are making a distinction that (rather surprisingly) is not usually made. They may distinguish, for example, between 100 million dead and 50 million dead, and argue that the latter state is better than the former. They may distinguish between war damage which sets the economy of a country back fifty years or only ten years. *Actually, when one examines the possible effects of thermonuclear war carefully, one notices that there are indeed many postwar states that should be distinguished.* If most people do not or cannot distinguish among these states it is because the gradations occur as a result of a totally bizarre circumstance—a thermonuclear war. The mind recoils from thinking hard about that; one prefers to believe it will never happen. If asked, “How does a country look on the day of the war?” the only answer a reasonable person can give is “awful.” It takes an act of iron will or an unpleasant degree of detachment or callousness to go about the task of distinguishing among the possible degrees of awfulness.

But surely one can ask a more specific question. For example, *“How does a country look five or ten years after the close of war, as a function of three variables: (1) the preparations made before the war, (2) the way the war started, and (3) the course of military events?”* Both very sensitive and very callous individuals should be able to distinguish (and choose, perhaps) between a country which survives a war with, say, 150 million people and a gross national product (GNP) of \$300 billion a year, and a nation which emerges with only 50 million people and a GNP of \$10 billion. The former would be the richest and the fourth largest nation in the world, and one which would be able to restore a reasonable facsimile of the prewar society; the latter would be a pitiful remnant that would contain few traces of the prewar way of life. When one asks this kind of question and examines the circumstances and pos-

sible outcomes of a future war in some detail, it appears that it is useful and necessary to make many distinctions among the results of thermonuclear war. The figures in Table 3 illustrate some simple distinctions which one may wish to make at the outset of his deliberations in this field.



TABLE 3  
TRAGIC BUT DISTINGUISHABLE POSTWAR STATES

<i>Dead</i>	<i>Economic Recuperation</i>
2,000,000	1 year
5,000,000	2 years
10,000,000	5 years
20,000,000	10 years
40,000,000	20 years
80,000,000	50 years
160,000,000	100 years

Will the survivors envy the dead?



Here I have tried to make the point that if we have a posture which might result in 40 million dead in a general war, and as a result of poor planning, apathy, or other causes, our posture deteriorates and a war occurs with 80 million dead, we have suffered an additional disaster, an *unnecessary* additional disaster that is almost as bad as the original disaster. If on the contrary, by spending a few billion dollars, or by being more competent or lucky, we can cut the number of dead from 40 to 20 million, we have done something vastly worth doing! The survivors will not dance in the streets or congratulate each other if there have been 20 million men, women, and children killed; yet it would have been a worthwhile achievement to limit casualties to this number. It is very difficult to get this point across to laymen or experts with enough intensity to move them to action. The average citizen has a dour attitude toward planners who say that if we do thus and so it will not be 40 million dead—it will be 20 million dead. Somehow the impression is left that the planner said that there will be *only* 20 million dead. To

him is often attributed the idea that this will be a tolerable or even, astonishingly enough, a desirable state!

The rate of economic recuperation, like the number of lives saved, is also of extreme importance. Very few Americans can get interested in spending money or energy on preparations which, even if they worked, would result in preindustrial living standards for the survivors of a war. As will be explained later, our analysis indicates that if a country is moderately well prepared to use the assets which survive there is unlikely to be a critical level of damage to production. A properly prepared country is not "killed" by the destruction of even a major fraction of its wealth; it is more likely to be set back a given number of years in its economic growth. While recuperation times may range all the way from one to a hundred years, even the latter is far different from the "end of history."

Perhaps the most important item on the table of distinguishable states is not the numbers of dead or the number of years it takes for economic recuperation; rather, it is the question at the bottom: "Will the survivors envy the dead?" It is in some sense true that one may never recuperate from a thermonuclear war. The world may be permanently (i.e., for perhaps 10,000 years) more hostile to human life as a result of such a war. Therefore, if the question, "Can we restore the prewar conditions of life?" is asked, the answer must be "No!" But there are other relevant questions to be asked. For example: "How much more hostile will the environment be? Will it be so hostile that we or our descendants would prefer being dead than alive?" Perhaps even more pertinent is this question, "How happy or normal a life can the survivors and their descendants hope to have?" *Despite a widespread belief to the contrary, objective studies indicate that even though the amount of human tragedy would be greatly increased in the postwar world, the increase would not preclude normal and happy lives for the majority of survivors and their descendants.*

My colleagues and I came to this conclusion reluctantly; not because we did not *want* to believe it, but because it is so *hard* to believe. Thermonuclear bombs are so destructive, and destructive in so many ways, that it is difficult to imagine that there would be anything left after their large-scale use. One of my tasks with The RAND Corporation was to serve as project leader for a study of the possibilities for alleviating the consequences of a thermonuclear war. That study was made as quantitatively and objectively as we

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could make it with the resources, information, and intellectual tools available to us. *We concluded that for at least the next decade or so, any picture of total world annihilation appears to be wrong, irrespective of the military course of events.*<sup>8</sup> Equally important, the picture of total disaster is likely to be wrong even for the two antagonists. Barring an extraordinary course for the war, or that most of the technical uncertainties turn out to lie at the disastrous end of the spectrum, one and maybe both of the antagonists should be able to restore a reasonable semblance of prewar conditions quite rapidly. Typical estimates run between one and ten years for a reasonably successful and well-prepared attacker and somewhat longer for the defender, depending mainly on the tactics of the attacker and the preparations of the defender. In the RAND study we tried to avoid using optimistic assumptions. With the exceptions to be noted, we used what were in our judgment the best values available, or we used slightly pessimistic ones. We believe that the situation is likely to be better than we indicate, rather than worse, though the latter possibility cannot be ruled out.

Exactly what is it that one must believe if he is to be convinced that it is worth while to buy Counterforce as Insurance? Listed below are eight phases of a thermonuclear war. If our decision makers are to justify the expense (and possible risk of strategic destabiliza-



TABLE 4

A COMPLETE DESCRIPTION OF A THERMONUCLEAR WAR

*Includes the Analysis of:*

1. Various time-phased programs for deterrence and defense and their possible impact on us, our allies, and others.
2. Wartime performance with different preattack and attack conditions.
3. Acute fallout problems.
4. Survival and patch-up.
5. Maintenance of economic momentum.
6. Long-term recuperation.
7. Postwar medical problems.
8. Genetic problems.



<sup>8</sup> *Report on a Study of Non-Military Defense*, The RAND Corporation, Report R-322-RC, July 1, 1958.

tion) that would be incurred in trying to acquire a capability for alleviating the consequences of a war, they must believe they can successfully negotiate each and every one of these phases, or that there is a reasonable chance that they can negotiate each of these phases.

I repeat: To survive a war it is necessary to negotiate *all eight* stages. If there is a catastrophic failure in any one of them, there will be little value in being able to cope with the other seven. Differences among exponents of the different strategic views can often be traced to the different estimates they make on the difficulty of negotiating one or more of these eight stages. While all of them present difficulties, most civilian military experts seem to consider the *last six* the critical ones. Nevertheless, most discussions among "classical" military experts concentrate on the *first two*. To get a sober and balanced view of the problem, one must examine all *eight*.

As an example of the necessity to be concerned about the last six phases, it might be appropriate to quote from testimony before the 1959 Johnson subcommittee on military preparedness during the hearings on the Berlin crisis (*italics mine*).

MR. WEISL: General White, I hate to keep you here so long, but there are some matters that *we feel ought to be in the record to make it complete*.

On March 9 of this year Dr. Libby, a Commissioner of the United States Atomic Energy Commission, in a public speech stated as follows:

"Now the fallout we fear in the case of a nuclear attack on this country, or in any other country for that matter, is the local fallout, and this arises solely from bombs which hit the surface."

Then I go on to what I consider the important quote:

"But in any case, the area covered can amount to several thousand square miles at such an intensity that it would be hazardous to life to stay out in the open for more than an hour, and the density would be high enough *so that farmland in this area would be ruined for something like 40 years* for anything except the culture of feed for beef cattle, or possibly swine, because of the strontium-90 that would be taken into any other kind of farm product."

I don't know whether it is fair to ask you whether you agree with that or not, but at least that is the statement of a responsible member of the Atomic Energy Commission.

GENERAL WHITE: I think there are other responsible scientists, though, who do not agree. I think Dr. Edward Teller is one such. While I agree that fallout is a terrific hazard and one that we don't know as much about as I hope we are going to know, and it is certainly a consideration in

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atomic war, I don't think that every horror story should be accepted 100 per cent.

MR. WEISL: I do agree that every horror story should not be accepted, but coming from a responsible member of the AEC, whose duty is to look into these problems, one must take account of it and not look upon it, at least I wouldn't look upon it, as solely a horror story.

SENATOR SYMINGTON: If the counsel will yield, Dr. Teller has opposed those who believe that strontium-90 and cesium-137 will be too damaging from the standpoint of current testing. If there is anything he has said from the standpoint of strontium-90 in answer to Dr. Libby, on the premise of an all-out war, with nuclear surface blasts, I wish you would put it in the record at this point.

GENERAL WHITE: I think the only thing I can say is I am sure there is disagreement among scientists as to the exact effects. I can't go beyond that.<sup>9</sup>

It is clear that if "farmland in this area would be ruined for something like 40 years," recuperation will be difficult. In that case we had better abandon Counterforce as Insurance and retreat to the Finite Deterrence position. However, we are going to consider the strontium-90 problem quantitatively below and will come up with some different results. The only point to be made now is that those waging a modern war are going to be as much concerned with bone cancer, leukemia, and genetic malformations as they are with the range of a B-52 or the accuracy of an Atlas missile. Senior military advisors in particular will increasingly be forced to deal with what would once have been called "nonmilitary" problems. They will need to be armed with documented studies rather than opinions.

Once one accepts the idea that deterrence is not absolutely reliable and that it would be possible to survive a war, then he may be willing to buy insurance—to spend money on preparations to decrease the number of fatalities and injuries, limit damage, facilitate recuperation, and to get the best military result possible—at least "to prevail"<sup>10</sup> in some meaningful sense if you cannot win.

<sup>9</sup> United States Senate, Committee on Armed Services, Hearings before the Preparedness Investigating Committee, 86th Congr., 1st Sess., March 1959 (Part I), pp. 132-133.

<sup>10</sup> The word "prevail" is much used in official statements. It is a carefully chosen word that shows that the user is trying to do the best he can even though he is aware that many deny the old-fashioned distinctions between victory and defeat. Because its use is ambiguous, the reader does not know whether the author is serious about his goal or is just making a meaningless concession to old-fashioned thinking; it probably does more harm than good to set it up as a goal. It would be better to use the old-fashioned concept of victory, as denoting the one who writes the peace treaty, while at the same time making explicit that victory can be costly.

## ALTERNATIVE NATIONAL STRATEGIES

*Insurance Against a Change in Policy.* One of the things which I will try to make clear in Lectures II and III is that *the military problem really is complicated and that it is impossible for fallible human beings to predict ahead of time exactly what capabilities they will wish or need.* This does not mean, of course, that one has to buy everything. Resources may not be as limited as some of the more budget-minded people think, but they are still quite limited. However, it does mean that whenever it is *cheap* to do so (and sometimes when it is moderately expensive), we should be willing to hedge against changes in our desires. The fact that it is expensive to buy and maintain a complete spectrum of military capabilities in being does not mean that we should not have what might be called "mobilization bases" for a complete spectrum of adequate military capabilities. The government, relying on current doctrine, current military capabilities, its estimates of the capabilities and intentions of potential enemies, or some aspects of the political situation, might be satisfied with current allocations for national defense. But it should still be willing to hedge against the possibility that circumstances may so change that the reluctance to spend money will also change, either increasing or decreasing. This hedging can be accomplished by spending a relatively small amount on advance planning and physical preparations. We will then be in a position where we can make the most rapid and effective use of larger funds if they become available, or we will be able to get the most value out of a smaller military budget if it seems desirable to cut back on expenditures.

There are many different kinds of programs that come under the heading "Hedging Against a Change in Policy." It is obvious that there is need for very broad research and development programs. While research is not cheap, it is far from true that research is so expensive that it can be afforded only on clearly needful items. The opposite is true. The penalty for not having researched on an item that turns out to be useful is so great that we must have an extremely broad program to be certain that all the things that could conceivably be useful will in fact be investigated. Development is somewhat more expensive than research. As a result, we cannot afford to have quite as broad a menu. But even here we should *develop* many more items than we actually *procure*. We may also procure some systems in part, even if we do not feel they are absolutely needful. Requirements can change.



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For example, many people today feel that in the ballistic missile age *air defense* is obsolete. As I will try to explain later, this is by no means true. But even if it were true that air defense should be termed obsolete because it might be unable to give protection against Soviet missiles, we might still be willing to have a "base" for air defense because we may be able to discover an answer to the missile threat, or we may later decide we want air defense against countries like China—or ultimately even smaller countries. We may find it easy to protect against small bomber forces, which could be very lethal if they had a free ride—very much more lethal, indeed, than any small missile forces these same countries might procure. (Of course, such an air defense system might look quite different from our current one.)

Similarly, while it might be our policy at a given moment to fight limited wars with atomic weapons, we may still be glad to have a large reserve force armed with conventional high-explosive equipment. After all, it is relatively cheap to keep up such reserves, and we recognize that we might change our minds—as we did in Korea. The existence of such a force could enable us to fight a war which otherwise we would have to lose by default, simply because we were unwilling to use nuclear weapons when the occasion actually arose.

There is a special type of mobilization base which I will call a "Preattack Mobilization Base." This can be extremely important. It is a capability for being able to improve rapidly our ability to fight or to threaten to fight either a limited or a general war. It includes preparations for putting in *adequate civil defense programs*. It also includes the procurement of very long *lead time* items for our strategic air defense and air offense, so that by just spending money rapidly we could bring all of these capabilities up to an adequate level. There is a very broad spectrum of preparations possible here. One kind of preparation would be useful only if a situation occurred in which substantial tactical warning (hours) was available; another set of preparations would be most useful in situations in which we had strategic warning—days, weeks, or even months. And still another set of preparations could be made to improve our ability to compensate for a possible deterioration in the international situation or an increase in our standards for an acceptable level of defense. I will defer to Lecture II discussion of the role that a Pre-attack Mobilization Base might play in deterring and correcting provocations or providing extra insurance against a failure of de-

terrence. I will only make here the obvious point that what might be called the Finite Deterrence function of the strategic force is too important to depend on warning. There should always be an adequate capability *in-being* to deter a surprise attack.

There are large resources available for defense if it becomes necessary to use them. Many economists have estimated that the United States could allocate between 40 and 50 per cent of its gross national product to military purposes for some years without subjecting individual citizens to any appreciable physical hardships. (Postattack living standards would be adequate by almost any reasonable standard. The situation would be much like World War II where we spent, at peak, about 43 per cent of our GNP on military products, and we could still buy phonograph records even if we could not buy phonographs.) In fact, if we make allowances for current unutilized resources, the country should be somewhat better off than in World War II. Such spending would undoubtedly leave a very unpleasant post-crisis legacy of debt, economic dislocation, some inflation, and so on. But if it ever came to a serious question of choosing between such spending and a high risk of national defeat, I think there is no question that the United States would choose to spend between \$200 and \$300 billion annually on national security—rather than face the alternative. We are actually spending today about one-fifth of this potential. Clearly there is an enormous amount of fat which could be converted into muscle if we felt that circumstances warranted this step. The problem is, Could we move fast enough? Whether we could would depend not only on how critical the military situation was, but also on our stop-gap military preparations, on our ability to recognize that circumstances have changed, on our resolve, and on the preparations already made for such an expansion. It would be most important that the actual physical plant and equipment of the Department of Defense (including installations) be such that it could be used as an existing base for a higher capability.

#### 4. *Credible First Strike Capability*

The next position on Table 1, that there are circumstances in which a nation may wish to have a Credible First Strike Capability, may seem to many Americans like a possibility for the Soviets—but not for us. One sees many statements to the effect that “We will

never strike first." In the context in which the remark is usually made (a "dastardly" surprise attack out of the blue against an unprepared enemy), this position is undoubtedly correct. Such a capability would not be worth much to the U.S. However, we have many treaties and other obligations. There is the obligation to come to the aid of NATO nations if they are attacked. It is generally supposed that this aid includes the use of our SAC against the Soviet heartland, even if the Soviets attack Europe *but not the United States*. From a technical point of view this means that in this instance *we* would strike *first!* The agonizing decision to start an all-out thermonuclear war would be ours. Surely there is a serious question whether we would live up to our treaty obligations under such circumstances.

That this doubt is plausible can be seen in the response of Christian Herter to a question by Senator Morse on the occasion of the hearings on his nomination: "I cannot conceive of any President involving us in an all-out nuclear war unless the facts showed clearly we are in danger of all-out devastation ourselves, *or that actual moves have been made toward devastating ourselves.*"<sup>11</sup>

A thermonuclear balance of terror is equivalent to the signing of a nonaggression treaty which states that neither the Soviets nor the Americans will initiate an all-out attack, no matter how provoking the other side may become. Sometimes people do not understand the full implications of this figurative nonaggression treaty. Let me illustrate what it can mean if we accept absolutely the notion that there is no provocation that would cause us to strike the Soviets other than an immediately impending or an actual Soviet attack on the United States. Imagine that the Soviets have taken a very drastic action against our allies in Europe. Let the action be as extreme or shocking as the reader's imagination permits. Suppose, for example, that the Soviets have dropped bombs on London, Berlin, Rome, Paris, and Bonn *but have made no detectable preparations for attacking the United States, and our retaliatory*

<sup>11</sup> *Hearings on the Nomination of Christian A. Herter to be Secretary of State, Committee on Foreign Relations, U.S. Senate, 86th Congress, 1st Session, pp. 9-10* (italics mine). Whether he means it or not, Khrushchev speaks a different language. On January 14, 1960, in a speech to the Supreme Soviet, he said: "I am emphasizing once more that we already possess so many nuclear weapons, both atomic and hydrogen, and the necessary rockets for sending these weapons to the territory of a potential aggressor, that should any madman launch an attack on our state *or on other Socialist states* we would be able literally to wipe the country or countries which attack us off the face of the earth" (italics mine). *New York Times*, January 15, 1960.

*force looks good enough to deter them from such an attack.* As far as we can tell they have done this horrible deed simply to demonstrate their strength and resolve. Suppose also that there is a device which restrains the President of the United States from acting for about twenty-four hours. It is probably true that if the President were not restrained he would order an attack on the S.U. (even if he had previously bought either the Minimum Deterrence or Finite Deterrence positions that no sane decision maker initiates a thermonuclear war against an enemy who can retaliate). However, we have assumed the existence of a 24-hour device which forces him to stop and think and make his decision in cold blood. The President would presumably call together his advisors during this time. Most of the advisors would probably urge strongly that the U.S. fulfill its obligations by striking the Soviet Union. Now let us further suppose that the President is also told by his advisors that even though we will kill almost every Russian *civilian*, we will not be able to destroy all of the Soviet strategic forces, and that these surviving Soviet forces will (by radiation or strontium-90 or something else) kill every American in their retaliatory blow—all 180 million of us.

Is it not difficult to believe that under these hypothetical circumstances any President of the United States would initiate a thermonuclear war by all-out retaliation against the Soviets with the Strategic Air Command? Few would contend that there is any plausible public policy which would justify ending life for everyone. It should be clear that our retaliation would not restore Europe; we could only succeed in further destroying it either as a by-product of our actions or because the surviving Soviet forces would subsequently destroy Europe as well as the United States. I am not saying that the United States would stand idly by. We would clearly declare war on the Soviets. We would make all kinds of *limited* military moves. We would go into a crash mobilization on at least the hundred-billion-dollars-a-year level. But there is one thing that we almost certainly would not do: We would not launch an all-out attack on Soviet cities.

There were two important caveats in the situation described: 180 million Americans would be killed, and the President would have twenty-four hours to think about his response. Let us consider these in turn. If 180 million dead is too high a price to pay for punishing the Soviets for their aggression, what price would we be willing to pay? This is a hard and unpleasant question. I have discussed

this question with many Americans, and after about fifteen minutes of discussion their estimates of an acceptable price generally fall between 10 and 60 million, clustering toward the upper number. (Their first reaction, incidentally, is usually that the U.S. would *never* be deterred from living up to its obligations by fear of a Soviet counterblow—an attitude that invariably disappears after some minutes of reflection.) The way one seems to arrive at the upper limit of 60 million is rather interesting. He takes one-third of a country's population, in other words somewhat less than half. No American that I have spoken to who was at all serious about the matter believed that any U.S. action, limited or unlimited, would be justified—no matter what our commitments were—if more than half of our population would be killed in retaliation.

The 24-hour delay is a more subtle device. It is the equivalent of asking, "Can the Soviets force the President to act in cold blood and full knowledge, rather than in the immediate anger of the moment?" This depends not only on the time he has to learn and ponder the effects that would flow from his actions (and I will describe many circumstances in which this time for reflection would occur), but also on how deeply and seriously the President and his advisors have thought about the problem in advance. This latter, in turn, would depend on whether there had been any tense situations or crises which forced the President and the people to face the concept that war is something which can happen, rather than something that is reliably deterred by some declaratory policy that never need be acted upon. (The effects of the war are usually considered irrelevant to one's declaratory policy, since it is assumed that the declarations will deter the war.)

Let me give an example of a crisis that the Soviets could precipitate that would, by forcing both the Europeans and the Americans to face the possibility of a war seriously, give the effect of a 24-hour waiting period. Assume that both the United States and the Soviet Union could reliably annihilate each other in a retaliatory blow so that there was no special advantage in one side hitting the other first. Assume also that the Europeans had bought their own independent nuclear deterrents because they assess such a balance of terror as extremely dangerous to themselves. As De Gaulle explained in a press conference in November 1959,

Who can say that if in the future, the political background having changed completely—that is something that has already happened on

earth—the two powers having the nuclear monopoly will not agree to divide the world?

Who can say that if the occasion arises the two, while each deciding not to launch its missiles at the main enemy so that it should itself be spared, will not crush the others? It is possible to imagine that on some awful day western Europe should be wiped out from Moscow and Central Europe from Washington. And who can even say that the two rivals, after I know not what political and social upheaval, will not unite?<sup>12</sup>

However, because they are so close to the Soviet Union, the independent European nuclear deterrent is so vulnerable to a Soviet strike it cannot retaliate effectively. Also assume (because of economy and relative technological backwardness) it is not large enough to destroy the Soviet Union if it goes first. The European deterrent, in summary, can only inflict about as much damage on the Soviet Union as the Soviets suffered in World War II. Therefore, the Soviets can threaten the Europeans with a disarming attack if they go first and with an annihilating retaliation if the Europeans go first, accepting whatever damage the Europeans do on their first strike. They are willing to run the risk of a European first strike because they feel that under these conditions the risk is very small, smaller perhaps than the risk of an accidental war caused by the proliferation of nuclear systems. The Soviets then deliver the following ultimatum: unless the Europeans disarm themselves in 30 days (they have no other demands), the Soviets will proceed to disarm them by force. They could make this demand after some incident, say, after a nuclear missile had been fired accidentally (or by intentional Soviet sabotage) at Soviet territory.

The Soviets might couple their disarming ultimatum with another one that would make specific their immediate goals. They could announce that from then on, Europe, Asia, and Africa would be considered as being in the Soviet sphere of interest; further, they would be willing to respect the Western Hemisphere, Australia, and maybe the British Isles and Japan as being in the American sphere of interest; and they would say they were suggesting this method of organizing humanity in order to head-off an uncontrolled arms race which had already resulted in an incident that could have touched off a cataclysm. The Soviets would claim to be willing to accept responsibility for their area and they would hold the United States accountable for its area.

While the above will strike most people as being closer to paranoia

<sup>12</sup> *New York Times*, November 11, 1959.

than to analysis, it is still worth while to observe that the basic assumption of a firm belief on both sides of a reliable balance of terror is not unreasonable. Given this belief, it is most unlikely that even a Soviet ultimatum as provoking as the above would result in an attack by the United States. Given the time available, the U.S. would feel compelled to ponder the results of an attack before ordering one. We might even feel it was possible to negotiate the Soviet demands. The Europeans would also be unlikely to start hostilities. They would be more likely to do the opposite and take off alert whatever forces they have on alert, to reduce the possibility of accident or sabotage. Having another European missile shot at the Soviets would now clearly bring intolerable consequences.

The Soviet ultimatum in this instance duplicates most of the pressures of the original hypothetical 24-hour delay situation. While some British and American readers may consider such a Soviet ultimatum even more improbable than the hypothetical situation just outlined, I suspect that a number of continental Europeans find it all too plausible. It is most important that we be able to convince our continental allies that the U.S. posture is such that the Soviets really would find it too dangerous to give such an ultimatum, and that if they did the U.S. would be able to take some corrective action that would not result in most of the Northern Hemisphere being wiped out or in a situation such as De Gaulle described in his press conference. I will discuss some of the possibilities in Lecture II.

It should now be clear what I mean by a Credible First Strike Capability. Credibility does not involve the question "Do we or the Soviets have the capability to hurt the other side on a first strike?" It is well known that this capability exists and in all likelihood will continue to exist. Credibility depends on being willing to accept the other side's retaliatory blow. It depends on the harm *he* can do, not on the harm *we* can do. It depends as much on *air defense* and *civil defense* as on *air offense*. It depends on *will* as well as *capability*. It depends on the *provocation* and on the *state of our mind* when the provocation occurs. One should also note that being able to use a Credible First Strike Capability to influence Soviet or European behavior depends not only on our will, but also on Soviet and European estimates of our will. Serious problems may be created for us if either of them does not believe in our willingness to attack under certain kinds of provocation.

Let us consider some European estimates first. I have discussed with many Europeans the question of how many casualties an

American decision maker or planner would be willing to envisage and still be willing to see this country live up to its obligations. Their estimates, perhaps not surprisingly, range much lower than the estimates of Americans, that is, roughly 2 to 20 million (clustering toward the lower numbers). In fact, one distinguished European expert thought that the U.S. would be deterred from retaliating with SAC against a major Soviet aggression in Europe by a Soviet threat to destroy five or ten empty U.S. cities.<sup>13</sup>

Will the Soviets find the threat of U.S. retaliation credible? I have not asked any Soviet citizens, so I lack the advantage of any introspection by Russians. But we do know that their formal writings strongly emphasize that decision makers should be able to control their emotions. The Soviets do not believe in cutting off their noses to spite their faces; they write and seem to believe that one should not be provoked into self-destructive behavior. They probably would assume that we do likewise. One would not think that the Soviets could believe that the U.S. would willingly commit suicide. In fact, I would conjecture that they would feel fairly certain about this matter. They could readily underestimate our *resolve*. We might easily be irrationally determined to resist the Soviets. We have no tradition in the United States of controlling our emotions. We have tended to emphasize the opposite notion (e.g., "Give me liberty or give me death"). A Soviet underestimation of U.S. resolve could create the worst of all situations—one in which we had not made preparations for the failure of deterrence because we knew we had enough resolve, but the Soviets did not believe it so they went ahead and provoked us and we were forced to initiate a war in retaliation, a war in which we were not prepared to do anything more than kill Russians.<sup>14</sup> But it seems likely that unless we institute remedial measures, the Soviets may estimate that we will be deterred, and they will be right in their estimate. It should be realized that a very low additional probability of war might not deter the Soviets. It is not as if there were no probability at all of war and their action had

<sup>13</sup> After observing, in passing, that the case for more civil defense was "perhaps best put eighteen months ago in a study by The RAND Corporation," the London *Times* of January 4, 1960 editorialized, "No amount of money or concrete could guarantee to prevent the deaths of some millions of city-dwellers from blast and heat, and it is just as difficult to imagine an American President willing to risk deaths of five million Americans as of fifty million."

<sup>14</sup> Nathan Leites points out to me that a convinced Communist might be perfectly willing to believe that the cold-hearted capitalist ruling class would be willing to lose 60 million or so of the "lower" classes; but even this ideological estimator would probably feel safe from an attack if a Soviet retaliation could kill many more than 60 million Americans.



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created this probability. It would be much more reasonable to say that just the existence of the U.S.-S.U. rivalry means that somehow there is always a probability of war of, say, one in fifty every year, and that if the Soviet action increased this by, in any one year, 50 per cent—from the assumed .02 to .03—that this might not be, for many reasons, as deterring as raising the probability from zero to .01. As the engineer would put it, the increased probability of war must dominate “the noise level” to be deterring. This is particularly true if the Soviets believe that their action would either decrease the long-run probability of war or increase markedly their chance of coming out of such a war very much better than if they had not improved their position. In addition, if the Soviets were not to risk all by a single attempt but tested our resolve more gradually by instigating a series of crises, then without running excessive risks they could probably find out experimentally a great deal about our reactions to extreme provocations. No matter what our *declared policy* might be, our *actual policy* could be probed. Most important of all, it is difficult to believe, in the absence of adequate measure for air defense and civil defense, that the Europeans will have faith in our declared policy when it is strained. The Soviets may be able to make their gains more easily by working on the will and resolve of the Europeans than by working on ours. We must convince the Europeans as well as the Russians of our resolve if we are to prevent appeasement or an undue degree of accommodation.

Here again is a summary of the situation:



TABLE 3  
TRAGIC BUT DISTINGUISHABLE POSTWAR STATES

<i>Dead</i>	<i>Economic Recuperation</i>
2,000,000	1 year
5,000,000	2 years
10,000,000	5 years
20,000,000	10 years
40,000,000	20 years
80,000,000	50 years
160,000,000	100 years

Will the survivors envy the dead?



## ALTERNATIVE NATIONAL STRATEGIES

The first three lines in this table indicate circumstances under which *some* Europeans still believe in U.S. "retaliation." The next two lines show circumstances in which *most* Americans seem to believe in it, and the last two lines indicate states in which *neither* Europeans nor Americans (nor presumably the Soviets) would believe that the use of our Strategic Air Command against the Soviet Union is credible—no matter what the Soviets did in Europe—providing they gave U.S. decision makers time to ponder seriously on the consequences of a war.

Unclassified published estimates of the casualties that the United States would suffer in a nuclear war generally run around 50 to 80 million. If these estimates are relevant (which is doubtful since they generally assume a Soviet surprise attack on an unalert United States), we are already deterred from living up to our alliance obligations. If these casualty estimates are not relevant, then we ought to make relevant estimates for now and the future.

The critical point is whether the Soviets and the Europeans believe that we can keep our casualties to a level we would find acceptable, whatever that level may be. In such an eventuality the Soviets would be deterred from such provocative acts as a ground attack on Europe, Hitler-type blackmail threats, or evacuation of their cities and presentation to us of an ultimatum. But if they do not believe that we can keep casualties to a level we would find acceptable, the Soviets may feel safe in undertaking these extremely provocative adventures; or at least the Europeans may believe that the Soviets will feel safe, and this in itself creates an extremely dangerous negotiating situation—one in which the possibility of extreme pressure and blackmail will always be in the background, if not the foreground.

The situation is actually worse than the mere estimate of the casualties or economic damage is likely to indicate. The most crucial and difficult question is the one asked at the bottom of the table: "Will the survivors envy the dead?" Unless the President believes that the postwar world will be worth living in, he will in all likelihood be deterred from living up to our alliance obligations. We must give some attention to the conditions of postwar life, to the full impact of a thermonuclear war as indicated in Table 4 on page 22.

As has already been explained, one does not have to be trying to achieve a Credible First Strike Capability to be interested in trying to cope with the eight phases of a thermonuclear war. Even

if one believes in mutual annihilation, he may still be willing to endorse Counterforce as Insurance Capability (the insurance against unreliability discussed in the previous section). This is because a reasonable person generally knows that his beliefs can be wrong. Many will agree, therefore, that some portion of the defense budget should be allocated to Counterforce as Insurance and to other measures designed to alleviate the consequences of a war. Because paper calculations can be misleading, it is rational to have even an inconsistent program which hedges against this possibility.

There is, however, a difference between Counterforce as Insurance and Credible First Strike Capabilities. In the case of the latter we do not say that there is a *modest* probability that the mutual annihilation theory is wrong; instead, we require that there be a *very high* probability that it is wrong. In short, *the time has come when we must believe that our programs are very likely to be successful under wartime and postwar conditions.*

When this has been said, it is still important to know (abstractly, we hope) that a war in which the U.S. made the first strike would result in more favorable conditions for us than would the wars that are generally considered. And even here we are more interested in *deterrence* than in *striking first!* We are more deeply interested in what the Soviets will conclude when they ask themselves, "If we try this very provoking act, will the United States strike us?" than in speculating on what could happen to us if we should actually strike them. It is quite possible that the Soviets may conclude when contemplating action that their risks are too high (even though the fact may be that we have already concluded that we would not actually dare to initiate the war). It is for such reasons that even a façade may be invaluable. Everyone knows that there is an enormous difference between a probability and a certainty.

##### 5. "Splendid" First Strike and no Limited War Capability

It is difficult for most people to believe that any nation would initiate a thermonuclear war against an opponent capable of retaliation no matter what capabilities it had and no matter how much it was provoked; nevertheless, there are many military planners who oppose having limited war capabilities to handle modest provocations. They say this is a diversion of our resources from more

important and essential central war capabilities. They seem to feel that our strategic force can be so effective in Soviet eyes that they would not dare to provoke us in even a minor way. They also believe that if the Soviets did provoke us we should then hit them at "a time and place of our choosing," thereby punishing the Soviets for their provocation. This is, roughly speaking, the massive retaliation theory as enunciated by former Secretary of State John Foster Dulles. While a Credible First Strike Capability to correct or avenge a limited but major aggression also involves massive retaliation, the distinction is that it is massive retaliation over *major* issues, not minor ones. It should also be clear that if the terror in the "balance of terror" intensifies, the line between major and minor issues will shift so that the level of provocation we will accept without triggering SAC will increase.

Anyone who studies even superficially the likely effects of thermonuclear war will inevitably reach certain conclusions. Chief among these is the idea that *even if one could launch a very successful first strike, the net damage, if only from the backlash (i.e., the fallout on the U.S. and the world from the bombs dropped on Russia, not to speak of the Russian people who would be killed), would make it unreasonable to make such a strike on a minor issue.* Is it not true that if we were to launch such a war it would not be over the minor issue bothering us but really because we had decided to engage in a form of preventive war? In the real world we would have to worry about far more than just the backlash from our blow; we would have to worry about Soviet retaliatory action. For such *practical* reasons alone, not to speak of vitally important moral and political ones, the notion of having a "Splendid" First Strike Capability seems fanciful.

## 6. Dreams

If a "Splendid" First Strike Capability seems in the light of facts and reason to be fanciful, it is no less strange than many of the ideas which make the rounds in Washington or in European capitals. In such places one finds consideration given to very implausible notions. One of these is a conflict in which a thermonuclear blow is followed by a three-year war of production accompanied by the kind of mobilization we had in World War II. Another is the notion that the enemy can go ahead and strike us first, but that our

defenses would keep us essentially untouched, and that we in turn can strike back and then survey the situation. There is the fervid belief in the possibility of a "leakproof" active defense system. There is the concept of a long-drawn-out conflict, a "broken backed war," waged with conventional weapons because both sides have simultaneously used up all their nuclear weapons. There is the claim that in a thermonuclear war it is important to keep the sea lanes open. And there is the quaint idea that the main purpose of civil defense is to support a thermonuclear war effort with men and materials. Or the equally quaint notion that after a massive interchange of thermonuclear bombs the major objective of the U.S. Army forces in the United States will not be civilian recuperation but to move to a (destroyed) port of embarkation for movement overseas. While all of these views are most implausible, they can be found in various types of official and semiofficial statements.

Where do such ideas come from? They generally result, it can be assumed, from doctrinal lags or from position papers which primarily reflect a very narrow departmental interest or which are the result of log-rolling compromises between several partisan departments of the government. We are fortunate that on the whole these views are no longer taken seriously even by many of the decision makers who sign the papers. Unfortunately, this does not prevent the papers themselves from influencing public opinion and policy to an important extent.

It should be noted that those who are convinced of the efficacy of Minimum or Finite Deterrence tend to believe that the Counterforce as Insurance, the Credible First Strike Capability, and the "Splendid" First Strike Capability views are as fanciful as the dream capabilities mentioned above. If anything, they find them more dangerously fanciful because so many people take them seriously. In this book only the following strategic positions will be considered seriously: Finite Deterrence, Counterforce as Insurance, Preattack Mobilization Base, and Credible First Strike Capability—all with varying degrees of Arms Control and Limited War Capability. The burden of my discussion will be on the nature, feasibility, and problems associated with each of these strategies, with the purpose of suggesting which one should be the basis of national policy. Our national policy at this writing seems to be drifting (mostly as a result of decisions evaded or decided for relatively minor technical reasons) toward accepting a strategy between Finite Deterrence

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and Counterforce as Insurance. *It is one of my main arguments that at least for the immediate future we should be somewhere between the Preattack Mobilization Base and the Credible First Strike Capability.* This posture would have, at least, enough capability to launch a first strike in the kind of tense situation that would result from an outrageous Soviet provocation, so as to induce uncertainty in the enemy as to whether it would not be safer to attack us directly rather than provoke us. The posture should have enough of a retaliatory capability to make this direct attack unattractive. It should have enough of a Preattack Mobilization Base to enable us to increase our first strike and retaliatory capabilities rapidly enough so that, if international relations deteriorate seriously, we will be able to acquire sufficient power in time to control or influence events. There should be enough Counterforce as Insurance so that if a war occurs anyway—perhaps as a result of accident or miscalculation—the nation will continue and unnecessary death and destruction will not occur. And lastly, the posture should include enough Arms Control and Limited War Capability to deter and correct “minor” conflicts and to make the day-to-day course of international relations livable until more permanent and stable arrangements are set up.

## CHAPTER II

# WILL THE SURVIVORS ENVY THE DEAD?

### *How Much Tragedy is "Acceptable"?*

BEFORE describing postwar problems, let us consider what we mean by an acceptable level of risk. We could start by asking, "How much tragedy can we live with and still not have 'the survivors envy the dead'?", but we will start with a more moderate question: "How dangerous or hostile a world would we be willing to live in and still call it a reasonable facsimile of a Russian or American standard of living?"

Nobody in either country would worry about a situation in which one thousand workers were engaged in some hazardous occupation which inflicted on each worker one chance in a hundred thousand per year of a fatal accident. Over a full year there would be approximately 99 chances in 100 that none of the workers would be hurt (see Table 5). Over a fifty-year period there would be better than an even chance that no worker would have been hurt. However, this attitude may change if the entire world population is subjected, as a result of some governmental action, to the same level of risk.



TABLE 5  
ACCEPTABILITY OF RISKS

#### *Peace*

$$1 \text{ thousand workers} \times \frac{1}{100,000} = 0.01/\text{year}$$

$$0.01 \times 50 \text{ years} = 0.5 \text{ workers}$$

$$3 \text{ billion people} \times \frac{1}{100,000} = 30,000/\text{year}$$

$$30,000 \times 50 \text{ years} = 1,500,000 \text{ people}$$

#### *Postwar*

$$180 \text{ million Americans} \times \frac{100,000}{1} = 1,800/\text{year}$$

$$1,800 \times 50 \text{ years} = 90,000 \text{ Americans}$$



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Because the world's population is so large (about three billion), one chance in a hundred thousand of a fatal accident per year means that on the average, 30,000 extra people per year would be killed. Over fifty years, 1,500,000 would die prematurely. While these are large numbers, something like this *might* result if many governments engaged in vigorous programs of weapons testing. Many people feel that any peacetime government action that could result in such a large number of casualties is intolerable.

We are concerned here, however, with the consequences of a war. One might well ask, "If a few bombs in the distant Pacific or Soviet Arctic will cause so much damage, would not a lot of bombs close-in be totally catastrophic?" The answer depends on how one defines "totally catastrophic"; a catastrophe can be pretty catastrophic without being total. Unfortunately, in order to make some necessary distinctions I will now have to treat some aspects of human tragedy in an objective and quantitative fashion even though some readers will find such treatment objectionable. I will tend to ignore, or at least underemphasize, what many people might consider the most important result of a war—the over-all suffering induced by 10,000 years of postwar environment. Instead, let us ask two questions: Can society *bear* the economic burdens caused by the increased sickness, malformations, and deaths? What view should a reasonable (nonhypochondriac) individual hold toward his own future?

The reader can easily see that from the viewpoint of these two questions, decision makers might define a postwar world as "tolerable" if death rates increased by about one per cent for tens of thousands of years, even though this might mean that at long length the war would cause the premature death of more people than are now alive. No doubt most decision makers under extreme compulsion would be willing to countenance the idea that the immediate survivors and later generations be subjected to levels of risk that industrial workers undergo in peacetime. Therefore, if as a result of a thermonuclear war long-lived radioisotopes are created which cause the premature death of some thousands of Americans each year (or hundreds of thousands of deaths over fifty years), simple arithmetic shows that such deaths would be of small significance *compared to the war itself*. Few would call it a "total catastrophe" if *all* survivors of a thermonuclear war lost a few years of life expectancy and even ten or twenty million of the survivors lost an



average of ten or fifteen years of life expectancy. To repeat: I think that any individual who survived the war should be willing to accept, almost with equanimity, somewhat larger risks than those to which we subject our industrial workers in peacetime. We should not magnify our view of the costs of the war inordinately because such postwar risks are added to the wartime casualties.

At this point I must make an admission. *The illustrative table is "faked."* A risk of one part in a hundred thousand is actually *far too small* to illustrate the industrial risks we accept in peacetime. We like to think that when we subject people to risk we do it at so low a level there is no discernible damage. But this is not even true of risks taken by all our population, not to speak of limited industrial risks. We design our roads and set up safety regulations to make driving reasonably safe, but rather than accept speed limits of twenty miles an hour we prefer to let automobiles kill forty thousand people a year (or about 25 per 100,000) and injure close to a million (or about 600 per 100,000). This degree of risk is in fact characteristic of a great deal of activity in modern societies.

Some of the risks of living in a modern society are assumed willingly and knowingly by those who bear them; even more are assumed willingly, but not knowingly; and probably most are just assumed. However, many people have a much more favorable attitude toward risks that arise out of useful or pleasurable civilian activities than those that arise from preparations for war—for example, as a result of testing nuclear weapons. These people feel even more



TABLE 4

A COMPLETE DESCRIPTION OF A THERMONUCLEAR WAR

*Includes an Analysis of:*

1. Various time-phased programs for deterrence and defense and their possible impact on us, our allies, and others.
2. Wartime performance with different preattack and attack conditions.
3. Acute fallout problems.
4. Survival and patch-up.
5. Maintenance of economic momentum.
6. Long-term recuperation.
7. Postwar medical problems.
8. Genetic problems.



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antagonistic toward risks that could potentially arise from fighting a war. I would like at this point to evaluate these risks objectively, without worrying how they arose, and later we will consider how they might affect calculations of deterrence and defense. More generally, I would like to describe some of the possible forms a postwar world might take in order to evaluate whether it is worth while to survive a war and how decision makers might view their country's prospects. We will be examining points 4 to 8 of Table 4, which is repeated above for reference.

### *Genetics and Thermonuclear War*

Many people who contemplate thermonuclear war have found number 8 on the table, the genetic hazard, particularly frightening. Partly for this reason and partly because it has been so widely publicized, we shall start with this problem. Distinguished geneticists and biologists have made statements which, when quoted out of context (and occasionally even when quoted in context), seem to imply that the human germ plasm simply could not survive a thermonuclear war. Even if one does not adopt this extreme position, the long-lasting and somewhat incalculable nature of the damage has seemed so frightening that even the experts tend to avoid calculating the effects of a nuclear war. By contenting themselves with discussions of the fallout from tests, they have sometimes given the impression that the damage from a war is so great that it does not have to be calculated.

I would now like to give a serious illustration of the kind of risk that is sometimes considered acceptable by discussing current public health standards with regard to the genetic damage caused by the peacetime use of radiation; this discussion will have the bonus value of providing some orientation about this important subject. How much damage would be done if everybody received a radiation dose to his reproductive organs as large as that considered acceptable by the National Academy of Sciences? According to the NAS, every effort should be made to limit the average dose to the reproductive organs to less than 10r (roentgens) during the first thirty years of life, and to no more than another 10r in each subsequent ten years. The reason for this limit is not so much the damage to the individual, but rather the possible genetic damage that will be passed on to his descendants. What would be the genetic effects if the entire world population received doses approaching NAS

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limits? Would effects be large or small? Using the best available information, we get the results shown in Table 6.



TABLE 6  
ESTIMATED GENETIC CONSEQUENCES IF WORLD-WIDE  
DOSES APPROACHED NAS 10r LIMITS

Type of Damage	Total Increase <sup>a</sup>		Per cent Increase <sup>a</sup>		Normal Rate (per cent)
	First Generation	Later Generation <sup>b</sup>	First Generation	Later Generation <sup>b</sup>	
Major Defects	1,000,000	10,000,000	0.04	0.4	4 <sup>c</sup>
Minor Defects	10,000,000	200,000,000	0.4	6	100 <sup>d</sup>
Early Mortality <sup>e</sup>	2,500,000	40,000,000	0.08	1.3	25
Decreased Fertility	5,000,000	100,000,000	0.17	3.3	-

<sup>a</sup> World population assumed constant at 3 billion.

<sup>b</sup> Also gives total damage over all generations due to a dose to one generation.

<sup>c</sup> Includes nongenetic defects present at birth.

<sup>d</sup> Everybody has minor defects.

<sup>e</sup> Includes miscarriages.



The estimated amount of human tragedy and accompanying misery is uncomfortably high. It is believed that if everyone in the world were subjected to a 10r dose, approximately one million children, who would not otherwise be defective, would be born seriously defective in the next generation. If this dose should be repeated generation after generation (the world population remaining stable), a new and higher level of defective genes would be established. When this new level of stability is achieved, every generation might see the birth of about ten million seriously defective children as a result of this NAS limit exposure. These are very large numbers, even for a generation.

We can obtain the corresponding numbers for the United States

alone (assuming average population to be 200,000,000) by dividing the totals by 15. This comes to roughly 65,000 defective American children in the first generation and 650,000 in every generation when new levels of stability are reached. This would be a large toll; moreover, we are talking about such serious defects as imbecility, crippling, blindness, deafness, and various debilitating or deforming diseases and defects. If not correctable by medical science, these congenital defects are viewed by most parents as human tragedy in its most extreme form—a live defective child. However, some may be surprised and shocked to learn that this toll has not only been judged to be acceptable hypothetically; it seems likely to be accepted by the technologically advanced peoples. The average person in the United States probably *now* receives about one half of the NAS dose to his reproductive organs from X-rays alone. The readers of this book very likely use more medical services than the average American, and as a result receive at least twice the average dose. The resulting damage is just part of the price we have to pay to live in a civilization with nuclear power plants, X-rays, fluoroscopes, tracer elements, weapons tests, and so on.

Many geneticists have raised serious questions about the acceptability of the damage just described. They argue not only that the predicted damage is very high, but also that there is a good deal of uncertainty in the calculations. Still, it has been decided by the geneticists on the NAS committees, and others, that the expected gains from using this level of radiation for medical and other purposes are greater than the losses. Even so, nobody is thinking of lowering the standards by raising the limit. The reason why we are willing to accept such losses is that they are small when expressed as percentages even though they are high numerically.

Referring again to Table 6, we note that the most important genetic effect of radiation—live but seriously defective children—starts from 0.04 per cent for the first generation and gradually increases to 0.4 per cent for later generations if the radiation continues. While four chances in a thousand is a high price to pay for the use of radiation, it is not obviously excessive, especially when one considers that it is only a 10 per cent increase in the natural rate of 4 per cent.

But four chances in a thousand is four hundred times larger than the hypothetical one-in-a-hundred-thousand risk that we originally discussed. Even in peacetime we are willing to subject large pop-

ulations to significant risks, accepting the resulting damage. War is a terrible thing; but so is peace. The difference seems in some respects to be a quantitative one of degree and standards.

I once mentioned in an unclassified lecture that I could easily imagine a war in which the average survivor received about 250 roentgens. Now 250 roentgens is 25 times greater than the 10 roentgens we have talked about. According to Table 6, 10 roentgens produces about .04 per cent defectives. According to the widely accepted theory of a linear relationship between dose and damage, 250 roentgens would produce 25 times as much damage as 10 roentgens. This would mean that about 1 per cent of the children who could have been healthy would be defective; in short, the number of children born seriously defective would increase, because of war, to about 25 per cent above the current rate. This would be a large penalty to pay for a war. More horrible still, we might have to continue to pay a similar though smaller price for 20 or 30 or 40 generations. But even this is a long way from annihilation. It might well turn out, for example, that U.S. decision makers would be willing, among other things, to accept the high risk of an additional 1 per cent of our children being born deformed *if that meant not giving up Europe to Soviet Russia*. Or it might be that under certain circumstances the Russians would be willing to accept even higher risks than this, if by doing so they could eliminate the United States.

At this point in the lecture a lady in the audience got up and said in a very accusing voice, "I don't want to live in your world in which 1 per cent of the children are born defective." My answer was rather brutal, I fear. "It is not *my* world," I observed, and I then pointed out that if she did not want to live in a world in which 1 per cent of the children were born defective she had a real problem, since 4 per cent of the children are born defective *now*. This story illustrates that peace also has its tragedies, and that we tend in our day-to-day life to ignore the existence of this continuing risk. Unless their own family or close friends or relatives have been affected, most people just ignore these kinds of risks in the environment in which we live and raise families.

I can easily imagine that if we lived in a world in which no children had ever been born defective and we were told that as a result of some new contingencies 4 per cent of the children would be born seriously defective we would consider such a world to

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be intolerable. We might not believe that people would be willing to bear and raise children if the risk were about 1 in 25 that these children would have a serious congenital defect. However, we live in that world now. We not only bear this relatively high rate of tragedy; we come close to ignoring it. While some women are greatly concerned about such possibilities during their pregnancy, it is only in such critical periods or when they are touched personally that most people think about this continuing burden of life. To add a further 1 per cent to the burden would be a terrible thing to do, but this additional burden is clearly comparable to the kinds of risks to which we have become accustomed in the peacetime world. Most people will be able to live with such increased risks.<sup>1</sup>

A magnified incidence of major defects, while dramatic, is not the only genetic cost of exposure. Table 6 indicates that there will probably also be about 10,000,000 new minor defects in the first generation, rising to an equilibrium in which people have 200,000,000 minor defects that they would not have had if their ancestors had not been exposed. These minor defects might affect the health,

<sup>1</sup> In testifying before a subcommittee of the Joint Committee on Atomic Energy on June 26, 1959, I made some remarks in which the words "peace also has its tragedies" appeared and a little later I said, "In other words, war is horrible. There is no question about it. But so is peace. And it is proper, with the kind of calculations we are making today, to compare the horror of war and the horror of peace and see how much worse it is. This is an emotion-laden issue, partly because it gets mixed up with the question of nuclear testing where many people have overdone such comparisons or said, rather violently, that they are totally irrelevant."

The comment was quoted or misquoted in several places to the effect that, "scientist testifies that peace is horrible." It is partly because of the danger of being quoted out of context that many technical people and government officials are unwilling to discuss these problems soberly. Almost invariably when one tries to put the tragedy into context or proportion, one is accused of either grossly underestimating or of being incredibly callous.

I should like to add another example of either a misunderstanding or a misquote. *On a number of occasions I have remarked that it is not necessarily true that both nations will be destroyed in a war; there are many circumstances in which only one nation will get destroyed and some in which neither will be.* Therefore, depending on the circumstances and the alternatives which a nation has, it is quite possible that decision makers could rationally and sanely choose to go to war. (I will expand on this a bit later.) The immediate reaction many had to this remark was that I was recommending preventive war. That is, they did not attack my estimates but simply some of the conclusions that they thought I would draw from these estimates.

I do not believe it will help us to solve the problems that are coming up in the next ten years to discuss the problems of war and peace on an emotional rather than factual basis. It is not that the problems are not inherently emotional. They are. It is perfectly proper for people to feel strongly about them. But while emotion is a good spur to action, it is only rarely a good guide to *appropriate* action. In the complicated and dangerous world in which we are going to live, it will only increase the chance of tragedy if we refuse to make and discuss objectively whatever quantitative estimates can be made.