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THE COMMAND OF STRATEGIC FORCES

Yale University

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Ph.D. 1982

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THE COMMAND OF STRATEGIC FORCES

A Dissertation
Presented to the Faculty of the Graduate School
of
Yale University
in Candidacy for the Degree of
Doctor of Philosophy

by
Paul James Bracken
May 1982
This dissertation examines strategic nuclear policy issues from the perspective of force management and organization. It divides the force management problem into the categories of warning, theater war, assessment in wartime, targeting, and command and control in order to advance certain core ideas which have broad applicability to national security policy. Recent policy issues, such as changes in nuclear targeting doctrine, crisis management, the threat to launch missiles on radar warning, deterrence, and European security are analyzed from this perspective.

The core ideas advanced are influenced by recent developments in organization and game theory, and center on the crisis and wartime behavior of military command organizations when constraints are placed on their ability to process information and coordinate actions. It is argued that both the American and Soviet nuclear command structures will pass from political to highly fragmented military control under wartime conditions, making political direction of a nuclear war highly unlikely.
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<td>Atomic Demolition Munition</td>
</tr>
<tr>
<td>ASW</td>
<td>Anti-Submarine Warfare</td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>American Telephone and Telegraph Corporation</td>
</tr>
<tr>
<td>BMEMS</td>
<td>Ballistic Missile Early Warning System</td>
</tr>
<tr>
<td>CIA</td>
<td>Central Intelligence Agency</td>
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<tr>
<td>CINCSAC</td>
<td>Commander in Chief, Strategic Air Command</td>
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<td>COMINT</td>
<td>Communications Intelligence</td>
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<tr>
<td>DEW</td>
<td>Distant Early Warning Line</td>
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<tr>
<td>DIA</td>
<td>Defense Intelligence Agency</td>
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<td>DSP</td>
<td>Defense Support Program</td>
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<tr>
<td>ELINT</td>
<td>Electronic Intelligence</td>
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<tr>
<td>EMP</td>
<td>Electromagnetic Pulse</td>
</tr>
<tr>
<td>EUR</td>
<td>European (Command)</td>
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<tr>
<td>ICBM</td>
<td>Intercontinental Ballistic Missile</td>
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<td>IRBM</td>
<td>Intermediate-Range Ballistic Missile</td>
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<td>JCS</td>
<td>Joint Chiefs of Staff</td>
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<td>LANT</td>
<td>Atlantic (Command)</td>
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<tr>
<td>MIDAS</td>
<td>Missile Defense Alarm System</td>
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<td>MIRV</td>
<td>Multiple independently targeted reentry vehicle</td>
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<td>MRBM</td>
<td>Medium-Range Ballistic Missile</td>
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<tr>
<td>NATO</td>
<td>North Atlantic Treaty Organization</td>
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<tr>
<td>NCA</td>
<td>National Command Authority</td>
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<td>NCS</td>
<td>National Communications System</td>
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<tr>
<td>NEACP</td>
<td>National Emergency Airborne Command Post</td>
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<td>MNCS</td>
<td>National Military Command System</td>
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<td>NORAD</td>
<td>North American Air Defense Command</td>
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<td>NSA</td>
<td>National Security Agency</td>
</tr>
<tr>
<td>PAC</td>
<td>Pacific (Command)</td>
</tr>
<tr>
<td>PSI</td>
<td>Pounds per square inch (blast overpressure)</td>
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<tr>
<td>QRA</td>
<td>Quick Reaction Alert aircraft</td>
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<td>SAC</td>
<td>Strategic Air Command</td>
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# ACRONYMS AND ABBREVIATIONS (CONTINUED)

<table>
<thead>
<tr>
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<tr>
<td>SACCS</td>
<td>SAC Control System</td>
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<tr>
<td>SACEUR</td>
<td>Supreme Allied Commander Europe</td>
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<td>SAGE</td>
<td>Semi-Automatic Ground Environment Air Defense System</td>
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<td>SALT</td>
<td>Strategic Arms Limitation Talks</td>
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<td>SAM</td>
<td>Surface-to-Air Missile</td>
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<td>SIDAC</td>
<td>Single Integrated Damage Assessment Capability</td>
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<td>SIGINT</td>
<td>Signals Intelligence</td>
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<tr>
<td>SIOP</td>
<td>Single Integrated Operational Plan</td>
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<tr>
<td>SLBM</td>
<td>Submarine-launched Ballistic Missile</td>
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<tr>
<td>SOSUS</td>
<td>Sound Surveillance System</td>
</tr>
<tr>
<td>SRF</td>
<td>Strategic Rocket Forces (Soviet)</td>
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<tr>
<td>SSBN</td>
<td>Strategic Nuclear Ballistic Missile Submarine</td>
</tr>
<tr>
<td>TACAMO</td>
<td>Airborne command post for the ballistic missile submarines</td>
</tr>
<tr>
<td>WWMCCS</td>
<td>World Wide Military Command and Control System</td>
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PREFACE

This dissertation examines structural and organizational aspects of the overt or threatened use of strategic nuclear forces. The motivation for such an exercise came from my exposure to what, at first, seemed to be straightforward problems in nuclear weapons employment policy. Many years before this exposure I had the intuitive feeling that these issues were far more complex than indicated by government studies and academic journal articles. This feeling came home with full effect when I attempted an original version of the work leading to what follows. I had intended to construct a collection of simplified models of targeting which included a dependence on information asymmetries between the two major actors, the United States and the Soviet Union. It immediately became apparent to me, and to members of my dissertation committee at Yale, that given the level of understanding existing on such things as command structure organization, interaction of warning and alerting systems, wartime assessment capabilities, and the special problems of theater nuclear forces, it was impossible to analytically study this area because the most basic questions about goals and functions had not seriously been asked in at least two decades.

Although this work is substantive, it is difficult not to make the point that absence of fundamental thinking on how nuclear forces...
would be managed in a crisis may be the major problem that faces civilization. To those who believe that these problems have been "solved," or have even been studied but cannot be discussed in public for security reasons, let me say that they are making a dangerously naive assumption about the behavior of a large bureaucracy. The lion's share of attention in national security policy has been given to force acquisition and to a particularly ephemeral version of "strategy" which tends to ignore organizational constraints. There has not been a single serious book written on nuclear command structure since the early 1960s. Andrew Marshall, the Director of Net Assessment in the Department of Defense, told a seminar on strategic forces command and control held at Yale University in November 1981 that there was really no one in the country who understood these problems from a functional point of view.

My own personal conviction is that a failure to think through the problems of nuclear force management does not lead to a greater likelihood that these weapons would never be used, as critics of the left would argue. Instead, it leads to having decisions made on these questions by individuals with extremely narrow perspectives. In effect, some of the most important policy choices imaginable are delegated to "gnomes in the bureaucratic basement" because of an absence of a broader scholarly concern about them.

The following pages attempt to rectify some of this past neglect in order that the study of nuclear force management can advance beyond its primitive state. I am indebted to my thesis committee for their patience in taking on such a new and unexamined field of endeavor with me. Garry Brewer, Martin Shubik, George Hogenson,
and Colin Bradford were all helpful in defining these complex problems. In addition, I would like to thank Herman Kahn for the many long discussions we had at Hudson Institute. Frank Armbruster and Donald Brennan were also most helpful for their insights and recollections. However, the author is alone responsible for the substantive judgments and conclusions which follow.
CHAPTER 1

INTRODUCTION

Nearly forty years into the nuclear age we are farther from coming to grips with the existence of nuclear weapons than we were at earlier stages of this journey. Indeed, many indications actually point to divergence between our understanding of these forces and the dynamics which drive their expansion. Arms control seems divorced from broader security concerns, weapon acquisition appears disconnected from strategy, and targeting policy grows ever more removed from management ability to carry it out. What is peculiar about all of this is not so much the existence of a failure to coordinate the parts of an overall policy, as it is the sense of many participants, the author included, that the fragmentation of the pieces seems much larger today than it did twenty years ago, and worse, that it seems to be growing all the time.

There has been no lack of scapegoats assigned culpability for this state of affairs. Blame has been placed on the liberals, the conservatives, the moderates, the militarists, and the disarmers. We have been urged to have the nerve to "think about the unthinkable," and to "ban the bomb." With all of the competing interest groups armed with their carefully cultivated symbols and metaphors it is not surprising that an informal bureaucratic politics interpretation of events dominates the personal world views of those involved in the details of national security management.
This dissertation takes a different cut at the problem of understanding the implications of the existence of nuclear weapons. For one thing, it nowhere demands that people rise to the occasion to reform their behavior. Indeed, in the final chapter a case is made about the policy implications of our study, suggesting that current trends can continue, and by so doing would greatly reinforce the deterrence regime now binding the superpowers together. This train of events can be thought of as a "business-as-usual" projection of current trends.

In addition to recognizing the limitations inherent in changing human behavior, this book shifts attention from the day-to-day log-rolling of bureaucratic politics to examine the structural differences and characteristics of various issues of strategic war. The reason for expanding the scope of the discussion in this way is simple. We believe that getting a better management handle on nuclear forces depends on thinking through these structural differences more than it does on imposing the views of any interest group, liberal or conservative. There is no lack of motivation for getting a management handle on the nuclear forces; there is only a lack of knowledge about how to do it.

The approach of examining structural differences in various nuclear issues relies on analyzing pieces of the nuclear force management problem, such as warning (Chapter 2), theater war (Chapter 3), assessment (Chapter 4), targeting (Chapter 5), and command and control (Chapter 6). This cut at the problem is thought to be more revealing than examining a single issue in detail, because it offers the opportunity to generalize on the final product. It is interesting, for example,
to think about certain core ideas in strategic warfare that have powerful applicability to both the warning and targeting problems. Single issue studies, such as those organized around the concepts of deterrence or escalation, also produce their generalizations, but too often as a matter of assumption. By focusing on a whole set of diverse issues we may be able to make a first step toward understanding strategic conflict which does not strip the problem bare of complexity and detail at the outset. The approach taken here fairly compels us to include this complexity because the strategic environment of today is vastly different from that of twenty years ago.

HOW MUCH HAS CHANGED?

Much of the framework for thinking about nuclear warfare had its foundation in the 1950s and early 1960s. The lectures, books and articles by the likes of Herman Kahn, Bernard Brodie, Thomas Schelling and others provided a major advance in the conceptualization of new and bizarre problems of the nuclear age. Theories of deterrence, limited war, arms control, first and second strike, and counterforce and countervalue targeting were developed and applied to the nuclear strategy problems of the day. The ideas became organizing metaphors for nearly all subsequent thinking about nuclear war. These were useful mental tools for thinking about difficult issues. Over the following two decades, however, changes have taken place which raise fundamental doubts about the continued utility of these inherited conceptual notions. Specifically, we argue here that expansion in the size of nuclear arsenals, broadly interpreted, coupled with a
proliferation of command and control systems has qualitatively changed the nuclear regime existing between the United States and the Soviet Union. A central thesis of this book is that despite an expansion both of arsenal size and information processing systems, the two have not developed together in a balanced way.

In October of 1962, the Soviet Union possessed about 40 intercontinental ballistic missiles (ICBMs). In 1982, it has on the order of 1,500 ICBMs. One of the major changes that needs to be realized is that the management problems of nuclear force control are far larger today than they were in the early 1960s. But the "size effects" on decision making for crisis or wartime control of large arsenals have received scant attention. Instead discussions have focused on static parity ratios for comparing the forces of the United States and the Soviet Union.

The number of deliverable nuclear weapons possessed by each nation is one indicator of the complexities of force management, and the trend in this variable clearly shows the deficiencies of static comparisons. Each nuclear weapon must be targeted, and must be given a delivery time if its use is to be coordinated in a war plan. While nuclear force management problems need not increase directly with arsenal size, this is true only if new forms of administration are able to compensate for the increased size of the force being managed. Recall that in the twenty years between 1962 and 1982 the intercontinental range arsenal of the United States went from about 4,000 to nearly 10,000 warheads, and for the Soviet Union from only 400 to nearly 10,000 warheads.¹

¹Sources for this estimate are contained in Chapter 6.
The NATO theater nuclear force doubled to 7,000 warheads during this time period, and Soviet theater nuclear forces have grown in numbers also.

The reversal of an American nuclear warhead advantage of approximately ten to one at the time of the 1962 Cuban missile crisis, to one of near parity by the early 1980s, and ultimately to inferiority by the mid 1980s has been one of the most debated aspects of American national security policy. To be sure, there is more to a nuclear war than the number of deployed warheads. Warning, targeting, command and control, and assessment will all be examined in detail later in this work. Yet the size of each superpower's nuclear arsenal can lead us to appreciate the increased complexity of operations involving thousands of weapons. A nuclear war waged by nations each possessing on the order of 15,000 warheads would be qualitatively different, especially in its controllability, than a war fought with 1,500 or 150 weapons. For a large war to remain controllable administrative structures would have to be in place to manage the exchange of multi-thousand weapon salvos, and yet still retain the capability to monitor damage information, collect intelligence, and offer national political leaders the prospect of making choices on this information.

But as the number of available weapons increases so does the management problem of putting all this information together, and so does the attractiveness of targeting the management systems given this task. With thousands of weapons available there is an inevitable decline in the ability of a central political headquarters to manage operations in detail, because it would be swamped both with status information about itself and corresponding intelligence about the...
enemy. Authority and control must be delegated and decentralized as a consequence. And the fragile communication and computation systems used to monitor and control events would themselves be paralyzed by large attacks, just at the moment when their use would be most important.

The composition of nuclear arsenals has also become more diverse as their size has grown. Large fractions of these arsenals have been provided to front line military commanders in order to meet time urgent threats. Others have been geographically dispersed in order to conceal their location, and to complicate enemy defensive plans. Still others have had certain qualitative features upgraded in order to improve their performance against special classes of targets. Direct physical control of nuclear weapons has passed from special civilian cadres to front line military commanders in both the United States and the Soviet Union. The idea that these weapons were unique and different from all others was advanced in each country. But gradually the demands of timely decision about usage and deployment to remote geographic areas necessitated that military units be given hands on control. The fact that an identical evolution of physical control occurred in both nations is a sign that there is a structural content to this issue. To the extent that arsenal size increases, new varieties of nuclear forces and modes of operation and control become more likely further increasing the difficulty of managing the varied pieces.

At the time Soviet and American arsenals were growing in size there were numerous initiatives to manage the difficulties introduced from this expansion. The proliferation of command control systems to improve force management stands out as the second major change between the nuclear forces of today and those of the early 1960s.
The term is here used to describe both command and control and intelligence systems together. Enormous networks of computer linked telecommunication systems now process information about the status and deployment of strategic forces, and automated intelligence collection systems routinely assess similar characteristics about enemy forces. In fact, changes in arsenal size have been surpassed in scale by these changes in information processing capabilities. It is in radically different information structures that the most important changes since the 1960s have taken place.

Information is the essence of any control system for strategic nuclear forces. From the planning factors that determine weapon acquisition to the status determination of enemy targets, the timely availability of accurate information is a necessary prerequisite to decision making in strategic warfare. Enormous arrays of data routinely flow through military command and control systems, and weapon exchanges are calculated on supporting computers to specify for senior decision makers the probable outcomes of exchanges. Indeed, the informational demands of strategic force management and operation have been among the most important factors driving the growth in size and speed of the modern digital computer.

It is important to remember that for this kind of conflict a decision maker will not get information first hand. Information will be manipulated and filtered many times through mathematical models, decision aids, information correlators, and other processors whose existence the decision maker will not be in the least bit familiar with. For example, the physical damage caused by nuclear attack makes it impossible to rapidly measure the levels of destruction caused
in a war. Yet a requirement for controlled, politically directed nuclear war means that such damage-assessments will have to be made nearly instantaneously. This requires that complicated models of urban and military destruction, and fallout patterns and their lethality be operated with overhead burst detection sensors in the midst of a war. Over the past two decades these mathematical models, computers, and sensors have all been developed to meet this end.

Damage assessment systems are but one of many systems which are intended to improve the management of nuclear forces. These command and control systems are enormously complex, geographically dispersed, and quick reacting. The United States, for example, has undersea sensor networks to monitor and track Soviet submarines. These are fully integrated with sea and shore based surveillance platforms and also with overhead reconnaissance systems to constantly monitor the deployment of Soviet ocean assets, both military and non-military. Equally elaborate intelligence collection systems monitor the state of Soviet armies in Europe. Other systems are devoted to monitoring Soviet missiles, from watching burn plumes to decrypting down-link telemetry channels. It is widely known that the Soviet Union maintains its counterpart information systems focused on United States forces.

The greatest utility is derived from this information if it is correlated, matched, and integrated with itself. This takes place in so called "data fusion centers." At the North American Air Defense Command (NORAD) in Colorado Springs, for example, information from early warning satellites, underwater acoustic sensors, meteorological satellites and ground stations, intelligence collection systems and ground based radars is integrated to permit a more complete appraisal
of the strategic military situation. In theory, at least, this is done with such speed that it can be used as an input to a vertically integrated warning and response system. Changes in Soviet nuclear deployments or operating procedures can automatically induce defensive measures in the operation and deployment of American nuclear forces.

The point emphasized here is that the information structures formed by command and control did not exist in the early 1960s in anything like the complexity they now do. There was then almost no capability for automated real time display of this fusion information, or of using it to instantly change the operation of American forces. During the Cuban missile crisis U-2 surveillance aircraft had to be ordered aloft to take their photographs over Cuba, and return to base. Courier aircraft then rushed the film to be developed and enlarged, and then distributed to photographic interpreters who ultimately conveyed their findings to senior officials in Washington. This process took many hours even when it worked smoothly. Today, and even more so in the near future, in theory, all of this information could be absorbed, processed, and distributed in near real time. Furthermore, it could be compared with a wide range of other information that would have been impossible to collect in the early 1960s. It is now routinely possible, for example, to monitor millions of point-to-point communications, such as radio and telephone conversations. This can be done by antenna pick-up of microwave dish transmissions or by low altitude "ferret satellites" that scoop up electromagnetic communications over a foreign nation. Properly organized, such information could be of immense value, especially during a period of tension or crisis, and
it fundamentally changes the nature of the warning problem, a subject examined in the following chapter.

THE BALANCE OF FORCES AND MANAGEMENT

To the question "How much has changed?," the answer offered here is that a great deal has changed. First, arsenals have grown larger. Second, command and control systems have proliferated. Some implications of these twin developments are developed throughout this volume, but for now let us note that they suggest a new slant on some old questions. Instead of focusing attention upon which nation possesses a margin of superiority in nuclear weapons, or of how this margin has trended during the past two decades, the two changes suggest a more subtle question, "Has there been a balanced expansion between arsenal size and command structure?"

It might be more important to have a balanced expansion of arsenal size with command structure than it is to maintain a specified lead in nuclear armaments over the Soviet Union. Arsenal size alone can provide few indications of what would happen in an exchange without introduction of command structure constraints. The approach taken later, especially in Chapters 3 and 6, is to explore this question as a function of the fit, or degree of congruence, between the strategy employed to direct the use of the nuclear arsenal with the underlying command structure. Changes in command structure are thus a response to an expansion in arsenal size and to changes in strategy.

The competitive relationship between the United States and Soviet strategic forces must also affect our thinking of balanced growth
of arsenals and command structure. Unbalanced growth, represented by an overbuilding of arsenals without corresponding changes in command abilities, is something which could lead both superpowers to ruin if it turned a limited crisis into an uncontrollable exchange. Furthermore, the issue of whether or not there has been unbalanced growth of the nuclear forces is one which each nation has greater control over than it does the arsenal size of its opponent. Rebalancing of arsenal size with command structure capabilities is a high leverage way to get a management handle on strategic force evolution. It could also rationalize arms reduction plans, for reducing armaments is one way to bring about a better balance between the forces and our ability to manage them.

In the 1980s, the United States will spend approximately eight percent of its strategic forces budget on command and control programs for managing these forces.\(^1\) Intuitively, this does not seem like much even despite our ignorance of what an ideal resource effort for command and control should be. The tendency of the American military services, and probably the Soviet services as well, has been to underfund command and control in favor of acquiring more weapons. But one very good reason why this practice continues is that no one can make a persuasive case about how much to spend in this area. Thus, two factors contribute to unbalanced growth of the forces. A bureaucratic factor favors weapons instead of management ability to control them, and a lack of knowledge about how much to spend, or even how to define the questions that might lead to an answer on appropriate budgetary levels allows the first bureaucratic factor to drive force

\(^{1}\)Author's estimate.
development. Without knowledge of the problems and issues of improving command structure it is almost impossible, short of blind luck, to fit the pieces of command and control together. This forms the substantive thesis of Chapter 6, where it is argued that although many information processing systems have been deployed there are strong doubts about their ability to coordinate events in the environment of nuclear conflict.

In other areas of policy research it has been suggested that unbalanced growth of different parts of a system may not, in fact, be undesirable. The reason is that many real world policy problems are so complex that the only way to make progress is to strip away some of the complexities, even at the expense of realism, in order to improve policy along one dimension. Eventually, improvements along one selected dimension top out because of the failure to incorporate features of the problem represented in the unselected dimensions. A shift of management attention and resources to a different, but still single, dimension of the problem then follows. The result is a zig-zag policy of unbalanced policy improvement, and just this behavior seems to characterize problem areas as diverse as economic development, military research and development, and general policy processes.¹ There are elements of this model of policy, which have been termed "muddling through" or "disjointed incrementalism" which apply to the evolution of strategic forces. The unbalanced growth of nuclear forces corresponds to one of the central tenets of muddling through, for

it is characteristic of highly complex policy problems to be solved piecemeal. A zig-zag development of arsenal expansion, and later force management improvements would typify the evolution of the nuclear regime.

An additional reason for considering muddling through as a model for the evolution of nuclear force is that it offers one of the few practical ways around the monumental problems of actually using nuclear weapons. The advice offered by this policy is simply to ignore everything that we don't readily understand. This permits a stripping away of complicating detail. In Chapter 3, a full dose of just this detail on theater nuclear forces is provided in the conviction that a realistic understanding of deterrence and warfighting in Europe can only come about with an appreciation of it. Muddling through would bypass this painful bit of homework, at least temporarily, in hopes of solving "easier" parts of the problem.

As a description of how nuclear forces have evolved in an unbalanced way, muddling through does a good job. For example, command and control issues are difficult to understand and quantify, at least compared to weapon acquisition problems, and so it tends to be underemphasized, a not surprising development suggested by muddling through. The difficulty with muddling through lies not with its fidelity to how the Soviet-American nuclear regime has evolved, but with where it eventually leads. The "shift" of attention and resources from one dimension to the next has not taken place, at least for a very long time. Since the mid 1960s the size of both superpower arsenals has been growing without commensurate improvements in our ability to manage a conflict. More generally, there have not been any major
reorganizations or reforms in the command structure or in the command and control facilities upon which it depends. We argue that both superpowers have decided to hang thousands upon thousands of new weapons on command structures built for a 1960s environment, supplemented with additional technical information processing systems which are not coordinated with each other, and therefore further confound an already difficult force management problem.

The continued unbalanced development of the nuclear forces is especially troubling because the muddling through policy which seems to capture the bureaucratic dynamic shaping the next generation of weapons reinforces the basic antipathy toward balanced development. The attitude among those senior government officials charged with responsibilities in force and command structure development is one of "we do what we can do," which most often translates into unbalanced development because of a lack of knowledge about command structure. This point is discussed in Chapter 7, but we can state here that where this ultimately drives the Soviet-American nuclear regime is toward an "innocent capacity" to fight a nuclear war. Changes in American targeting strategy, described in Chapter 5, move official policy ever closer to fighting, rather than deterring a war, but the unbalanced development of the force posture means that the capacity to carry out this strategy is not even remotely capable of doing so. It is an innocent capacity because the difficulties and stresses of the nuclear environment are greatly underestimated by those people directing the arsenal into a warfighting posture.
OVERVIEW

Changes in arsenal size and in the magnitude of the general force management problem suggest that other specific management problems be reexamined using concepts and ideas that have special power for explaining the structural differences and characteristics of strategic war. That is the purpose of this book. Although there is no magic set of methods to turn to for help, some broad guidelines can direct our efforts. First, there has been an unfortunate tendency to strip away too much vital detail about the forces from theories about the forces. Not surprisingly, this has led to data free conjectures, which no matter how interesting they are, cannot fully grasp the essence of the difficulty of managing large complex forces. The unbalanced development of nuclear forces described earlier was caused in good measure by a management philosophy that avoided complexity, and consequently was driven to solve the more understandable problems of weapon acquisition. The way in which principles developed for weapon acquisition and force sizing drove out analysis of force management problems is an important story whose full account has yet to be written. The implication for us is to incorporate, rather than to avoid, the complexities of operating such large arsenals.

The difficulty with this objective is that it can overwhelm limited human abilities to understand and remember what is happening. But if the overwhelming of human understanding is a danger in peacetime, how much more will it be a problem during periods of high alert or war? In other words, it seems silly to exclude the complexities of force operations from peacetime discussions because they are poorly
understood, when in a war or crisis just these complexities will increase at a time when they will have to be faced up to. To default on this issue in the interests of simplicity is to let some important choices involving national survival be decided by the standard operating procedures used within organizations to "solve" complex problems. Drawing the line about how much detail and complexity to include is a problem not unique to managing nuclear operations, but is something confronted by all managers. The perspectives on managing the nuclear force have tended to incorporate too little of this detail, and we will here attempt to swing the pendulum in the other direction.

A second guideline is to be problem-oriented wherever possible. The reason for this is apparent to all who have studied national security problems, and that is the tendency for methodologically centered analyses to cast all problems as particular examples of the methods used. Eventually, the methodology so shapes our thinking that what gets analyzed is an artifact of the original problem. An example of this is offered in Chapter 4, where certain uses of nuclear exchange models are criticized. In this book a conscious problem orientation has been chosen, following the sequence of problems arising in a strategic exchange. Warning, assessment, targeting, and command and control are considered, with the only problem not fitting into this sequence being theater nuclear issues. This last is so different and unique that a chapter has been added on it alone.

Another guideline is to be interdisciplinary in concepts and methods even in a problem-oriented approach. The disciplines of special relevance here are those that have something to say about the management of large complex organizations. The intellectual underpinnings for this
do not arise from one discipline, but from many. Especially in the last few years a wealth of ideas from fields as diverse as decision theory, game theory, policy research, the administrative sciences, operations research, and mathematical economics have been largely overlooked for what they may contribute to the study of strategic force operations.

Finally, we attempt to approach the subject of managing nuclear forces in a conceptual way from the "bottom up" rather than the "top down." The reason for this is our dissatisfaction with top down approaches, which usually posit an overarching theory of how nations do, or should, behave, and proceed to make logically consistent deductions from these macroprinciples. There is an almost irresistible temptation in this grand theory building to ignore detail and complexity because it is so easy to establish what is, and is not, relevant subject matter within the theory. Examples of this are provided throughout the following chapters.

An equally insidious feature of grand theorizing about management of nuclear forces is the independence of the conclusions deduced from any size effects of arsenal growth, or even from the context of the situation. The theories developed seem to apply to arsenals of a few hundred to tens of thousands of weapons. This is hard to believe.

The following chapters are not a critique of macrotheories of national behavior in a nuclear weapons context. Rather, they are an attempt to describe some of the more important concepts and processes of nuclear force operations with the goal of establishing a set of core ideas. The core ideas are summarized in the concluding chapter,
and offer a first step in acquiring tools for unpacking the meaning of different nuclear problems.
One of the greatest fears associated with nuclear weapons is that in a crisis events could get out of the control of rational leaders. An intuitive understanding of this possibility is widespread, especially among those who have either had first hand experience in actual crises or have studied historical experience. Yet for the most part its consideration is lacking in contemporary force balance analyses, net assessments, and exchange calculations. The exclusion of factors contributing to a momentum for war can divert attention away from this troublesome possibility, producing little attempt to design doctrine, training, or arms control provisions to forestall it.

The classic example of a momentum for war was in the outbreak of World War I. There, as noted by Fred C. Ikle, an irreversible process of action-reaction mobilizations moved Europe into war. This was a system that performed exactly as it was intended to on a national basis. But the aggregate effect of each national mobilization was to function like a ratchet: it could move, step by step, toward war but never back toward stability and peace.

The events of 1914 may, unfortunately, hold special significance for the nuclear age. The cascading events and interlocking alerts

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of July-August 1914 arose from the rapid devolution of command to provincial control centers which gave little or no thought to the broader political consequences of their actions. It was in the failure to recognize the enormous momentum built into the war-making systems of the day for just this sort of devolution that the political strategies of 1914 proved so utterly bankrupt. This was not a case of a military faction pushing for war with a political group holding out for peace, but rather of politicians formulating strategy in ignorance of interlocking organizational dynamics that took on a momentum of their own. With decision-making time in the nuclear era compressed into a few minutes there would be even less chance of recognizing the buildup of such a momentum until it was too late.

A major consequence of all of this is that the planning process itself takes on far more importance than in the past. The compression of decision time dictates that realistic war plans be assembled in peacetime. It may no longer be possible to discard plans drawn up in peacetime for the simple reason that there would be so little time available to draw up alternatives. Thus any gaps occurring in the planning process that fail to anticipate an interlocking momentum leading to war could be especially catastrophic.

This chapter first deals with the drastic reduction in warning and decision time that might be available to leaders in a crisis. It then develops some of the key decisions and related structural implications that could directly affect the likelihood that preparation for war could itself contribute to the likelihood of it.
COMPRESSION OF WARNING AND DECISION TIME

Early warning information provides decision-makers with a description of enemy forces as they prepare for or actually initiate an attack. The sensors used for this purpose include overhead satellites, ground based radars, communications intelligence systems, and other highly secret means. Information from these many different sources is transmitted to "fusion centers," where it is processed, synthesized, filtered, and distributed to political and military command centers for action.

Early warning information is essential for the survival of many parts of both the American and Soviet nuclear arsenals and their related control systems. For example, the American bomber force, in particular, is dependent on timely early warning information so that it may be scrambled from ground alert to airborne deployment where it is far less vulnerable to attack. One of the principal design components of a modern bomber force is its ability to get off the ground quickly. Airplane designers are willing to make major concessions in other performance criteria in order to drive down what is known as a bomber's "escape time." This is because there is little point to having a sophisticated plane if it is destroyed in a first strike attack.

This particular problem began to reach major proportions for the United States Air Force in the early 1970s when the Soviet Union began to routinely base SSBNs off America's coast. In these positions SLBMs could reach interior air bases on the order of 12-15 minutes. This substantially reduced the allowable bomber escape time and posed a major threat to this leg of the American triad.
A principal counter to this threat was the construction of early warning space satellites that would detect enemy missiles soon after their launch.\footnote{A description of the existing and planned American early warning network is given in "Improved U.S. Warning Net Spurred," \textit{Aviation Week \& Space Technology}, June 23, 1980, pp. 38-45.} Information on attack would be relayed to American bomber commanders who could order all alert aircraft aloft, escaping destruction from incoming enemy missiles. The important thing to observe here is the complimentary relationship between the warning system and bomber force. Without this warning information any improvements in minimizing bomber escape times would be useless.

Another key part of the American defense system that is critically dependent on early warning information is the survival of the president. His position in the Washington, D.C. area makes him extremely vulnerable to enemy attack, especially from submarine launched ballistic missiles. It has been reported that plans exist to evacuate him in the event that early warning sensors pick up evidence of an enemy missile launch.

Closely related to the early warning problem are what have come to be known as launch on warning options. Warning is necessary for proper selection of plans that would order the launch of a silo-housed missile force prior to the impact of attacking enemy missiles. What has made this option necessary is the growing first strike threat to the survivability of silo-housed ICBMs. One of the original design intentions behind the silo-housed missile program in the early 1960s was to allow the United States the option of riding out first strike attacks. With such a ride-out capability, early warning information may have been useful but it was not essential. The advent of silo
threatening attacks however has removed the attractiveness of riding out an attack because the number of surviving ICBMs would be so few. However, the threat to launch the ICBM force on warning of a first strike attack raises a new set of questions and problems. The existence of silo-threatening attacks makes warning information critical to ICBM survival, and this could push in the direction of de facto launch on warning policies, a concept explained later.

It is difficult to find historical parallels for problems of warning in nuclear conflict. This is because of the extremely short decision times available to nuclear war fighters. Although individual historical battles have had short decision times, these have generally involved only low level tactical military decisions. In the nuclear age high level political and military decisions will be necessary and it is not at all clear that enough attention has been paid to these questions. Time compression for decision represents a revolutionary change in warfare. At one level, it has necessitated the growing use of automated decision aids to cut down response time as much as possible. Beyond the crudest assertions of the danger of war by technical accident the implications of this have gone unnoticed. The fear of technical accident does not address the difficulty of contacting political leaders in the few minutes available, nor does it deal with the problem of how such a momentous, irreversible decision could be made in such a short period of time.

Thus even if timely warning information is available there is little analysis given to what should or could be done with it. Although it is possible to make arguments both for and against policies which promptly resort to major escalations, it has to be recognized that
exceedingly strong military and organizational forces push in just this direction. It may be relevant to speak of the "attractiveness" of automatic or launch on warning tactics rather than an official policy declaration on the subject. Official declaratory policies can change in a moment, but the technological and organizational forces driving toward ever compressed decision-making times cannot be changed in a crisis.

American Tendencies

The main reason for America's development of a nuclear force that could be used quickly is to be found at the very beginning of the nuclear age. Because of the large disparity in ground forces of the Eastern and Western blocs in the late 1940s virtually all American war plans called for the immediate use of atomic weapons at the outbreak of war. It was thought, reasonably enough, that the only realistic way to halt an invasion of Western Europe was the mass destruction of Soviet Armies and supporting logistic systems before they could overrun the continent.

In 1948, following the Czechoslovakian crisis and the beginning of the Berlin blockade, the National Security Council authorized the military to draw up contingency plans on the presumption that nuclear weapons would be available for defense. This was embodied in National Security Council (NSC) Memorandum 30 which has guided virtually all subsequent military planning (emphasis added):

> It is recognized that, in the event of hostilities, the National Military Establishment must be ready to use promptly and effectively all appropriate means available, including atomic weapons, in the interest of national security and must therefore plan accordingly.

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This planning guidance took on even greater importance following the Soviet development of a significant nuclear weapon capability. For then the overall military direction of war planning expanded to include damage limitation to the United States, as well as the blunting of a Soviet invasion of Western Europe. Damage limitation would require that Soviet bombers and missiles be destroyed on the ground before they could inflict damage on the United States. While the planning for halting a Soviet ground advance required the delivery of nuclear weapons over a period of a few days, the requirements for damage limitation were even more stringent. They necessitated a major launch of nuclear weapons immediately at the outset of conflict in order to prevent the counter launch of Soviet missiles and bombers. While it might take a few days for Red Armies to overrun Europe, it would require only about thirty minutes for Soviet ICBMs to reach the United States. The advent of the solid fuel Minuteman missile, whose very name was symbolic of its potential, met the requirements for a damage limitation in the early 1960s. This weapon was encased in an underground concrete silo which also provided protection to ride out a Soviet first strike. It thus has twin capabilities: it could fly on a moment's notice, or it could ride out an attack, thus providing substantially increased decision time to determine a politically acceptable response to whatever provocations existed. Nonetheless, the option of riding out an attack foreclosed the possibility of substantial damage limitation. Presumably, after the Soviets had fired first the Minuteman would largely be a weapon of revenge as it could not prevent damage to the United States.
As the Soviets began to harden their own force of ICBMs in the late 1960s the damage limitation option for the American arsenal was reduced considerably. Now a new problem was to push in the direction of reducing warning and decision time still further. The deployment of accurate MIRV warheads made it possible, in theory, for a first strike attack to destroy a high percentage of an opponent's silo-housed missile force. In addition, the firing of close-in SLBMs made it possible to destroy an even higher fraction of non-alert bombers. The result of these threats was to drastically encourage the attractiveness of saving the silo-housed missile by launching it before enemy missiles impacted. Launch on warning became especially attractive because the needed quick reaction capability had been already built into the Minuteman system.

If the decision to launch the American missile force is not physically turned over to a computerized warning system the flight times of ICBMs make it possible, again in theory, to rush an option to the president so that he could authorize launch before enemy missiles had landed on United States soil. It is this decision that necessitates the existence of the black bag or "football," the briefcase of nuclear war codes that accompanies the president at all times and in all places. Presumably, it contains coded response options that could be instantaneously transmitted to major command centers for execution. But here decision time shrinks below warning time, and only about ten minutes or less would be available to select a response.

The speed needed raises problems that almost all strategists and planners would prefer not to think about. For example, if the president could not be reached in time and the incoming attack looked
truly massive, what would the default option be? Planning bureaucracies of a civilian persuasion or academic strategists could maintain that this situation is impossible because of the deterrent threat that there might be a launch or that surviving submarines would constitute a sufficient retaliatory deterrent. This is using deterrence theory to suppress unpleasant problems in overt form, a not uncommon feature of the planning process.

Military planners, on the other hand, are likely to believe the situation could not arise by claiming that the president can always be reached in time. It is easy to comprehend the reluctance of the military to raise the possibility of such a problem because it challenges the deepest constitutional principles of the American government. It raises far too many problems to discuss at any level of classification, and is more easily handled by the bureaucratic convention of simply assuming that the president can always be reached in time.

This particular problem is only one of the many that emerge from a realistic assessment of the effects of increasingly compressed warning and decision time. It illustrates how the planning process is unlikely to address such issues in peacetime, and how this aversion in itself becomes a part of the actual decision problem. As warning and decision times have decreased because of force survival needs, there is a tendency to neglect the full technological and organizational implications of the problems raised.

An unfortunate consequence of this neglect is that a lack of coordination becomes possible among different groups that must each make plans and decisions in peace and war. Problems not raised on
the official planning agenda will either be ignored, or else 'solved' in a decentralized manner, each group making its own assumptions and mental calculations. This explains why there has been a simultaneous movement toward technically reducing the time needed to launch nuclear forces, along with a growing chorus of strategic writings decrying the concept of launch on warning. At first sight, such a divergence may seem contradictory, but it can be explained by the fact that different levels of defense organization have different problems, constraints, and world views. Unless the deep technological and organizational forces pushing toward very early use of nuclear weapons are recognized and explicitly addressed it is unlikely that the dangers in this tendency can be easily rectified.

**Soviet Tendencies**

On the Soviet side the situation is troubling because of their seeming attraction to the ideas of preemption and automatic firing. During the tension that mounted over the status of Berlin in 1959, for example, Premier Nikita S. Khrushchev warned Averill Harriman:

> Your generals talk of maintaining your position in Berlin with force. That is bluff. If you send in tanks, they will burn and make no mistake about it. If you want war, you can have it, but remember, it will be your war. Our rockets will fly automatically.

The term "automatically" was emphasized as Khrushchev's colleagues echoed this part of the threat. Further evidence of Soviet attraction to automatic firing policies occurred during the 1960 U-2 crisis. Deputy Secretary of Defense Roswell Gilpatric, when questioned about Soviet control of their nuclear weapons, remarked:

\[\text{The primary source for this is } \textit{Life Magazine}, \text{ July 13, 1959, p. 33.}\]

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With regard to top-level control over the use of nuclear weapons, the Soviets have not explicitly and formally identified where the responsibility for authorizing use resides, as has the United States. It can be presumed that in the U.S.S.R. this authority is in the hands of Khrushchev alone, or in the Presidium of the Central Committee. At the same time, Soviet statements have indicated that this authority may be delegated to the military under some circumstances. For example, shortly after the U-2 incident Khrushchev said that Marshal Malinovsky was empowered to respond instantly with missile attack on any bases from which further U-2s might be sent.

It would be a mistake indeed to discount such Soviet tendencies as mere political bluff. Most obviously, this would fail to account for the fact that the capability for automatic or quick launch systems has been a preeminent design goal of Soviet ICBM forces. Automatic quick launch capabilities are not a by-product of technological developments, but are rather guiding capabilities that have been an integral feature of the Strategic Rocket Forces since their inception. Khrushchev, in his memoirs, for example, writes that one of the reasons he disliked the early SS-6 missile, tested in 1959, was because it could not "be fired at a moment's notice." This was the missile originally expected in the West to form the backbone of the Soviet rocket force and which led Western intelligence agencies to predict the existence of a missile gap. The SS-6 was never deployed in substantial numbers. A considerable period went by without major deployments until SS-7s and the SS-8s were introduced in 1962 and 1963 respectively. Khrushchev recounts that the designers of these systems "tackled the

1Letter from the Deputy Secretary of Defense to Senator Hubert H. Humphrey, August 23, 1961, contained in Disarmament Agency Hearings, U.S. Senate Committee on Foreign Relations Hearings on S. 2180, August 14, 15, 16, 1961, pp. 110-111.

problem of perfecting a rocket that could be launched on short notice.\(^1\) Unlike the SS-6, the SS-7 and SS-8 had storable liquid fuel that permitted quick launch capability. They were certainly more in keeping with a desire for "automatic" nuclear response.

The fact that Khrushchev passed over the SS-6 and instead concentrated on rapid launch ICBMs even though this delayed the deployment of a major ICBM capability for several years is evidence of the importance of this capability. General Daniel O. Graham, a former Director of the Defense Intelligence Agency, has maintained that the Soviet Union actually adopted a launch on warning policy, beginning in the mid 1960s. General Graham asserts that this occurred with the operational availability of Soviet early warning radars in 1966-67, and he provides several citations of Soviet writings to support his contention.\(^2\)

Following Soviet operationalization of modern warning radars in the mid 1960s, there occurred in the 1970s further doctrinal elaboration of the benefits of near automatic preemptive nuclear strikes. The notions of "preemption" and "launch on warning" are not identical by any means, but they do share common features and characteristics. Soviet emphasis on "preemption" in military doctrinal writings stresses the detection and countering of an opponent's attack before it is initiated. This is not to be confused with a bolt from the blue surprise attack. Rather, it relates to getting in the first blow, immediately


prior to an enemy's attack, to prevent the opponent from enjoying the benefits of a first strike.

An emphasis on preemption is a recurring theme in Soviet military writings. For Moscow was just as surprised and shocked by the 1941 German invasion as the United States was by Pearl Harbor. This later created an overriding concern with the importance of the early phases of conflict, for with modern forces it became possible to settle the outcome of an entire war in the opening moves. In his 1974 book *The Initial Period of a War* Soviet General S.P. Ivanov emphasized the need for large preemptive strikes at the outset of conflict. This necessitates, in his view, the transfer of various planning functions which formerly occurred after a war's outbreak into the prewar period. During the initial period of conflict it is seen as unlikely that sufficient time would be available for these things to be done properly. This again exemplifies the consequences of compressed decision time.

The fact that Soviet peacetime doctrine emphasizes preemption is, of course, no guarantee that this would be actual practice in a crisis. Its most important implication may be for indoctrinating preconceptions throughout the Soviet defense organization. Once the planning process grasps such a view of war there would be little chance that competing theories of conflict would receive very much attention, either in studies, training, or in funding of command and control systems needed to implement the alternatives. By building an arsenal and training system directed to large scale preemptive strikes other strategies are precluded from serious consideration,

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and this would make it more difficult to change plans at the last minute.

This is a problem reminiscent of the difficulties encountered at the outbreak of World War I. When European leaders searched for last minute alternatives to mobilization, which they sensed the danger of, they were told that railroad mobilization schedules dictated that immediate actions be taken according to preestablished plans. Failure to take action would jeopardize national security. In the nuclear age it would be all but impossible to develop the command and control systems needed to avert all out general war if this had not been undertaken years before hand. Just the writing of the immense volume of computer programs required for selective launch and retargeting would demand considerable previous work. The compression of warning and decision time has thus had one of its greatest effects on reducing feasibility of last minute changes in war plans. Indeed, for the case of automatic firing or launch on warning policies the times involved are short enough to preclude any serious political input whatsoever.

Finally, the compression of decision time drives toward increased preplanning and automation of procedures for operating strategic forces. This raises new and interesting questions about top level political control. In the Soviet case, for example, it is most often argued in Western descriptions that an adversarial relationship based upon deep suspicion and mistrust characterizes civil-military relations. Available evidence suggests that this was indeed the case during the Stalin years, attested to by his military purges and his refusal to form a high military command (Stavka) until after the German invasion of his country. However, organizational imperatives of the nuclear
era, especially the compression of decision time, have made it essential that institutional structures be developed to manage these new complex problems. The willingness of Khrushchev to even suggest delegation of nuclear authority demonstrates a fundamentally different perspective in the post-Stalin nuclear era. The widespread dissemination of a nuclear doctrine that calls for intensive coordinated military planning before a conflict, as in General Ivanov's book, also reflects a less adversarial relationship between civil and military groups. It would seem very unlikely that these kinds of actions could occur if the civil leaders of the Soviet Union held such a deep distrust of the military. A more reasonable perspective might assume that the Soviet military are the agents of political leaders. This is a different perspective than the usually employed framework of bureaucratically contrasting political versus military control. By emphasizing the role of the military as agents new questions are identified on coordination of political and military objectives, organizational command procedures, and the effect of technology on the classical lines of authority for controlling the large Soviet defense establishment.

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1 For arguments along similar lines see Ross O'Donoghue, "A Viability Analysis of Stavka via Function," Defense Intelligence School, June 1977.

INTERACTION EFFECTS

One consequence of the growing automation of operating procedures necessitated by compressed warning time can best be illustrated by an example of a recent false alert at the headquarters of the North American Air Defense Command (NORAD) inside of Cheyenne Mountain, near Colorado Springs. An operator mistake there led to the transmission of an erroneous message that the United States was being subjected to nuclear attack. This information was sent to NORAD fighter bases, and ultimately ten fighters from three separate bases in the United States and Canada were scrambled and sent airborne. Furthermore, American missile and submarine bases throughout the nation automatically switched to a higher level of alert.

Several months later, a failed integrated circuit in a buffer minicomputer led to the transmission of a similar message to American forces. This time about 100 B-52 bombers were readied for take-off and the President's emergency aircraft, the so-called "NEACP" (for National Emergency Airborne Command Post), held at Andrews Air Force Base outside of Washington, D.C., was also prepared for take-off.

These incidents suggest some of the problems and complexities associated with an early warning system designed for automated response.

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against a reactive, intelligent opponent. The reactions that occurred, which were for all practical purpose automatic, would in a real crisis, be observed almost immediately by Soviet technical intelligence systems. If the Soviets detected a large scale B-52 launch simultaneous with the take-off of the President's NEACP aircraft, it is a near certainty that they would have to alert their own strategic forces, perhaps automatically, purely as a self-defensive measure. Note that in this action-reaction process the postulation of an operator mistake or integrated circuit failure is superfluous. The mutually reinforcing actions are a consequence of the system doing precisely what it is designed to do. A serious issue arises, however, when both sides possess such alerting procedures, for then a series of interlocking alerts could reinforce each other, leading to a heightening of a crisis, or perhaps even to war itself.

The extraordinary linkage between the Soviet and American strategic forces established by interacting warning and intelligence systems needs some explanation. By using ferret satellites for communications intelligence (COMINT), signals intelligence (SIGINT), and other means, it has become possible to tap into an opponent's military information network. The full extent of this has only been dimly appreciated by strategic analysts, and it exemplifies a radically new development created by the vast increase in technical collection systems. Some examples of current capabilities in this area have become public despite the blankets of security that cover the field. In 1969, the North Koreans shot down in international air space an American RB-121 electronic reconnaissance aircraft. In a news conference shortly thereafter, President Richard Nixon made known the fact that not only was the
aircraft in international space, but that the United States knew that the Soviets and the North Koreans were aware of this. This (apparently) inadvertent presidential remark revealed the existence of an American ability to "read" Soviet radar scopes and to "listen" to the Soviet military as they tracked the RB-121 aircraft. Apparently, U.S. ELINT and COMINT sensors were penetrating the Soviet early warning and tracking radar networks.\(^1\)

Another instance of penetration of one technical intelligence collection system by another was revealed in 1975 when the operation of the highly classified Holystone missions by the U.S. Navy became public. These missions employed specially fitted attack submarines to enter Soviet territorial waters in order to monitor their SLBM tests. Perhaps more importantly, "one source said that the submarines were able to plug into Soviet land communication cables strewn across the ocean bottom and thus were able to intercept high level military messages and other communications considered too important to be sent by radio or other less secure means."\(^2\) The use of hard wire lines for communication with nuclear forces has long characterized Soviet operating procedure. Not only does this enhance secrecy and communications security, it also provides a redundant means of controlling these forces along with radio methods. Such security and redundancy are defining features of Soviet command and control.\(^3\) A capability

\(^{1}\)This description was given in the ABC Television Network's broadcast of the program "20/20" on the evening of December 12, 1979.


to listen in to highly secret communications over the Soviet control system could be exploited to enormous advantage in time of war or crisis. It might constitute the penultimate early warning information source, especially if it were correlated with other COMINT and ELINT channels and interlinked with American strategic forces, not only to tell of imminent attack but also to detail characteristics of attack. In extremis, it could provide enough advance warning of attack to permit a quick reacting missile force to launch a preemptive first strike, not minutes after a Soviet launch, but minutes before such a launch.

A more explicitly interactive example of mutually reinforcing moves occurred in April 1978, when two Soviet Yankee-class submarines moved unusually close to the eastern coastline of the United States. In such close-in positions these nuclear missile equipped submarines were capable of launching attacks with little or no warning on bomber bases, command and control centers, submarine bases, and even Washington, D.C. itself. Their movements were tracked by an elaborate underwater acoustic detection network operated by the U.S. Navy known as SOSUS (for sound surveillance system), described in Chapter 6. This technical intelligence system relied on sophisticated signal processing analysis performed at large computer installations around the country.

The American response to this provocation was "to let the Soviets know that we know" how close in they had moved. This was done by raising the alert level at several SAC bomber bases, and ultimately by dispersing the aircraft to other bases. Such an action is suggestive that the bomber force was preparing to launch against the Soviet Union. Presumably, these actions were detected immediately by Soviet ferret
satellites overhead. The Soviet submarines soon retreated from their close in positions to their usual deployments farther out in the Atlantic. The fact that this "war of nerves" occurred in conditions where there was no threat of war should not obscure the likely speed up of the interactions that would occur in a crisis.

These examples highlight the likelihood of mutually reinforcing and interlocking alerts. The Soviet-American strategic forces are growing increasingly coupled in near real time by the linkage that has been built between intelligence collection systems and the strategic forces. This is a natural evolutionary development arising from the growing power and speed of computer driven information processing networks. It must be remembered that the purpose of intelligence systems is not to warn American intelligence agencies that attack is imminent, but rather to alert the commanders of American strategic forces of this fact. That is their most fundamental purpose, for warning can never be separated from decision.

It is inevitable that such intelligence information systems be vertically integrated with the strategic forces, and this is precisely what has happened since the late 1960s. This produces tightly coupled interactions between the two strategic forces, as suggested in figure 2-1, because each side is building ever more powerful intelligence and information processing systems that penetrate the other. For such elaborately complex systems to function effectively, considerable delegation of authority and overall standardization of performance must be in place. At lower levels in the hierarchy there is likely

FIGURE 2-1
THE COUPLING OF STRATEGIC FORCES

U.S. technical information collection systems

Soviet strategic force action

American strategic force action

Soviet technical information collection systems

near real time information link
to be a dominant concern with narrow performance criteria, with relatively little thought given to the political ramifications of particular tactics. These could be a source of momentum for war that is exceedingly difficult to control.

THE IMPORTANCE OF CONTEXT

With such a potential for reinforcing alerts to take on a momentum of their own it is surprising that the world has survived thus far into the nuclear era. Even more remarkable has been the absence of any movement to the highest levels of alert by either superpower. For there has never been a general alert of the strategic or theater nuclear forces of either side. The closest thing to this was at the time of the Cuban missile crisis in 1962, when American forces were placed on the second highest alert position. Even with this, there was no full alert in Europe and tactical nuclear weapons were not dispersed out of their peacetime storage bunkers.

The absence of any full-scale general alert does not mean that a continual war of nerves is not played between the forces of the two superpowers. As already outlined, submarines move close in to a coastline threatening inland targets, bombers are readied for launch, aircraft are flown toward the foreign border in order to stimulate radar signals, and a pursuit-evader game between antisubmarine warfare (ASW) forces and enemy submarines are accepted as routines of military behavior.

Two reasons can explain why these interactions do not escalate into full-scale general alerts leading to the brink of war. First,
while the individual interactions are in many cases dangerous they are only pieces in an overall pattern of interactions. The individual interaction may be perceived as annoying, challenging and even somewhat provocative--but it alone is not perceived as threatening in any vital way. The fact that one part of the Soviet defense establishment is engaging in provocative behavior is perceived in the pattern that most other parts of their establishment are simultaneously dormant. Thus, for example, when a Yankee SSBN moves near the American coast the Soviet strategic rocket and theater nuclear arms are either dormant or have low activity rates.

A second reason working against an upward momentum of reinforcing alerts is the effect of context. Under peacetime conditions it is just about inconceivable to most people that a bolt from the blue surprise attack would erupt onto the United States. Even at Pearl Harbor, there was a long preceding period of worsening diplomatic relations. Without a context of acute crisis there is likely to be an overwhelming tendency to perceive provocative strategic force movements as only a continuation of the war nerves that has been going on since the early 1950s.

It is not widely known that the often repeated analogy of the outbreak of World War I for the nuclear age contained its own important pattern and contextual variables. In fact, prior to the declarations of war in the summer of 1914 there had been several mobilizations and war scares. Despite the widespread perception that "mobilization means war" Austria had twice fully and twice partially mobilized in the decade before 1914. But what had not occurred was a simultaneous general mobilization of all the major powers. In particular, Germany
had never gone to full mobilization prior to July 1914. The fact of German mobilization then made an enormous change in the context of how the tension was perceived by the major powers. In all previous crises this had not occurred and this became the accepted pattern of expectations. When this pattern was abruptly changed a new phase of the crisis was initiated, and could not be stopped short of war.

This kind of radical change in the expected pattern of actions and deployments would be a major turning point in a nuclear crisis. The absence of any historical precedent for all out alert, especially by the Soviet Union, makes its occurrence an event that could transform the nature of a crisis into a cascading sequence of actions that take on momentum of their own. Thus if several Soviet Yankee class submarines moved close to the American coastline, theater and strategic nuclear forces were placed on highest alert, tactical nuclear weapons were distributed to front line armies, and airborne command posts were activated, the perceptions of the situation would be starkly different. Nothing even remotely approaching this has ever occurred. No matter how provocative any single action might appear, the fact that it is only a single action serves to convince commanders that the situation is not vital to national survival, and hence that war is not imminent.

However, since a full alert has never taken place it cannot be clear what patterns are to be expected at the highest levels of alert. For years, the strategic intelligence organizations of the Soviet Union and the United States have observed individual provocative actions, field exercises, and simulated conflicts, and they have become conditioned to these patterns. Changes in operating practices that do
occur are likely to be incremental or conducted in isolation from other parts of the force. But just as in the case of German mobilization in 1914, a full scale alert by both sides would stimulate radically new patterns as perceived by the indications and warning staffs of each nation's intelligence organization. These new patterns may themselves be construed as evidence that war is intended or imminent. It is at this point that the issues discussed previously of compression in decision time, interlocking alerts, and resort to automatic launching take on a truly ominous cast. And it is also at this point that the chances of accidental war manifest themselves, for in peacetime conditions this is not likely to be a major problem. The false alarms at NORAD mentioned earlier were perceived as spurious because of related patterns indicating inactivity discerned by other intelligence sensors. Yet if such false alarms are technically possible under the low stress conditions of peacetime they would seemingly be more likely at higher alert levels. A false appearance of incoming missiles occurring when both nations are poised at full alert, and intelligence sensors are tracking SSBNs close to shore, is the kind of stress that could trigger a full scale eruption in violence.

An even more important contributing factor for controlling a crisis is the context of the situation as perceived by political and military leaders. It is probable that a change in the scenario of a crisis could produce more radically different behavior than could changes in technical intelligence patterns. Experiments in extremely simple decision making situations point to this. In one study, two person zero sum games were given to different groups of players, and an associated verbal description of each game was also supplied.
When different verbal descriptions, or "stories," were assigned to the identical matrix it turned out that significantly different varieties of play followed. Even for such a simple decision situation, where the technical pattern of payoffs remained constant, changes in the context of the situation evoked major differences in which strategies were played. In any actual full alert situation decision making by leaders would be far more complex than in a two person zero sum game.

Contextual aspects of a crisis may also supply political leaders with reasons for not wanting to fully alert their strategic forces because they intuitively sense the dangers involved. Thus even if a warlike crisis is occurring, this may present such obvious dangers that a mutual fear of loss of control serves to dampen the desirability of continued provocative actions. An attitude of "don't rock the boat" may prevail. For this to be effective tight centralized political control of the forces would be essential. Here it is useful to make a distinction between the political versus the provincial control of nuclear forces. Political control refers to management of the forces by the president or his legitimate successor, where concern will be for the broad national interests of the government as a whole. Provincial control refers to management of the forces by those elements of the military organization where a narrow parochial perspective is called for. The highest ranking military officers in control of the nuclear forces probably share elements of both political and provincial outlook, depending on the circumstances. Compression of decision

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time could shift the weight of control from political to provincial commanders, as the forces of the two sides mutually interact with each other. This underscores the importance of carefully thinking through the relationship of provincial to political control. For nuclear war could come about not by any direct political calculations, but rather from effective control of events being dominated by provincial actions taken to support political objectives, as occurred in 1914.

Broadly speaking, the focus of most peacetime planning studies is on the technical aspects of force interactions alone rather than the effect of contextual changes on how these interactions are perceived. The importance of alternative scenarios is rarely studied in any systematic way and yet the above discussion suggests that such variations could be more important than technical changes alone. The fact that most technical studies are undertaken in peacetime could have important and unnoticed effects on how the forces interact in crisis or war. Sometimes this shows up in war games or other kinds of simulated combat. A good example is the tendency of most strategists to strongly emphasize the disadvantages and potential disasters that could accompany launch on warning policies for ICBMs. Such condemnations would apply very well in peacetime, but they fail to address the basic question of protecting the force when both sides are on alert, and a first strike is able to destroy much of his opponent's force.

Another example of the tendency to ignore contextual changes is in the design of control policies for operating at sea submarines armed with SLBMs. In peacetime, positive control is obviously the most favored, safest procedure. Yet in a crisis when communications
links to the submarines are threatened there may be strong attraction to employing negative control to counter this threat. In one war game played in the 1960s the Soviets were postulated to interfere with these communication lines in an attempt to force American submarines to reveal their positions. The response of the American team was to give very serious consideration to the employment of negative control, or fail-deadly, policies for maintaining deterrence. Fail-deadly control amounts to authorizing force execution unless a countermanding order is received at specified intervals. Fail-safe control, on the other hand, authorizes force execution only upon receipt of authenticated positive orders. In the game referred to, a fail-deadly or negative control policy could be effected by authorizing the submarines to launch their weapons unless they received an order not to do so at some periodic interval. For example, weapons would be launched unless a coded signal were received at four hour intervals. Negative control is clearly the more dangerous policy, but it does counter the threat of an enemy's attacking the command and control system. In the opinion of the above mentioned game's designer resort to negative control was judged "plausible if fail-safe procedures appeared in an extreme crisis to jeopardize national security more than they protect it."

The lesson to be drawn from this is the need for explicit contextual analysis of how strategies appear when subjected to different scenarios. This is rarely done. Instead there has been a tendency

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"A Political-Military Exercise of Naval Communications During a Nuclear Crisis," Detex II Games, Center for International Studies, Massachusetts Institute of Technology, February 1964, P. 11-6.
to emphasize "context free" nuclear exchange calculations, mathematical models, and mental exercises stripped of so much vital detail that any remaining value in them is uncertain at best.

We now turn to a subject that relates closely to warning. The prospect that conflict in Europe would accompany the contemplated use of intercontinental nuclear forces is high. War in Europe is often seen as one of the seminal warnings of the imminence of general war, and for decades precisely this connection has been reinforced by the deep coupling of American war plans for Europe with those of intercontinental attack. For this reason we now examine European nuclear forces and their organization. The compression of decision time and the likelihood of escalatory interactions in Europe are seen to be even greater than for the strategic forces.
The potential for interlocking strategic alerts is dependent on several factors. One of the most important of these is the drastic compression of decision time in which political leaders would be forced to act. This reduction in warning and decision time arises for technological, organizational, and doctrinal reasons. Together these may have induced major constraints on the way political leaders can operate. Increasingly, functions which were formerly undertaken after the start of a conflict are now undertaken in peacetime. Furthermore, compression of warning time drives the system toward greater use of standard operating procedures.

Another factor making reinforcing alerts more likely is the increasing automation of the strategic forces. This, in itself, is necessitated because of the need to protect the forces when they are vulnerable to attack. It does not necessarily mean that automatic firing would occur, but rather that near automatic alerting actions would be taken. These could have a mutually reinforcing aspect to them. The momentum in this direction would be tempered, however, by the overall operating patterns perceived by intelligence organizations, and by the context as seen by political leaders. The most dangerous possibilities manifest themselves when many parts of the strategic forces are simultaneously alerted, because this is likely to produce radically new patterns and could itself change the context of the crisis. At such a point the momentum gathered by a host of provincial actions to enhance survivability could force each side to take ever more drastic actions for self-protection, leading to a cascading ratchet like movement into war.
CHAPTER 3

THE SPECIAL PROBLEMS OF THEATER NUCLEAR WAR

Many of the problems that emerge from consideration of nuclear crises restricted solely to intercontinental range arms have their counterparts in the European theater. Planning for war in Europe must use many of the same methods, and be subject to the same institutional distortions found in any planning process. The nature and utility of warning information must be considered, and due thought given to targeting and command and control. But a theater nuclear war is different in fundamental ways. It is different because in Europe there are thousands of nuclear weapons integrated into conventional ground forces, radically transforming the command and control problem. It is different because of the coalition nature of both NATO and the Warsaw Treaty Organization making for the possibility that the Italians or Greeks could explode thousands of tons of nuclear explosives on Soviet soil. And it is different because the scale of the battlefield in both space and time is shrunk from intercontinental ranges, so that decision times are compressed into minutes, and the very concept of a distinction between strategic and theater conflict loses meaning. The flight time of a Pershing II missile launched from a West German base to the Soviet High Command posts around Moscow is about eight minutes, effectively fusing strategic and theater war into a seamless eight-minute campaign.
Because of the unique character of theater nuclear war a separate treatment is required that identifies its most distinctive features. In this chapter the special problems of European security are examined from the perspective of those particular decisions and organizing principles which have such unique theater significance. Of course, this does not mean that more general consideration of warning, net assessment, targeting, and command and control are absent from a theater conflict. All of these items are very much in evidence. But the qualitative differences that arise from decentralized coalition control of nuclear weapons, or from shrinking the Soviet command's reaction time from twenty to eight minutes produce an unusually interesting and unique set of problems.

The perspective on NATO taken in this chapter may need some further clarification at the outset. Broadly speaking, the perspective employed is of the relationship of strategy with actual force structures. It is not an analysis of peacetime nuclear politics and logrolling, factor inputs of materiel and manpower, or of the technical characteristics of a new missile system. All of these are important in their own right, and all have received an immense amount of written attention. What is lacking, however, is an appreciation of the complicated relationship between NATO's strategy and the force structure which has been evolving for the past three decades. It is this relationship that will be the greatest determinant of what happens in a future European crisis.

An example should illustrate this point. In most standard discussions of NATO strategy, central emphasis is given to theater nuclear weapons as a mechanism for retaliation against invasion. The threat of this action and its credibility are widely studied as to whether or not NATO would actually use nuclear weapons against any such attack. In point of fact, this formulation of the NATO strategy problem strips away so much vital detail that the resultant problem loses any resemblance to the decisions NATO leaders actually would confront. NATO decision makers will not be faced with one choice on nuclear usage, but with many. The NATO force structure determines this fact, because it is made up of so many parts that interact in a nonsimple way.

Decisions will have to be made about evacuation of urban populations, on whether the Turks and Greeks will have nuclear weapons released to their control, on whether to implement the massive demolition and flooding plans that exist, on whether to disperse thousands of nuclear artillery rounds on German soil, and on whether to airlift well over 300,000 American military dependents back to safety in the United States. Taken alone, each of these is a "hard" choice. Taken together in all of their interrelatedness, they change what is most often perceived to be the key NATO strategic question, nuclear usage, to something far more complex, unstructured, and uncertain. The articulation of options, and consequences of decisions, in this framework is not at all clear, but is likely to be considerably different than in the simple framework of using or not using nuclear weapons. By treating theater warfare problems in the more complicated framework, some initial steps toward formulating realistic problems confronting decision makers can be taken.
The plan of this chapter is to first describe the difficulty of even defining a theater nuclear war. The nuclear systems are then described with force structure features highlighted, that is, the formal and informal lines of authority and communication among the different administrative offices and levels of the military command. Another fundamental aspect of force structure, the information and data that flow through the lines of authority and communication, is analyzed following an examination of European attitudes toward nuclear war. These information flows are intimately related to command and control of theater nuclear forces, and also to the theater-strategic interface, war termination, and most importantly, to the enforcement mechanisms that implement the NATO deterrent strategy.

**BACKGROUND ON THEATER NUCLEAR FORCES**

The variety of theater nuclear weapons is so large, and the force structures in which they are embedded are so different from intercontinental nuclear forces, that some basic information about them needs to be summarized so that a clear understanding about these forces is possible. The very first item needing clarification is a proper definition of a theater nuclear war itself. The term has no standardized meaning, and does not even possess an accepted defining criteria. Not only is there a lack of agreement among specialists about what ranges qualify to be termed "theater," but there is no agreement that range is itself a defining criteria.

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More than semantics are involved in this definitional impasse. For theater nuclears do exist and they have come to take a middle position in the hierarchy of conflict between conventional high explosive wars and intercontinental nuclear exchanges. For better or worse, this particular conceptualization shapes the definition of theater nuclear forces among American political leaders. In 1975, for example, Secretary of Defense James R. Schlesinger articulated the widely accepted idea that if NATO's conventional armies were unable to withstand Soviet attack "NATO political leaders may choose to accept the risks of first [nuclear] use."¹ It is clear from many other comments that the Secretary of Defense embraced a three-pronged conception of NATO strategy: conventional non-nuclear, theater nuclear, and strategic nuclear forces. In this strategy conventional forces are relied upon to repel a Soviet conventional attack, and if this fails resort to theater nuclear forces is then warranted. Should the Soviets retaliate with their own theater nuclear forces, then American intercontinental nuclear weapons would be called upon to attack Soviet forces and their supporting units.

This conceptualization does not actually define a theater nuclear war. But it suggests a functional definition of theater nuclear war as a "buffer" between conventional and all-out intercontinental nuclear exchange. It is this functional role, rather than any technical definition, which most accurately describes how leaders in the United States have come to think about these weapons. European conceptualizations appear to be different, as explained later, and this difference confounds the problem of how to think about theater nuclear war.

The idea that theater nuclears function as an intermediate kind of war is conveyed in the following diagrams. The first diagram, at the top of figure 3-1, shows a simpler alternative conception of a theater nuclear war. It describes a conception of political strategy popular in the 1950s, and officially abandoned by the United States in 1962. In this conception, there is an abrupt transition from peace to "all-out" nuclear war, meaning massive intercontinental exchanges involving extensive destruction of urban and industrial areas. Conventional and theater nuclear forces are also exercised, but mainly in conjunction with the intercontinental attack, rather than as a buffer or escalation control device. This is still the favored European conception of theater nuclear forces.

The lower diagram in figure 3-1 illustrates the intermediary role of theater nuclear weapons, in which conventional forces are first used to repel attack, and resort to theater nuclears follows a failure to resist with conventional means. Intercontinental attack would then backstop theater nuclear usage providing three distinguishable layers of military defense.

It must be emphasized that we are not describing the actual course of a conflict, or even the structural capability to carry out this three-layered conceptualization of conflict. Only a highly simplified conceptual model of current American thought on theater nuclear war is offered. Yet these conceptual models, however simplified, have a powerful role in framing how leaders think about this kind of conflict.

\[1\text{A good review of various conceptualizations of theater nuclear forces can be found in Harold A. Feiveson, "The Dilemma of Theater Nuclear Weapons," }\text{World Politics }23(\text{January 1981}): 282-298.\]
FIGURE 3-1

THE INTERMEDIATE ROLE OF THEATER NUCLEAR WAR

PEACE

ALL OUT NUCLEAR WAR

PEACE

CONVENTIONAL WAR

THEATER NUCLEAR WAR

ALL OUT NUCLEAR WAR
Their very simplicity makes them appealing, for they offer one way to cope with the enormous complexity of the European defense question. The problem always exists, however, of whether the right simplifying ideas are contained in the conceptual models, and whether or not the models are shared by allies and adversaries. Most importantly, we must ask if there is a match between the simplifying strategy and the force structure needed to carry it out. A disconnect between strategy and structure will be seen to characterize American thinking on NATO strategy.

For all of its defects a functional definition of theater nuclear war as intermediate between conventional and intercontinental war does specify what theater nuclear weapons are. They are simply those nuclear weapons that are intended for other than intercontinental attack. This definition is fuzzy, vague about its inclusion of allied and opponent nuclears, and, most importantly, indifferent to the really hard questions of theater warfare. It slides over the fact that this "intermediate" nuclear conflict will appear to the Europeans, including Europeans in Russia, to be strategic in the fullest sense of the word. And it focuses on certain natural questions suggested by the diagrams in figure 3-1, such as when nuclears would be used, and when full intercontinental attack would be initiated. These are simple decisions, in the sense that they do not involve a large number of pieces of the defense picture that must be fitted together. As mentioned in the chapter introduction, this formulation suggests a clarity and definition to the nuclear decision that is unlikely to exist.

That the offered definition of theater nuclear war leaves so much to be desired is testament to two things. First, the definition
reflects an ambiguity about the wartime purpose of these forces. The absence of a shared sense of objectives and concept of use will be seen to have important planning implications. Second, decisions about deployments must be made, and have been made, even though definitional problems exist. In the practical world, the mere lack of an unambiguous sense of objectives is no obstacle to the acquisition and deployment of thousands of nuclear weapons. Defense organizations have a way of running themselves even without clear and consistent guidance. They especially have a way of running themselves in wartime when there is little time and much confusion. Choices have to be made, and are made. A failure to establish an unambiguous sense of centralized direction for a defense system only means that direction is supplied from decentralized sources. For understanding a crisis in Europe this requires knowledge about the particular features of the weapons and organizations available to fight a nuclear war.

A good way of understanding theater nuclear war, then, is to turn from important, but still inadequate, conceptualizations of function to weapons and organizations. This is an onerous task. There are so many different kinds of nuclears dispersed among so many different nations that it is difficult to find patterns and categories which meaningfully simplify the problem of how to think about theater nuclear war. We are almost drawn to accept simplifying conceptual models, such as that theater nuclears are for conflict intermediate to conventional and strategic war, because they offer an easy way out. This path is attractive, but it runs the danger that vital details have been removed for the purpose of simplification, producing a wildly invalid conceptual model. As was seen in Chapter 2, it is
very easy for national security organizations to fall into this trap. Thus, any feeling of being overwhelmed with minutiae about theater nuclear weapons should be tempered by recalling the necessity of grounding a conceptual model in the world of actual force structures of which the weapons themselves are one important part.

Theater Nuclear Weapons

A sense of the heterogeneity of NATO's theater nuclear forces arises just from listing the systems that have been fielded. Nuclear mines, artillery, surface-to-surface and surface-to-air missiles, air delivered bombs and rockets, and naval weapons, have been in use for well over two decades.\(^1\) It is widely reported that over 7,000 nuclear warheads are deployed in Europe as of the mid 1970s, and this number excludes nuclear weapons of the American fleets, which are themselves believed to be extensive.\(^2\)

Table 3-1 shows one estimate, made in 1974, of the breakdown in types of nuclear warheads deployed in NATO. Warheads, not delivery vehicles, are tabulated in this table. Although this estimate is several years old, there has not been a great deal of change in the intervening years. This estimate should be understood as an approximate one that illustrates broad characteristics of the NATO warhead stockpile.

The most striking feature of the types of warheads is the way all services, and nearly all branches of services, have been nuclearized.

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\(^1\) A detailed catalog of NATO and Warsaw Pact nuclear weapons may be found in R.T. Pretty, ed., \textit{Jane's Weapon Systems} (London: Jane's Yearbooks, 1976).

\(^2\) See source for table 3-1.
TABLE 3-1

U.S. AND NATO THEATER NUCLEAR WARHEADS IN EUROPE

<table>
<thead>
<tr>
<th></th>
<th>NUMBER</th>
<th>PERCENT OF TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atomic Demolition Munitions (ADMs)</td>
<td>300</td>
<td>4</td>
</tr>
<tr>
<td>Artillery Rounds</td>
<td>3,030</td>
<td>42</td>
</tr>
<tr>
<td>Surface-to-Surface Missiles</td>
<td>499</td>
<td>7</td>
</tr>
<tr>
<td>Bombs and Missiles for Aircraft</td>
<td>2,244</td>
<td>32</td>
</tr>
<tr>
<td>Surface-to-Air Missiles</td>
<td>720</td>
<td>10</td>
</tr>
<tr>
<td>Antisubmarine Weapons for Aircraft</td>
<td>380</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>7,173</td>
<td>100</td>
</tr>
</tbody>
</table>


Only the Army infantry and armor do not possess nuclears, assuming that the nuclear land mines known as atomic demolition munitions (ADMs) are not counted as infantry weapons. The philosophy that modern combat necessarily involves joint land, sea, and air operations has been carried into the nuclear age by arming each of the services with atomic weapons. Nuclear armaments have been overlaid onto the basic trend in warfare of joint operations.

A second observation on table 3-1 is the large number of warheads for World War II era weapons. Although it has become a cliche to speak of the revolution in military affairs caused by nuclear weapons, the fact of the matter is that air-delivered ordnance and artillery

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1U.S. Army infantry units were at one time provided with a nuclear recoiless rifle, the Davy Crockett. It was ordered withdrawn in 1967. New York Times, March 25, 1967, p. 10.
were among the most basic casualty inflicting mechanisms of World War II. Nearly 75 percent of NATO nuclear warheads are for just these delivery systems. Nuclear weapons may be revolutionary in a technological sense, but as far as the organization of military forces is concerned, they have produced less momentous consequences. Military forces in the theater are not organized on a radically different basis than their World War II counterparts, despite their being equipped with nuclear arms.\(^1\) The Soviets have followed a very similar path as will be made clear. All of this strongly suggests that force structure issues are relatively enduring features of military organizations, and that consideration of nuclear strategy without structure is likely to produce very incomplete ideas about the shape of atomic war. Theater forces have not been built around nuclear arms, but rather nuclear arms have been built into traditional military organizations.

Theater nuclear weapons are also embedded in the differentiated force structures of the nations in the NATO coalition. The nature of this dispersion of weapons is a highly complicated subject, and has not been fully analyzed to date. Only an overview can be given here. Broadly speaking, all nuclear weapons committed to NATO are American owned, with the exception of the independent nuclear force of Britain. France has its own independent nuclear force, but as France left the military structure of the Alliance in 1965 these weapons are generally not counted in NATO totals. American-owned warheads

\(^1\)The U.S. Army did experiment with a radically different organization beginning in 1956, known as the Pentomic Division. It was reorganized back to a more traditional form in 1961, and this period represents the only real attempt by any army in the world to restructure itself for the nuclear battlefield. Russell F. Weigley, History of the United States Army (New York: Macmillan, 1967), pp. 537-538.
are provided for allied delivery vehicles under a series of bilateral treaties and agreements between the United States and the various host nations. The weapons are governed not by a multilateral NATO instrument, but instead by individual arrangements made between various countries and the United States.\(^1\) The exact nature of these agreements is kept highly secret, as indeed are the deployments of American-owned nuclear warheads on foreign soil. Nonetheless, a compilation of information on the delivery vehicles for nuclear warheads, which are owned by host nations, can give a picture of the national distribution of NATO's nuclear assets. Figure 3-2 shows an estimate of this distribution.

The mechanism for maintaining physical ownership of the warheads by the United States in the host nations is through the so-called "dual key" control mechanism. This is not really a key at all (although it once was), but rather the simple procedure of maintaining the warheads under American custodial control. One "key" is the warhead, and the other the foreign-owned delivery vehicle. When the weapon is matched to the delivery vehicle and the system is launched, or fired, both keys can be thought of as turned together.\(^2\) About half of the 7,000 weapons in Europe are under dual key control.\(^3\) American warheads deployed for use by American troops on European soil do not have this control feature, and neither does the British nuclear force.


\(^3\)Ibid.
FIGURE 3-2
NUCLEAR-CAPABLE WEAPONS SYSTEMS IN THE POSSESSION OF NATO EUROPEAN NATIONS

<table>
<thead>
<tr>
<th></th>
<th>Britain</th>
<th>Netherlands</th>
<th>Belgium</th>
<th>W. Germany</th>
<th>Turkey</th>
<th>Greece</th>
<th>Italy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mines (ADMs)</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Artillery</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Lance</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Honest John</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Nike Hercules</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Pershing I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Fighter-Bombers</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>


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The distribution of weapons shown in figure 3-2 only begins to suggest the complications over dual key nuclears. For example, ownership of a delivery vehicle does not necessarily imply that nuclear warheads are stored on the host nation's territory. It might turn out that Dutch artillery units would receive their warheads from American custodial units on German soil. Alternatively, it is possible that American artillery rounds could be stored in Belgium or Britain, to be flown into Germany for matching with Dutch artillery weapons during a crisis. Each NATO country represented would have its own unique needs and problems, although in some cases geographic factors would greatly influence deployments. Thus, Turkey and Greece are so remote from the central front in Europe that it is unlikely warheads would be dispatched to them from this area.

The most important observation on figure 3-2 is that the diversity of theater nuclear weapons discussed previously is overlaid onto seven national command organizations, representing six different languages. Although joint planning for employment can ameliorate some coordination problems, political realities must also influence the extent to which this can occur. National military organizations are under national control, for there are no mixed military units in NATO. Turkish forces serve under Turkish command, not under any direct NATO commander.

An analogy with the integration of nuclear weapons into traditional combat branches described earlier can be made. Just as standard military organizations have not been restructured for theater nuclear arms,

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1The examples are hypothetical. One report suggests that American nuclear artillery rounds are actually stored in the Netherlands, "Dutch Feeling is Strongly Antinuclear," Baltimore Sun, March 20, 1981, p. 13.
so have Europe's national military forces remained organizationally unchanged by the addition of nuclear arms. Nuclear arms have been overlaid onto the conventional forces of the independent national military establishments of countries participating in NATO. Thus, there are no special NATO fighter squadrons or artillery battalions simultaneously composed of Italians, Greeks, and Belgians. Common sense suggests why this kind of organization for NATO would be extremely difficult to effect. Language barriers, questions of national sovereignty, control, and responsibility, cost sharing and many other factors immediately come to mind. NATO's dual key nuclear weapons are integrated into national military commands by reason of organizational necessity.

With this preliminary background on theater nuclear forces it is now possible to analyze the weapons themselves, and the force structures in which they are embedded. Our approach will begin with the shortest range systems, and will be as concise as possible consistent with providing a sense of the highly differentiated force structures which control them.¹ Both Soviet and American nuclear arms will be examined.

a. Nuclear Mines

Nuclear land mines, or atomic demolition munitions (ADMs), as they are called, have been fielded by the United States at least since 1960.² They are stored primarily in West Germany, Turkey, Greece, and Italy and are intended to destroy bridges, tunnels, and to create delaying obstacles in mountain passes.³

¹As stated earlier force structure here refers to the lines of authority and communication in a military organization.
³See sources for figure 3-2.
Because of mountainous terrain and natural invasion corridors, they would have special suitability for blocking, or delaying invasion in the Anatolian region of eastern Turkey, along the Greco-Bulgarian border, and in northeastern Italy.

ADMs are used by specially trained teams of five or six men. They do not appear to be integrated into standard infantry or artillery units, but instead report along special lines directly to Army and Corps commanders.¹

There are conflicting reports about Soviet possession of ADMs, but nothing is known for certain about their concept of use if they do indeed exist. It should be pointed out that ADMs may play an important role for stay behind forces, or for sabotage by military or non-military agents. Although nothing is documented on this subject, rumors to this effect have circulated since the 1950s.

b. Artillery

For many years there has been speculation about the existence of Soviet nuclear artillery, but it is now widely believed that this capability has been developed.² Very little additional information is known about their nuclear activities in this area however. The United States, in contrast, has had nuclear artillery deployed in


Europe since 1953.\(^1\) That both nations now seem to have developed these systems raises the possibility that a future war in Europe would see extensive nuclear firepower deployed low enough in the military organization to support the ground-gaining arms of the armor and mechanized infantry. This would be true battlefield nuclear war.

The maximum range of American nuclear artillery is about 11 miles, and that of the Soviets between 11 and 18 miles, depending on the weapon.\(^2\) The yield of the American warheads is estimated at 2 kilotons.\(^3\) Little is known about Soviet yields.

American artillery units are organized for support of both division and corps operations. Nuclear rounds have been developed for the weapons basic to these units, the 155mm and 8-inch howitzers. This means that nuclear artillery strikes would involve two separate command channels. Coordination would take place through fire control centers organic to the standard Army division. The purpose of this fire would be intended, like all artillery fire, to support the ground-gaining arms, isolate the battlefield, and provide depth to the combat. These tasks would be assigned in different degrees to division, corps, or special artillery groups. Although the assignment would be different for Soviet artillery the basic task structure would be along the same


lines. At least two command structures, division and army, and probably more, would have to be coordinated.

It is worth noting that the main emphasis in American artillery since World War II has been the development of quick reacting, decentralized fire control. Thus, all artillery in U.S. armored and mechanized divisions are entirely self-propelled, allowing it to move as rapidly as the combat arms it supports. In the 1970s, the Soviets had begun to emphasize this same trend. Overlaying nuclear capability onto this trend suggests that a strong decentralizing force will be at work for a battlefield nuclear war, because the mobile ground forces which artillery supports are trained to be self-contained, independent, and reliant on their own capabilities.

c. Tactical Missiles

Tactical nuclear surface-to-surface missiles are intended to support division level operations. Missiles with maximum ranges of less than about 115 miles would fall into this class. The United States has fielded, and given to some of its Allies, the Lance and Honest John. They have ranges of 68 and 23 miles respectively. The yield of the Honest John is estimated to be 20 kilotons. The Lance possesses a variable yield selection of between 1 and 100 kilotons.

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2Ibid.
3Jane's 1976, pp. 41 and 440.
5Ibid.
The Soviets have fielded a family of tactical nuclear missiles that have become known as Frogs (actually, for Free Rocket Over Ground). The latest Frog variant has a range of 37 miles and a yield in the kiloton range.\(^1\) A program is underway for bringing in the longer range SS-21 to replace the Frog.

The Soviets have fully integrated the Frog into their divisional force structure as shown in figure 3-3. A Frog battalion is a standard part of their division. This is another illustration of how theater nuclear arms have been overlaid onto existing conventional force structures. In this particular case, the Frog series of rockets has been in use since the 1950s as just another form of divisional artillery. It is capable of carrying either conventional, chemical, or nuclear warheads. However, its poor accuracy indicates that it would have little effect with a conventional warhead. Of course, there would be no way for a defender to know the warhead type prior to detonation.

During their 1979-80 invasion of Afghanistan, Soviet motorized rifle divisions carried Frogs with them, provoking the kind of speculation that could be expected on a much larger scale if Soviet forces went on alert in Europe.\(^2\) Since the Frog is part of the motorized rifle division its movement into Afghanistan could be interpreted as simply the implementation of standard operating procedures associated with any division movement. Alternatively, it could be read as a threat to use chemical attacks in Afghanistan, where other movement

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\(^1\) *Jane's 1976*, p. 442.

FIGURE 3-3
A SOVIET MOTORIZED RIFLE DIVISION

of chemical decontaminating equipment was also detected. Although the threat of nuclear use in Afghanistan is certainly remote, any operations in Europe would immediately raise this question. This dilemma of interpretation could be manipulated by the Soviets to induce anxiety or intimidation.

d. **Battlefield Support Missiles**

Battlefield support missiles are designed to assist the corp level of command, or in the case of the Soviets the equivalent army level of command. This function would include missiles of less than about 575 miles range. The only NATO missile in this category is the Pershing I, with a range of about 450 miles.²

For the Soviets, their Scud series of missiles fills this role. They are integrated into the army level of command, as shown in figure 3-4. Here again, these surface-to-surface missiles take their place along with pontoon bridge and artillery regiments in a traditional conventional force structure not terribly different from the ones that overpowered Germany in World War II. Scuds have a range of about 185 miles.³

Soviet armies are grouped into frontal units which are comparable to U.S. army groups, meaning they could consist of up to 15 or 20 divisions. Not surprisingly, this echelon of Soviet command has its own theater nuclear weapon, independent of those in the Scuds assigned to its armies. This is the SS-12 Scaleboard with a maximum range

1Ibid.

2Leitenberg, "Background Materials," p. 112.

FIGURE 3-4
A SOVIET ARMY

of about 560 miles, meaning that if located in Poland it could reach nearly all targets in West Germany and the Benelux nations. It reportedly carries a megaton yield warhead.\(^1\) The Scaleboard is now being replaced by the new SS-22, with a range of 620 miles, and the army level Scuds are being replaced with a longer range SS-23.\(^2\)

The Scud/SS-23 and Scaleboard/SS-22 are especially interesting Soviet theater nuclear weapons because they are the longest range, and most destructive, weapons integrated into the Red Army organization. All of the longer range surface-to-surface missiles are controlled by the Soviet Strategic Rocket Forces (SRF), which is roughly counterpart to the American Strategic Air Command. The Soviet Army and the Strategic Rocket Forces are radically different organizations. Most importantly, the Soviet Army is basically a conventional army, whose organization has evolved from centuries of trial and error military evolution. Like all armies of the world, it is trained to do many different things. The SRF, on the other hand, has only one basic mission defined on the peculiarly simple fire-don't fire principle.

Some evidence suggests that the development of the Scaleboard missile was an attempt to lengthen the range of Red Army nuclear firepower so that resort would not have to be made to weapons of the SRF.\(^3\) It is not clear whether this represents the outcome of some bureaucratic

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\(^1\) Jane's 1976, p. 46.

\(^2\) Kennedy, "Soviet Forces," p. 79.

dispute between the two organizations, or whether it signifies a Soviet attempt to decouple theater and strategic forces.

e. Naval Theater Nuclear Systems

Both the United States and the Soviet Union deploy a wide diversity of theater nuclear weapons at sea. The heterogeneity within this class of weapons alone is enough to make wartime interactions extremely difficult to predict, or even to conceptualize during peacetime. Partly this is because American nuclear forces are centered on the carrier task force, while the Soviets emphasize cruise and surface-to-surface missiles. Although extensive attacks against the American carriers with the Soviet nuclears is probably to be expected, the nuclear weapons of both sides could easily be targeted against critical land targets, such as ports, bases, troop concentrations, and logistic centers. The command of these forces would be through naval lines of authority and communication.

The United States maintains about five carriers in the European area, but in crisis or war these would be reinforced considerably. Since the early 1950s, the U.S. Navy has had a major nuclear delivery role for nuclear torpedoes and antisubmarine rockets and for the aircraft aboard these carriers.¹ This subject has received little public attention, and few details are available on the numbers of aircraft involved, missions, or the yields of nuclear munitions carried. As with many U.S. Army systems, carrier aircraft could serve in a dual capable role, delivering either nuclear or conventional warheads.

¹Leitenberg, "Background Materials," p. 120.
Soviet naval theater nuclear weapons consist of surface-to-surface and cruise missiles. Their Shaddock cruise missile has a range of about 115 miles, and is deployed on both submarines and guided missile cruisers.\(^1\) Other missiles include the Serb and Sawfly, with ranges of 700 and 1,800 miles respectively.\(^2\)

The standard Soviet Navy force structure that would control these nuclear weapons would be complimented by a highly centralized satellite-based ocean surveillance system.\(^3\) Presumably, these satellites would transmit target location data on the American fleets back to ground stations in the Soviet Union, where it would be used to direct sea-based nuclear attacks, and ground-based air attacks of the naval aviation forces, against the American carriers. American carrier-based forces would be under considerable pressure to neutralize Soviet fleet elements along with the land-based aircraft that support them. The trend that seems to be emerging is similar to many World War II naval battles, but with the incorporation of nuclear arms and more sophisticated sensor systems into the forces. Of course, these technical developments change the nature of war at sea considerably from World War II, but the force structures themselves are an extension of those developed to wage classical naval campaigns.

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\(^1\)Jane's 1976, p. 50. There is also a land-based Army version of the Shaddock.

\(^2\)Ibid., p. 186.

f. Air Defense Forces

The air defense units of the Soviet Union are divided between those intended for defense of inland targets, and those deployed forward with army and air force units to assist in combined arms operations. The former are controlled by a specially dedicated command, the National Air Defense Forces. It controls radars, fighter-interceptors, an extensive warning-communication network, and nearly 10,000 surface-to-air missiles (SAMs).\(^1\) Command of these assets, which are geographically dispersed from the German border all the way to China, is exercised through a highly centralized headquarters in Moscow.\(^2\) Although SAMs in this system do not appear to have nuclear warheads, they would be intricately involved in a theater nuclear war because they would be used to destroy incoming NATO aircraft, which in all probability would be armed with nuclear bombs and rockets. The command center that directs air defense against theater attack is the same one that directs defense against intercontinental range attacks. Its destruction in a theater war would simultaneously strip away protection from strategic attack by American bombers and cruise missiles. Here is a critical example of the way force structure can couple theater and strategic war. By having force structures with overlapping theater-strategic, and conventional-nuclear, missions the likelihood that a clean distinction in the different kinds of war could be maintained is reduced.


NATO's air defense forces consist of a network of early warning radars and weapons deployed from northern Norway, through central Europe, and eastward into Turkey. One of the primary armaments of this system is the Nike Hercules, which can be armed with either a conventional or nuclear warhead. Its nuclear yield is about 1 kiloton which it can deliver over a slant range of 84 miles.\footnote{Leitenberg, "Background Materials," p. 111.} Although ostensibly under the control of dedicated air defense organizations, the Nike missile is a U.S. Army system and it is widely reported that its main role would be in a surface-to-surface firing mode for destruction of enemy troop or armor concentrations.\footnote{Robert Shreffler, "The New Nuclear Force," in Stockholm International Peace Research Institute, Tactical Nuclear Weapons: European Perspectives (London: Taylor & Francis, 1978), pp. 309-312.} This points up the fact that standard organization charts cannot be completely relied upon to understand theater nuclear force structure, or indeed any kind of military force structure. As in virtually all organizations, there are informal lines of authority and communications that will greatly influence the actual behavior of the organization. These are precisely the activities that are least susceptible to centralized political control because informal communications and procedures tend to be worked out in the lower levels of the organization. They will not likely even enter into the definition of what constitutes an important strategic factor for senior decision makers.

\textbf{g. Air Forces}

NATO air forces are equipped for dual nuclear or conventional capability, and one of the most critical military decisions in any
crisis will be the determination of arming capability for these aircraft. This is an extremely complicated decision because of the many internal and external uncertainties that must be balanced, and also because it is a very hard decision even in the presence of complete certainty and cost-free information. Weather conditions, fuel availability, enemy deployments, and enemy warhead load (nuclear or conventional), are all among the critical uncertainties. Beyond this, there is the question of what missions NATO aircraft will be assigned. These include the gaining of air superiority over the battlefield, close support of ground forces, deep strike of enemy air bases, or battlefield interdiction. The decision facing NATO air force commanders will be to allocate targeting assignments to these aircraft, and this decision will entail the selection of type of warhead to be carried. It is a decision that can only be made rationally if it is delegated to trained air force personnel who have familiarity with all of the subtleties and complexities present.

This sketch of the decision problem facing NATO air forces is provided because it sets the context of how aircraft are likely to be used in a conflict, and how they are likely to be deployed in peacetime to prepare for this assignment. It is misleading in the extreme to view NATO air forces in numerical terms compared to Warsaw Pact air forces. The mere fact that NATO is reported to have 1,400 frontline aircraft compared to 3,000 for the Warsaw Pact tells us nothing about the dynamics of combat, or the controllability of war. It not only removes the organizations which allocate and control these

forces, but it sweeps away the basic decision problem for which these air forces were built in the first place.

Principal NATO nuclear capable aircraft include the F-4, FB-111, and F-104. The FB-111 has a combat radius of about 1,150 miles, and thus could strike targets throughout Eastern Europe and western Russia (including Moscow and Leningrad) with nuclear weapons.\(^1\) In addition, the British maintain their Vulcan and Buccaneer nuclear bombers, which can be staged in either Britain, Cyprus, or Turkey, and have ranges of 2,300 and 1,150 miles respectively. This would permit striking virtually all important targets in western Russia.\(^2\) For the most part, the yields of the nuclear weapons carried by these aircraft are large, in the hundreds of kilotons or even in the megaton range.\(^3\)

The organization of NATO's nuclear capable air forces is determined by the standard air force structures which control them. This organization is necessary in order to rationally decide on aircraft allocation and armament type so that decisions can be made to optimize the effectiveness of the limited number of aircraft.

There is one important exception to this organization. The NATO quick reaction alert (QRA) force of aircraft and Pershing missiles is under control of the Supreme Allied Commander Europe (SACEUR), the highest ranking military officer in NATO. QRA aircraft are kept on a high alert, and are thought to be armed with their nuclear weapons

\(^1\)Ibid., p. 80.


\(^3\)Leitenberg, "Background Materials," p. 119.
The purpose of the QRA is to deter a Soviet surprise attack, by maintaining a fully ready nuclear strike force instantly available. As the QRA aircraft are on continual alert, and hence exposed to attack, they would have to be dispatched to their targets before any incoming Soviet missiles or aircraft attacked them. Under conditions of political tension the QRA are kept on even greater levels of alert, with some aircraft maintained on runway alert ready to launch on a moment's notice. Although the QRA are a "theater" nuclear force, they could strike most of the urban areas west of the Ural Mountains with megaton-class weapons.

Soviet air forces are also fully capable of delivering nuclear weapons, and many of the same basic decision problems would confront their commanders, except that they would likely be on the offensive. Their MIG 23 and 27 fighters have ranges of about 600 miles, which would permit them to cover most targets on the continent. Furthermore, many analysts believe the Soviets are in the process of developing a deep strike orientation to their air force, which would bring extensive combat to the Benelux nations and Britain very early on after the onset of war (effectively 10-15 minutes). Again, one of the most fundamental problems for NATO will be the intense uncertainty as to whether an incoming strike is conventional or nuclear. A decision on this determination is necessary for the survivability of the QRAs and many other military assets as well.

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1 Ibid., p. 43. A permissive action link (PAL) device is required to be unlocked before the weapons could be employed.

2 See Peterson, Soviet Airpower, pp. 5-11.
Soviet air forces stationed in forward areas are under the operational control of frontal and army commanders. This subordination of the air force to the ground force commander is quite different than in NATO where army commanders typically "nominate" targets to air force controllers. The ultimate targeting decision in NATO is left to the independent air force, whereas for Soviet air forces it is the ground commander who makes this decision.

Soviet Naval Aviation also contributes considerable nuclear air striking power against both land and sea targets. Their Backfire bombers, deployed in peacetime near Murmansk, on the Baltic, and in the Crimea, have a range of some 5,700-6,900 miles. This means Backfires could reach (unrefueled) past the Azores in the Atlantic, cover all of the Persian Gulf, while easily operating against virtually all targets in Europe. The surging of Backfires from the Baltic area and the Crimea would certainly be an ominous indication that an attack was imminent on NATO, or that high level psychological warfare was being waged. It would of necessity trigger many NATO countermeasures in order to protect the American carrier fleets in the Atlantic and Mediterranean. In broader terms, the real significance of this kind of interaction is that long distance nuclear forces are being used which are under the direct control of military organizations, in this case the Soviet Naval Aviation, which have significant roles and missions whose importance is provincially seen to be at least as great as their political bargaining or signaling value.

1. Medium and Intermediate Range Ballistic Missiles

Medium and Intermediate Range Ballistic Missiles (M/IRBMs) are classified as having ranges between 690 and 1,726, and 1,726 and 3,450 miles respectively. At the present time NATO does not field any M/IRBMs although some preliminary agreements have been reached to deploy a cruise missile and long-range Pershing II missile beginning in 1983. In the past, however, NATO fielded many different kinds of these systems. In the early 1960s, for example, there were seven IRBM bases, four in Britain, two in Italy, and one in Turkey armed with megaton class Thor and Jupiter missiles. In addition, Mace and Matador cruise missiles with ranges in excess of 600 miles were deployed in West Germany. All of these systems were withdrawn in the 1960s, largely because of their great vulnerability and provocative character.

The Soviets have continued to rely on their M/IRBMs, from the 1950s to the present. The SS-4 MRBM has a range of about 1,120 miles and is based in the Soviet Union to cover targets in Western Europe and China.¹ It is estimated to have a one-megaton warhead, as is the longer range SS-5 IRBM, meaning it would only be useful against fairly large area targets, such as cities.² Both the SS-4 and SS-5 were developed with the idea of holding Western Europe "hostage" to Soviet nuclear bombardment, as a counter deterrent to the superiority of the American Strategic Air Command in the 1950s and 1960s.

The SS-20 IRBM with a range of 3,100 miles is the replacement for the SS-4s and SS-5s.³ It is mobile and carries three MIRV warheads,

¹ Jane's 1976, p. 15.
² Ibid.
making the threat against Western Europe even larger in target coverage terms than was the case in the 1960s. About 700 SS-4s and SS-5s were aimed at Europe in the 1960s, and the prospect for the 1980s is that a much larger number of IRBM warheads, perhaps on the order of 2,000, would give less than ten minutes warning of attack. Soviet M/IRBMs are under the control of the SRF.

m. Other Long Range Theater Nuclear Forces

In addition to the weapons already described there are some long-range systems that are often referred to as being theater in character. The terminological distinctions between theater and strategic in this case have only a tenuous connection with reality and may amount to little more than convenient semantic classifications. They are described here both for completeness sake, and because some force structural distinctions about them are worth noting.

The United States has assigned around 50 Poseidon missiles aboard American SSBNs to SACEUR. Precisely what this means is not clear, but presumably it would imply that SACEUR has operational control over them once they are released by the president. Authority would pass to SACEUR, instead of to the U.S. Navy which ordinarily controls them. The range of the Poseidon missile is sufficient to reach most targets in the Soviet Union. They are probably intended to fire against M/IRBMs in the western Soviet Union, which are physically adjacent to ICBM fields. In such a "theater" nuclear war Moscow would somehow have to determine that incoming Poseidon missiles were launched from

officially authorized SACEUR controlled stocks, rather than from the Navy's central strategic systems.

In addition to the American SLBMs allocated to SACEUR, the United Kingdom possesses four SSBNs carrying 192 nuclear warheads.\(^1\) Authority to launch this force rests with the British Prime Minister, and operational control goes to the Chief of Staff of the British Navy.\(^2\) However, in the event that a nuclear attack has destroyed the responsible authorities capable of giving such an order, it has been reported that British submarine commanders retain authority to launch their missiles.\(^3\)

Both France and China also possess nuclear weapons that could become involved in a theater war in Europe. France maintains Mirage aircraft and 5 SSBNs armed with 80 missiles that are capable of striking targets in the Soviet Union. China has now also developed missiles capable of reaching Moscow.\(^4\) Shorter range missiles and bombs are fielded by both of these nations as well.

Finally, a school of thought has arisen suggesting the use of American strategic weapons in a theater role. For example, an attack of Soviet divisions in Eastern Europe, or the western Soviet Union, with land-based Minuteman missiles launched from the United States would represent a theater use of these weapons. Part of the reasoning

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\(^1\)Ibid., p. 30.


\(^3\)Ibid.

behind such an idea is to intentionally blur the distinction between theater and strategic conflict, while at the same time offering a proposal that features the retention of American authority over the weapons in question. Such ideas have been termed limited nuclear options, and their incorporation into the SIOP in the mid 1970s was an attempt to strengthen the coupling between theater and strategic forces. Of course, the line of authority for such an attack would pass through the Strategic Air Command.

* * *

The great diversity of theater nuclear forces creates many special problems analyzed later in this chapter. For now, three observations can be made about the importance of force structure for theater war. First, there is no centralized organization which controls theater nuclear forces. This is true of strategic forces to a degree, but theater forces are dispersed over many different commands and subcommands. Nuclear artillery, battlefield support missiles, and naval weapons are all controlled by very different organizations. It is not so much the large variety of theater nuclear weapons that is important as it is the large number of different organizations which have responsibility for determining how they are used. Army divisions, aircraft carrier groups, fighter squadrons, commando teams, and army groups all have their own nuclear weapons. The coordination necessary for a centrally directed, and politically controlled, conflict is made difficult by the large number of different organizations which must be interrelated. Moreover, each of these organizations is designed and trained over a period of years to successfully complete their
own peculiar missions. The training, indoctrination, and "corporate culture" unique to each of these organizations will have a powerful effect on their actions in time of war.

Second, the geographic confinement in Europe means that choices will have to be made not in the 30-minute flight time of an intercontinental missile, but in the roughly one-third of that time in which it takes a Scaleboard, Lance, or Shaddock to reach its target. It seems intuitively plausible that reduction in decision time by a factor of three increases political management difficulties by far more than this factor. The number of interrelated choices involving the many organizations which control nuclear weapons further complicates the difficulty of wartime management. Below some threshold of decision time available, it is likely that there would be a bias for decentralized decision making and the use of preplanned procedures. Both of these are answers to the problem of coordinating many parts of the defense system.

The compression of decision time also makes it exceedingly difficult to separate a theater from a strategic campaign. Western European capitals and Moscow could be destroyed with only a few minutes worth of technical warning. This need not even be from long range attack, but could arise from tactical spillover of artillery firefights or a wayward fighter aircraft. In these instances there would effectively be zero warning.

Lastly, the above two consequences of theater force structure must be overlaid on several national commands that do not even share a common language, yet alone a set of common political goals. Coordination problems will arise from having nuclear armed fighter bombers

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of nine nations, from firing nuclear artillery on allied territory, and from simply trying to manage the inventory of nuclear weapons once they are dispersed to national control.

EUROPEAN ATTITUDES AND NUCLEAR WAR

The bewildering complexity of theater nuclear forces stands in contrast to the simple deterrence strategies that govern their use. This is more than coincidental for they are deeply related. NATO leaders have possessed a keen sense of the consequences for Europe if a war should ever erupt there. And although they have not attempted to fully comprehend the operational direction of theater nuclear war, they have generally acquiesced, or even encouraged, the deployment of a diverse array of nuclear warheads in Europe. At the same time they have developed relatively simple theories about deterrence, conventional war, and coupling. In all of this simplification, however, there has been little or no demand for simplifying the forces into an exclusively centralized second strike deterrent or to a coherent warfighting force. The reason for this is intimately related to European attitudes toward nuclear war.

When NATO was formed in 1948 it was assumed as a matter of course that resort to atomic weaponry would be essential if the West were to offset the Soviet superiority in conventional armies. At this time, most of Western Europe was both willing and eager to accept the American lead in military matters. The destruction and loss of vitality in the war had drained too much spirit for a dynamic European leadership to reassert itself in strategic affairs.
In the United States also the overriding concern in 1948 was the development of a strategy to forestall Soviet conquest in Europe. Yet even with this objective there were important undercurrents which are largely forgotten today and which bear upon the current state of atomic defense. For instance, one of the earliest articles concerning nuclear defense in Europe appeared in The Saturday Evening Post of October 15, 1949. General Omar N. Bradley, then Chairman of the Joint Chiefs of Staff, commenting on the opinion that Europe could be defended solely with atomic weapons stated:

This train of thought represents so much compound folly that it is hard to answer it patiently...It foolishly assumes that the atom bomb is omnipotent. It fails to explain how, if some millions of invader troops moved into Western Europe and were living off the country, we could use the bomb against them without killing ten friends for every enemy foe.

General Bradley's recognition that nuclear defense could entail the destruction of Western Europe was the first surfacing of an intractable dilemma that lasts to this day. It surprisingly took a few years for Europeans themselves to realize the full implications of atomic defense. Opinion polls taken in Germany in the early 1950s indicated that the public believed Soviet aggression was deterred by fear of America's industrial mobilization capability, and not by its atomic arsenal. This belief was to change as the new Eisenhower administration emphasized its strategy of massive retaliation. Europeans were to become much more cognizant of nuclear weapons and their destructive capabilities.

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1Hans Speier, German Rearmament and Atomic War (Evanston, Ill.: Row, Peterson and Co., 1957), pp. 112-113, 132-140.
Another factor in addition to the massive retaliation strategy which brought European attention to nuclear issues was the rapidly advancing development of battlefield nuclear weapons by the U.S. Army. Although nuclear bombs had accompanied SAC bomber deployments to Great Britain in the summer of 1948, there was a great deal of secrecy over such weapon movements. Tactical nuclear weaponry for ground warfare, on the other hand, was intentionally publicized as a visible commitment to European defense. Just as the French government had decided to release films in the 1930s of the Maginot Line for deterrent effect, so too was there a great deal of television, newspaper, and magazine publicity surrounding the development of U.S. Army nuclear weapons.

The first Army weapon landed on the European continent was the 280 mm "Long Tom" atomic cannon, which reached Bremenhaven, in October 1953. This was a cumbersome weapon whose symbolic value far transcended its military capability. It was tested in 1952 in Nevada in fully operational mode, i.e., with an atomic charge and with troops observing the shot.\(^1\) A great deal of publicity surrounded it, and President Eisenhower ordered it sent to Korea as an obvious nuclear threat to force the North Koreans to terminate the war still going on there.\(^2\) Its deployment to Europe in 1953 was followed in 1954 by shipments of Honest John and Nike missiles. All were intended to bolster the confidence of the Europeans, and to serve notice on the Russians of the consequences of attack. In the heady days of near complete American superiority over the Soviets, and in an era when Europe had not recovered

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enough self-confidence to question American actions, the momentum behind nuclearization of the battlefield seemed to make sense.

The realization in Europe of the consequences of actually using these weapons was not long in coming after this publicity. In December 1954, the NATO Council announced that it was basing all of its future planning on the assumption that atomic weapons would be used in any war. Such a public declaration naturally stimulated a considerable amount of newspaper and magazine coverage in Germany. It was almost inevitable that the popular press would emphasize the sensational and catastrophic effects of nuclear weapon use, and that is exactly what happened.¹

Sensational press coverage about nuclear destruction in Germany continued in early 1955 and set the stage for elite and popular reaction to a large military exercise held in June, known as "Carte Blanche." This exercise was designed to test the NATO Council's decision of the previous year on early use of nuclear weapons. It was held with over 3,000 NATO aircraft and, because of space constraints, was run in a North-South rather than an East-West direction. It took place in France and the Low Countries, as well as in the region from Hamburg to Munich in West Germany. A simulated 335 atomic weapons were "dropped" on more than 100 targets during the exercise. These resulted in an estimated 1.7 million Germans "killed" and 3.5 million "wounded." Fallout casualties were not computed. Thus, in the span of nine days of simulated war, three times as many civilian casualties were inflicted

on Germany as in the entire six years of World War II. Press and public reaction was total shock. People inside and outside the German government believed that NATO was intent upon blowing up the Federal Republic.

It has been exceedingly difficult to achieve any serious West German political interest in detailed nuclear warfighting schemes since 1955, largely because of the images of nuclear war formed by exercises like "Carte Blanche." Furthermore, this exercise seemed to produce a policy decision in Bonn that the discussion of nuclear issues was not a fit topic for open public debate. Future discussions after "Carte Blanche" would be confined to generalities as a matter of course.1 When discussions of military policy cannot be kept to such generalities a political storm often breaks out. In October 1962, for example, the Hamburg magazine Der Spiegel published the results of the "Fallex 62" exercise run by the German defense ministry. An estimated 10 to 15 million people were "killed" in these war games even though targeting plans were selected for "purely military" purposes. Civil destruction at these levels is virtually impossible to explain in terms of rational foreign policy objectives. And it is this potential of massive destruction, so astutely observed by General Bradley in 1949, that has been one of the strongest forces shaping NATO military and strategic policy to this day.

Over the years there has been an official American policy of lessening the collateral consequences of war in Europe. American

nuclear weapons have been made more accurate, constraints on targeting have been developed, and warhead yields have been reduced in selected cases. Yet these changes have been marginal. The basic problem of controlling unwanted civil sector damage is made nearly impossible because of the roughly 14,000 tactical nuclear weapons, 10,000 artillery pieces, 4,000 combat aircraft, and over 70 divisions that are crammed into one of the most urbanized areas on earth. In the event of war a substantial percentage of these forces would be targeted on West Germany, a nation the size of Oregon, with a population density over twice as great as the Northeastern United States. The geographic confinement in Central Europe indicates that if any significant fraction of the conventional, nuclear, and chemical firepower deployed there were actually used, the resulting destruction to the civilian sector would be extraordinarily high. Indeed, it would likely be much higher than indicated in such highly controlled simulations of war as "Carte Blanche" or "Fallex 62," because these have tended to emphasize the minimization of civil sector destruction.\footnote{1} The methods used to determine collateral civilian damages in these simulations of nuclear war are fully centralized computing schemes, but as pointed out in the preceding section there is little realistic prospect of such centralized control in actual conflict. Collateral damage will be caused by military forces that are not fully coordinated by a central programming unit, and where assumptions of instantaneous error-free transmission of information are untenable.

\footnote{1 Some of this material is drawn from Paul Bracken, "On Theater Warfare," Hudson Institute, HI-3036-P, July 1979.}
European reaction to the perceived suicidal nature of a war has had direct effect on the Alliance's approach to security. Norway and Denmark have refused permission for deployment of any nuclear weapons on their soil. And West Germany has demanded a strategy of forward defense, whereby any military operations would be conducted immediately on the border rather than by waging a defense in depth. A defense in depth with tactical nuclear weapons would only extend the area of devastation.

But the most important consequence of the suicidal nature of a war in Europe had been the deterrence strategy around which all of the Alliance's plans and forces have been built. It is here where the true strategic, rather than theater, character of a war from the European perspective shows itself. Although Americans may have a strong interest in limited nuclear warfighting, there is little reason to believe that this kind of war would not destroy the very prize being defended. For this reason most Europeans have been more interested in deterring, rather than in fighting, a war.

Theater nuclear weapons become a mechanism for ensuring that a conflict goes nuclear, rather than for destroying enemy forces, in this view. However, weapon requirements are quite different than those needed for a second-strike deterrent. If insurance of triggering a nuclear war is desired, a fully controllable, invulnerable force

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may be actually undesirable, for its employment would depend on a rational decision to execute the threat. In the face of the suicidal consequences of a war in Europe, it is easy to imagine why a political leader might not want to take rational steps leading to devastation. What is needed instead of a rational procedure for going to war is a posture that is so complex that it could be triggered in any one of a number of different ways. Although the European deterrence strategy is uncomplicated, the force structure needed to enforce it is necessarily extremely complex. The almost overwhelming complexity displayed earlier in the theater nuclear weapons and the command organizations in which they are embedded describes a force structure that is congruent with the NATO strategy of deterrence.

The "fit" between the predominant European strategy of deterrence and the theater nuclear force structure actually built is not often recognized. Complaints of a lack of serious thought behind the development of the tactical nuclear forces, or that the NATO strategy is now outmoded because of the growth of Soviet strategic forces are still frequently heard. Both of these views fail to appreciate that theater nuclear war in the European perspective is not intended to be an intermediate sub-strategic war as reflected in American views. European nuclears are not designed for gaining battlefield advantage through attrition of enemy forces, but are intended to implement deterrence by necessitating that any war be nuclear. What some observers see as a disorderly, thoughtless, development of highly differentiated nuclear forces is in fact precisely the kind of force structure required of a deterrence strategy whose implementation would be suicidal. Although many strategic debates among nuclear specialists have broken
out over the years about the need for conventional forces, tactical nuclear warfighting postures, and other alternative foundations for NATO security, what has been ignored is that strategy in this particular case is determined by structure. And from the perspective of most NATO political leaders there is a good fit between strategy and structure.

ENFORCING NATO'S DETERRENT STRATEGY

NATO forces are structured to circumvent the classic problem of a deterrent strategy: that it is often counterproductive to actually implement a threat once deterrence has failed. Because of the absolutely fundamental importance for deterrence of being able to go into a potentially suicidal nuclear war, it is interesting to explore some of the ways that this threat could be carried out. Broadly speaking, three key factors make the NATO threat believable: decentralized and delegated control of nuclear weapons once they are put on alert, the ambiguity of command authority over their employment, and the complexity of wartime and crisis management. Although these three factors help enforce the nuclear deterrent threat, they are certainly not without major risks and problems. Yet it is the very manipulation of risk that gives credibility to the NATO posture, even if it ultimately contributes to a loss of political control.

The decentralization of NATO's control over nuclear weapons is a function of the degree of alert that has been ordered. In peacetime, most of the 7,000 nuclear warheads are kept in protected storage igloos,
known as "special ammunition sites."¹ It is estimated that "over 100" special ammunition sites exist in NATO.² Although these sites are protected by guards, they are not hardened targets in any military sense of the term. They could be destroyed by conventional, nuclear, or chemical attacks and there is consequently a strong incentive to disperse the warheads from them in time of crisis.

Not all of NATO's nuclear weapons are kept in storage sites. As discussed earlier, QRA aircraft and some Pershing missiles are kept on alert at all times. The number of QRAs on alert is classified, but whatever the number it is certain to increase in periods of tension.³ Furthermore, an undisclosed number of surface-to-air missiles, artillery rounds, and other nuclear weapons can be kept on alert status, and this is apparently done.

The alerting procedure for NATO is complicated, but conceptually it can be described as a large-scale dispersal from the storage sites in time of crisis. This amounts to turning 7,000 weapons over to the military forces that control the delivery vehicles for them. Figure 3-5 illustrates the concept. Here we have made the plausible assumption that Warsaw Pact forces follow a similar dispersal procedure.

Technically, NATO could disperse only some of its nuclear weapons from their storage sites. This might be done, for example, in order to field a more controllable force. Weapons exceedingly difficult to control, or those that are especially provocative such as nuclear artillery, might be kept in their storage sites. However, there is

¹Leitenberg, "Background Materials," pp. 16, 34.
²Ibid.
³Ibid., p. 36.
FIGURE 3-5
A THEATER NUCLEAR FORCE ALERT

NUCLEAR WEAPON
NUCLEAR WEAPON STORAGE SITE

PEACETIME
FULLY ALERTED

NATO
WARSAW PACT
good reason to believe that this would not be a very practical alternative. NATO storage site locations must be assumed well known to the Warsaw Pact. Leaving nuclear weapons in their storage igloos might encourage preemptive attack.

A decision not to go on full alert in the face of Soviet preparatory moves might then turn a crisis into a historic opportunity to disarm NATO. A preemptive attack on NATO when it was in a status of only partial dispersal of its nuclear weapons would make it practically impossible to organize a counterattack. For this reason there are likely to be strong pressures for a general release to NATO military forces assigned the task of using these weapons. Without such a release, the military would be unable to carry out its mandated assignments.

Once NATO has gone on alert, as indicated in figure 3-5, its nuclear forces are geographically dispersed. At this point, if fighting broke out it must be assumed that operational control of these weapons would decentralize to the highly differentiated commands that maintain physical control over them. For example, it is unlikely that centralized control over self-propelled artillery could be achieved, because these systems depend on movement and concealment for their survival. Since NATO's nuclear weapons are integrated into conventional forces each of these would contribute its own peculiar operating constraints.

In an actual battle, even one initially restricted to conventional weapons, the fact that nuclear weapons were deployed with these units would substantially increase the likelihood that some of these thousands of weapons would be fired.

As a practical matter, the prospect that centralized political command could intervene in a large conventional war to maintain detailed
control over nuclear weapons must be seriously discounted. Centralized political leaders would have little capability to respond in the very short decision times that characterize modern combined arms combat. Even if there were sufficient decision-making time, political leaders would lack detailed information on local conditions and knowledge of how to operate combined arms forces. Decisions of this sort cannot even be made at a high level inside the military command structure, but must be delegated downward in the hierarchy to division and brigade level. The development of nuclear weapons has done nothing to change this organizational feature of conventional forces, and we should be skeptical of purported technological solutions to problems that have deep organizational roots.

Specifically, the electronic locks that are on these weapons, known as permissive action links (PALs), do nothing to alleviate the organizational and environmental pressures to decentralize and delegate control of most theater nuclear forces. While it may be technologically possible to lock weapons against unauthorized use, this is hardly the issue faced in a European crisis. The same effect as an unbreakable lock would come from removal of the weapons from the military altogether. For if weapons were sent into battle while political authorities retained control of the codes needed to unlock them, there could be no guarantee, or even likelihood, that all of the proper codes could be matched with their respective weapons in the confusion of a conventional and perhaps chemical-nuclear war. The political command, or any centralized depository for the codes, could be attacked,

1PALs are described in ibid., pp. 41-42.
thereby paralyzing the military's ability to strike back. A substantial bias thus exists to release any needed codes as the weapons are dispersed from their storage sites.¹

There is little evidence about Soviet alerting practices for their theater nuclear weapons. Yet the organizational and environmental variables facing them would be the same as for NATO. One U.S. Army intelligence publication does state of Soviet theater forces: "Once authority to use nuclear weapons has been obtained, they will be controlled by front and army commands."² Once command is delegated to the front and army level it is not hard to imagine a further decentralization to even lower levels of the hierarchy.

The second major factor that enforces the NATO threat to employ nuclear weapons is the ambiguity that surrounds the authority to use them. The dual key bilateral nuclears stand out here. The intense uncertainty and indistinctness that surrounds command mechanisms of the non-American members of NATO make it virtually impossible to discount the chances of retaliation.

An ambiguity in command means that opaque, multiple, or possibly even competing, lines of authority are perceived by the military organization responsible for physical possession of the nuclear weapons. A kind of organizational redundancy exists, in which several different interpretations of the command authority are simultaneously held. Even an individual group may hold no single view about precisely who

¹This is not to say that PALs are useless. PALs are a very important part of the command system for they successfully prevent the unauthorized use of a nuclear weapon in peacetime by an aberrant member of the military. Furthermore, they prevent any terrorist who might somehow seize a NATO weapon from actually using it.

²U.S. Army, Understanding Soviet Developments, p. 25.
can order the use of nuclear weapons. The general phenomenon of ambiguity of authority is common in many military organizations. It especially shows up in highly stressful situations where secrecy or political sensitivity have prevented the practiced development of standard operating procedures. Palace revolts, coups, impeachments, and civil wars all generate an uneasiness in command organizations because there is no predictability as to how authority will be perceived by the diverse military units involved in the stressful events.

Although there are no instances of nuclear weapons being fired because of an ambiguity of command, there are examples of what could at least be called uneasiness about an indistinctness in command relationships. During the revolt of the French Generals against President Charles de Gaulle in 1960, Paris ordered one of its previously scheduled nuclear tests to be conducted several days ahead of plan so that the warhead would not fall into the hands of the Generals.¹ More recently, in 1974 when Turkey invaded Cyprus, there was considerable concern in the United States about the American nuclear weapons stored in Turkey and Greece. Both governments were deeply split about their national policies. The situation reached the point where American Marines with the 6th Fleet in the Mediterranean were alerted and prepared for a helicopter assault of the nuclear weapon storage sites in Turkey in order to maintain United States possession.² During this crisis the nuclear warheads kept on alert aboard the QRA aircraft

of the Greek and Turkish air forces were removed from the planes out of American fears that stability of command could not be assumed.\(^1\) Since the vital security of the Greek and Turkish states was not at risk over the Cyprus dispute, as would be the case in a NATO crisis, the possibility of even greater stress on the respective commands to take preemptive action could be expected.

One of the greatest sources of ambiguity about the authority over nuclear weapons are the binational understandings and agreements established between the various nations which have American nuclear weapons and the United States. These are kept highly secret, but indications point to complications, vagueness, and reliance on verbal understandings. The American defense pact signed with Turkey in 1980, for example, runs to 100 pages, of which only 6 pages were submitted to the Turkish National Assembly.\(^2\) In the United States this particular agreement is treated as an executive agreement in order to circumvent Congressional scrutiny and approval.

A particularly interesting example of ambiguity over the use of foreign bases for nuclear attack arose in Greece. Here the issue was not Greek use of American nuclear arms, but rather American use of Greek bases to launch nuclear strikes. There is evidence that the Greek government in the form of its Foreign Ministry refused to yield this privilege. Despite this, the Greek Defense ministry proceeded


to sign an agreement with the United States on this point. In a crisis the potential for major reassessments about the exact nature of the relationship would be called for. And although all nuclear weapons stationed in Greece are under the technical control of American units, there is little that the United States could do to protect these weapons against a determined attack. Attacks might be motivated by internal splits in the host government, fears that nuclear weapons might be launched from their territory, fears that they might not be launched, or some other combination of bizarre events.

We should be skeptical that any bilateral understanding signed in peacetime could anticipate the stresses of a nuclear crisis. No matter how secret are the details of authority over weapon use, consultation procedures, and collateral damage guidelines, many more questions are raised than are settled. One of the only ways to establish any sort of agreement is to rely on vague and ambiguous terms in the bilateral agreements. This ambiguity over command of nuclear weapons contributes to the credibility of the NATO deterrent by making it all but impossible to predict the outcome of a crisis that involves the alerting of military forces.

A final key factor in enforcing NATO's nuclear threat is the complexity of crisis and wartime management. The definition of complexity here is the number of weapons, organizations, and decisions that would have to be coordinated for war. Beyond some point such complexity could swamp NATO's decision-making capacity, thereby yielding wartime

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command to the decentralizing forces described earlier. This observation relates directly to the nuclear usage question often advanced as the cornerstone of NATO security. Although nuclear weapons are indisputably the physical foundation of NATO deterrence, the decision surrounding their use will not be a single well-defined one, but rather will involve many interrelated choices. With increased complexity there is more likelihood that the nuclear threat will be carried out.

A sense of the complexity can be best understood with an example. One particular choice will be whether or not to release nuclear land mines that block mountain passes, valleys, and other invasion corridors. This is not a decision that can be made in isolation from other choices. Nuclear mines are intended for use on NATO territory, but they require giving atomic arms to those nations most in need of their services. This likely means West Germany, Italy, Greece, and Turkey. A decision to disperse nuclear mines immediately raises the issue of a general nuclear weapon dispersal, because of their great vulnerability to preemptive attack if they remain in centralized storage. And if a decision is made on general dispersal it requires that troops in rear areas be moved forward, refugee movements be controlled, and orders be issued from political to military commanders about exactly what they are to do in the event of war. This last requirement in turn creates the need for coordination among NATO political leaders of their coalition objectives.

The seemingly simple decision to authorize use of nuclear land mines is seen to create a chain reaction of other decisions that are difficult to decouple from one another. If these decisions could be decoupled, NATO would be in a better position to bargain with the
Warsaw Pact by using a series of individual decisions as coercive actions that escalated the crisis in a controlled way. After issuing mines to the troops, artillery weapons, tactical missiles, and other weapons could be systematically released in an effort to convince the Pact that NATO was willing to stand fast against any threat. Carried into wartime this line of thought follows the American conception of theater nuclear weapons as a layer of intermediate forces between conventional and strategic conflict. But for better or worse, the decisions needed to implement this American version of nuclear strategy are not decoupled from one another, and a choice to take incremental steps toward war is most likely to produce a cascading sequence of interactions among the many parts of the NATO force structure. Complexity of decision making contributes to deterrence because it raises the risk that the military aspects of a crisis would get out of political control. Following nuclear weapon dispersal, the forces of decentralization and delegation, and the ambiguity of command authority make nuclear usage so unpredictable as to create a plausible threat that no attacker can discount. Far from relying on a deliberate and simple choice to use conventional, theater nuclear, and then strategic nuclear weapons for defending NATO as suggested in figure 3-1, force structure complexity achieves the goal of deterrence in a fundamentally different way. So many redundant triggers to nuclear war exist that, as a practical matter, deterrence ought to prevail regardless of political breakdowns, stresses, and errors that work against it.

Yet a deterrent strategy based on the likelihood that wartime complexities will swamp decision-making capacity and control, leading
to escalation and enforcement of the nuclear threat, creates problems as well as credibility. Thomas C. Schelling and Herman Kahn long ago noticed that NATO strategy is greatly dependent on "the threat that leaves something to chance" and a fear of "rocking the boat" for its credibility. As an observation about political bargaining in a crisis their arguments seem persuasive. But there is still a gnawing feeling that in a really intense crisis West Germany is going to be enormously reluctant to ratify a decision that turns over nuclear weapons to the Turkish Air Force as a way of enforcing a threat that leaves something to chance. A strategy based on this risks coming apart at the seams just as it is called upon to do its job.

To cite one obvious decision turning point, once the German government agrees to the dispersal of nuclear artillery rounds from storage igloos, it has abdicated a considerable amount of responsibility over its own destiny. Artillery weapons are intrinsically short range, and could lead to a nuclear war fought only in the forward area of NATO, meaning a conflict restricted to West Germany. Even if the conflict were terminated on terms acceptable to NATO, the extensive use of nuclear artillery could devastate much of West Germany. The specter of Soviet-American nuclear artillery duels through the urban corridors of Germany, or of atomic firefight through Hamburg and the Ruhr Valley would put enormous pressure on Bonn to proceed cautiously on the decision to disperse these weapons. Any decision

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would likely be made in the midst of domestic chaos because of Allied military preparations and movements, and because of massive refugee traffic about which almost no forethought has been given.¹ Outright disruption of the attacks to forestall retaliation cannot be ruled out. As the Anglo-French Alliance of 1940 became unglued this is precisely what happened.²

The decentralization and delegation of nuclear control, ambiguity of command authority, and complexity of wartime decision making all contribute to making the NATO nuclear threat one that just might be carried out. It further makes Soviet behavior an important determinant of whether nuclearars are ever used. Yet the peculiar enforcement mechanisms built up in the NATO force structure over three decades contain major defects that stand out. First, in a prolonged European crisis it is entirely conceivable that NATO cohesion may vanish, or worse. It may disappear under pressure of a decision to disperse nuclear warheads to the multinational forces of the Alliance.

One of the first crucial decisions leading to such ugly considerations will be the need to authorize use of nuclear land mines in the mountain passes connecting Anatolian Turkey with the Soviet Union. In the 1960s the Turks demanded a special arrangement whereby they would receive predelegated control of these devices so that they could

¹Ibid.

²In June 1940 French military units physically blocked a British bomber force from using an airfield in Marseilles as it was about to launch an attack on Italy. British officers on the scene requested permission from Prime Minister Winston Churchill to clear the runway with machinegun fire. This permission was refused and the air strike never took place. Noel Barber, The Week France Fell (New York: Stein and Day, 1976), pp. 93-95.
be used quickly.\footnote{\textit{"Turkey Requests Leeway in Using Atom Land Mines,"} \textit{New York Times}, April 6, 1967, p. 1.} Other Alliance members will then be confronted with the decision of turning over nuclear weapons to Turkey, and this is almost surely to be seen as a first step in a general nuclear release of all nuclear munitions. Especially if a crisis were slowly building up in Europe there would be great reluctance to exacerbate the tensions by such actions. Would Germany, Denmark, and the Netherlands really be willing to initiate nuclear war in order to defend Turkey? Any nuclear release might be seen as producing a catalytic effect in that it might induce the Warsaw Pact to disperse its own nuclear weapons.

Northern European NATO members are especially likely to have major concerns over the Turkish, Italian, and Greek fighter bombers armed with nuclear weapons. If the Soviets were on full alert with dispersed warheads, a single Turkish pilot could trigger World War III, as could a Soviet naval officer in charge of a Shaddock cruise missile. A chain reaction of nuclear salvos could spill over political boundaries in a matter of minutes because of the ten-minute flight time it takes for Scaleboards to reach into Germany and the Low Countries from Eastern Europe, or because a Soviet missile frigate within range of Naples might have concluded that it was about to receive an incoming nuclear attack. Possibilities like these will achieve an overwhelming realism in time of crisis, and might create strong incentives for accommodation.

A second major defect of the strategy described in this chapter is that it becomes all but impossible to discuss these matters in public. What government can possibly announce that its security is...
dependent on turning nuclear weapons over to a battalion commander who just might pull the trigger even if he were not authorized to do so? Even professional and academic studies have difficulty comprehending the extraordinary nature of this strategy. As a result, most attention is devoted to the understandable issues suggested by the simplifying theories of limited war, wartime bargaining, and escalation control. Unfortunately, the force structure actually built is totally disconnected from these particular strategies, being far better matched to a strategy of deterrence by massive duplication of the nuclear trigger.

Finally, and this should be obvious by now, if a war occurs it is likely to be intrinsically uncontrollable because the NATO command system has not been designed to provide such control. Centralized warfighting control would confront NATO members with a rational path for going to war, and the potential devastation of a European conflict strongly suggests that political leaders would never voluntarily take this path.

The uncontrollability of a European conflict relates to the subject of how a war there could be stopped once it had started. Although a few analytical papers have been written on strategic war termination, to this author's knowledge, none have ever been written on war termination in Europe. The vagueness of this subject is stunning, and some fundamental questions about it are badly in need of being asked. Regardless of how easy or hard it is to disperse NATO's arsenal of theater nuclear weapons from their storage sites, once war breaks out it is going to be extraordinarily difficult to get them back under lock and key again.
A few remarks can elaborate the problem. The survivability of many of these weapons depends on mobility and concealment. Consequently, they are likely to be carried by mobile armies, ships at sea, and dispersed aircraft. The sheer inventory control problems of such a force are immense, especially in an environment where communications are disrupted and coherent political authority may not exist. Possession of nuclears may become one of the few symbols of authority, and military commanders may be very reluctant indeed to return them to centralized, and vulnerable, storage.

A nuclear cease-fire would be precarious in the extreme. Any national force, or even sub-national group, that felt the terms of the cease-fire were not totally equitable could restart the war in spectacular manner. Opportunities to take care of long standing grievances could prove so attractive as to be irresistible. The Cyprus dispute and the Armenian problem both stand out. It would be all but impossible to determine culpability in these chaotic conditions, as nuclear weapon bursts are virtually indistinguishable as to their source. Some theory of getting thousands of unused tactical nuclear weapons back under central control is one of the most important questions facing NATO if there is to be even a rudimentary political direction given to a conflict.
SUMMARY

This chapter began by pointing to the difficulty of defining a theater nuclear war which is related to uncertainties that are much more than definitional in character. It is hard to define theater nuclear war not for semantic reasons but because conflicting images prevent any agreed upon definitions, and mental characterizations strip away so much vital detail that we must seriously question their realism. Only by turning to the force structures that would fight such a war can the most important questions be raised about what a theater war might really be like.

The singular feature of NATO's nuclear forces are the highly differentiated command organizations that would control them. The multiplicity of lines of authority produce an organizational redundancy that is exploited by European members of NATO to guarantee that nuclear weapons might be used in their defense. Far from providing for controllable actions that could incrementally escalate military power as desired in American thinking, the actual NATO force structure seems designed to trigger nuclear usage in an effort to escape from centralized political control. For the deterrent strategy favored by NATO Europeans this makes a congruent match between strategy and structure.

Detailed enforcement mechanisms for the NATO deterrent strategy are further based on existing tendencies to make nuclear battlefield decisions in a decentralized manner. While a decentralized deterrent can be very convincing, it runs the risk of producing catastrophic consequences because of ambiguous interpretations of authority and complexity of management. For these reasons, it is difficult to have
candid public discussions of the reality of theater nuclear war. Moreover, if war were to come about the decentralized operational commands might take on an unstoppable momentum that swamps political direction, meaning that war termination might only be possible when nuclear arsenals had been emptied.

One requirement for political control then is some means for getting back authority over nuclear weapons after they are dispersed to the military. This condition is one of several that are needed not only for maintaining political direction of nuclear forces but, more importantly, for averting rapid catalytic escalation of minor military interactions into all-out nuclear exchanges. As things now stand, there is very little chance that a conventional war in Europe could stay that way very long.

In the following chapter another requirement for averting rapid escalation and decentralization of command authority is examined. So called net assessments of relative force balances are routinely performed with the goal of providing leaders with a comparative sense of adversary strategies, available forces, and opposed doctrines. For the most part, these net assessments reflect a peacetime bias in their neglect of wartime disorders. This defect permits an artificial integration of the decentralizing tendencies, thereby providing an illusion of control.
CHAPTER 4

ASSESSMENT IN WARTIME

Choice in war depends on knowledge and information that are different than in peacetime, and both peacetime planning and wartime command systems had best take account of these differences. Knowledge of circumstances in battle often does not exist in centralized or integrated form, but exists instead as dispersed pieces of incomplete, and often contradictory, information possessed by many different groups. Dispersed knowledge like this is probably a definitive feature of all battles, as testified by military historians from ancient times to the present. Yet nuclear battles, with their capability to wreak havoc with communication systems, may enforce an even more radical departure from peacetime information conditions. Preconflict information on numbers and locations of enemy missiles, submarines, and bombers could vanish in the confusion and disruption of the moment. It may even be impossible to obtain timely integrated knowledge on the location and status of one's own forces. Since military forces are designed and built in peacetime, when information flows that hold them together are unimpaired, the problems of fragmented knowledge are not likely to receive the attention they need. As an example, consider a first strike attack which destroys a victim's ability to collect and analyze the damage inflicted upon him. In the most
frequently advanced scenarios put forth by nuclear specialists, the nation attacked will make a comparative assessment of the warheads, megatonnage, or payload remaining to it. A second strike will be executed if the relative balance of these quantities is improved, that is, if a second strike can "even up" the firepower levels. But ignorance of sustained damage precludes such a computationally complex decision. Without knowing how many of its own missiles are destroyed, inputs to a second-strike calculation are lacking, and the basis for making decisions has been knocked away.

One of the questions this chapter explores is the informational needs of a nuclear strategy. Before command and control systems can be designed to make sense this is a question needing an answer. For many scenarios of nuclear war the answer appears to be that informational requirements are enormously burdensome, that is, if postulated strategies are carried out. Data on surviving missiles, urban damage, and location of enemy missiles will have to be pulled in on a global scale, and processed in short order. But as the quantity and flow of needed information increases, so does the difficulty of the task, and the attractiveness of targeting the assessment systems needed to collect and process it increases as well.

The above comments center on intellectual debates carried on by the few people who concern themselves with nuclear strategy. Leaving aside academic aspects of the problem, compelling though they may be, questions about wartime assessment can lead to greater understanding of what shapes actual war plans. The United States and the Soviet Union have developed plans for nuclear conflict and the questions raised in this chapter point to a new determinant of why nuclear
postures look the way they do: informational economies. An excessively burdensome information processing requirement may block a proposed change to nuclear forces every bit as much as a bureaucratic obstacle, a budget constraint, or an ideology.

ASSessment in Peacetime

By an assessment we mean an appraisal of military forces and their capabilities, current strategies, and goals, in a competitive interaction. This appraisal process is sometimes called "net assessment," emphasizing its competitive features. Net assessments place great stock in the way differences in cognition and perception influence the selection of actions. "Can the Soviet Union's nuclear forces destroy a high percentage of American missiles on the ground, and if they can, what American retaliatory targeting assignments can maximize deterrence against such a first strike?" is a typical question in a net assessment. The answer depends on numbers of Soviet and American missiles, their technical characteristics, such as accuracy and reliability, Soviet goals as to the desirability of a nuclear war, Soviet strategy as to whether an attack would try to minimize civilian damage (for example, through careful aiming and airbursting to decrease radioactive fallout), and so on for the many factors influencing this particular attack.

Our interest is in less expansive appraisals of the strategic nuclear universe. Yet even a restricted treatment of wartime assessment could include many factors, and here we will emphasize knowledge about numbers of missiles, their locations, and damage sustained by
military and civilian targets. This last factor is broad enough to include whether leaders knew that an attack had destroyed the enemy's communications system connecting its political leaders with their military forces.

Although our direct concerns are not as all inclusive as the questions asked in a net assessment, it is necessary to describe net assessments because they establish an important comparative context for wartime assessments. For example, net assessments of nuclear war are often based on use of quantitative models of weapon exchanges that tabulate damage and surviving missiles for each side. In war, knowledge about destroyed missiles might not be available, or might be available only as information known to many local commanders. What kind of assessment process would replace that relied upon in peacetime? This is a critical question, and its elucidation requires an understanding of the alternative information and assessment regimes that rule in peace and war.

Broadly speaking, the objective of a net assessment is to develop a profile of the likely strategy changes each competitor might make, each side's probable response to a range of strategic moves, and each competitor's reaction to technological and environmental shifts. Sophisticated net assessments ask such questions as "How will deployment of long range missiles to Europe affect overall targeting assignments, and how will the Soviets react, both in their own targeting and in development of new weapons?," "Do the Soviets possess enough raw military power in Asia to endanger the security of America's allies, and are their goals such that they might use this military power?,"
and "How does nuclear deterrence depend on the existence of invulnerable retaliatory forces?"

A convenient way to think about net assessment is shown in figure 4-1. Goals, strategies, and capabilities are distinguished as inputs to an interaction profile which determines how these diverse factors affect overall outcomes. Each of the components in figure 4-1 has its own peculiar methodologies, kinds of knowledge, and tests of validity. The key feature of a net assessment is its integration of the different components. This is represented by the interaction profiles' component in figure 4-1. Net assessment cuts across traditional boundaries of academic and military disciplines because it integrates knowledge from all relevant sources. The need to formalize this process arises from the enormous quantity of information available about capabilities, goals, and even strategies. Without some order imposed on this information it reduces to data, that is, raw knowledge deprived of a contextual setting.

National goals in a net assessment are determined by political analysis and foreign policy studies. The methods used in these fields range from what can only be termed "revealed truth," to sophisticated content analyses, examination of political signals, and plain common sense. The various methodologies used for determining Soviet and American goals, to include a refinement of the meaning of a goal for

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1The goals of the Soviet Union in the Cuban missile crisis of 1962 have been exhaustively analyzed with divergent conclusions that lead one to believe that the analyzers could hardly have been examining the same crisis. For an illustration compare Arnold L. Horelick and Myron Rush, Strategic Power and Soviet Foreign Policy (Chicago: University of Chicago, 1965) with Graham T. Allison, Essence of Decision (Cambridge: Harvard, 1971).
FIGURE 4-1
COMPONENTS OF A NET ASSESSMENT

CURRENT STRATEGIES
- E.g., surprise attack, preemption, restriction of collateral damage

INTERACTION PROFILES
- E.g., model of Soviet attack of U.S. missiles

GOALS
- E.g., eliminate U.S. nuclear military power

CAPABILITIES
- E.g., weapon inventories, characteristics, command & control effectiveness
a nation, are highly different from one another. This divergence
in methods, and hence results, compounds the difficulties of this
component of net assessment considerably.

Descriptions of current strategies in a net assessment are closely
related to goals. The difference being that strategies are understood
as instruments for attaining goals. An example can clarify the dis­
tinction. A goal of the Soviet Union could be to eliminate American
nuclear military power, and one way to accomplish this would be through
a preemptive attack on military targets. The attack might have several
variants. Only land-based missiles might be targeted on the assumption
that the resulting imbalance of forces following attack would neces­
sarily compel the United States to capitulate. An attack against
American military units in Europe might try to minimize the spillover
damage to civilian areas, to allow economic exploitation of conquered
areas following the conflict. Both of these attacks are strategies
in the sense of furthering the attainment of destroying American mili­
tary power.

One of the most widely used methods for determining a nation's
strategy is the reading of doctrinal texts, field manuals, military
journals and staff reports. Despite security restrictions, there
is usually more of this kind of material available than there is time
to read it all. Once this doctrinal material is read and analyzed,
compendiums of digested Soviet writings can be synthesized for insights
about their strategies.¹

¹An example is Joseph D. Douglass, Jr., The Soviet Theater Nuclear
Capability analysis for net assessment is greatly reliant on the intelligence arms of the American military and civilian defense establishments. The CIA and the special intelligence groups of the Army, Navy, and Air Force all contribute estimates of deployed Soviet forces along with their technical characteristics. An enormous effort has gone into developing intelligence mechanisms for ascertaining this information. The methods used include satellite reconnaissance, monitoring of radio and radar emissions, human agents inside the Soviet Union, interviews of defectors and travelers, and a careful monitoring of newspapers and public radio broadcasts. It is painstaking to collect all of this information, and it is even harder to piece it together so that evolutionary trends in capabilities can be predicted.\footnote{See Lawrence Freedman, \textit{U.S. Intelligence and the Soviet Strategic Threat} (Boulder, Col.: Westview, 1977).} With the time needed to develop weapon systems now approaching a decade or more, it becomes necessary to ascertain Soviet capabilities both today and for years in the future.

Finally, net assessment has an integrating component that takes goals, strategies and capabilities and fits them together to determine what may happen in a given interaction. The methods used for this include mathematical models, computer simulations, war games, analogies from military history, informal bargaining models suggested by game theory, and simple quantitatively based conjectures.\footnote{For a description of models, simulations, and games see Garry D. Brewer and Martin Shubik, \textit{The War Game} (Cambridge: Harvard University, 1979); for the military history approach see T.N. Dupuy, \textit{Numbers, Predictions, and War} (Indianapolis: Bobbs-Merrill, 1979); for game theory inspired reasoning, Herman Kahn, \textit{On Escalation} (Baltimore: Penguin, 1965); and for simple quantitative conjectures see John M. Collins, \textit{Imbalance of Power} (San Rafael, Calif.: Presidio, 1978). The last one}
may be the most widely used, and can involve nothing more than concluding that victory will go to the side with more missiles, bombers, and submarines. More sophisticated methods try to develop interaction profiles based on the other inputs to net assessment, and sometimes these are quite complicated. For example, mathematical models of Soviet missile attacks on the United States can consume many hours of computer time, and war games with human players can take months or even years to prepare.

We can summarize some of the broad aspects of net assessment as it is currently practiced in the United States. Most importantly, it is an integrated process which takes the results from several specialties and analyzes their different effects in their totality. In this sense, net assessment is more of a synthetic than an analytic undertaking. Whereas analysis breaks a problem into its constituent parts, net assessment synthesizes the separated pieces back into a singular appraisal of a military interaction. It produces integrated knowledge.

With its integrated character net assessment is greatly dependent on communicated information, and is therefore reliant on lines of communication and all of the paraphernalia used in modern information processing. This dependence is easy to overlook in peacetime when there is no danger of disconnected communications. Unless accurate timely estimates of Soviet missile strength are determined by satellite reconnaissance, however, it is impossible to exercise the standard calculating procedures used to determine strategic advantage.

Lastly, net assessment suggests particular ways to incorporate uncertainty into its appraisals. It is biased in favor of treating
uncertainty in the same way it is handled by its constituent methodologies. For mathematical models this is often probability theory, for computer simulations it is statistics, and for war games it is conjecture about the behavior of people and nations. But there is little place in net assessment for uncertainty about the ability of the lines of communications to deliver input information. Uncertainty about the existence of this required information would reduce, and perhaps remove, the integrative underpinnings of net assessment.

WAR TIM E A S S E S S M E N T

Wartime assessment differs from the net assessment just described in ways that shape war plans, transform decision-making mechanisms, and create new structures for dealing with uncertainty about the existence of communicated information. Yet the difficulty of articulating the detailed nature of these differences is considerable, so much so that there is a tendency to apply peacetime thinking to analysis of wartime problems. This can result in a misunderstanding of war requirements, a tendency for peacetime descriptions of wartime behavior to be artificial, and most ominously an imposition of a peacetime design philosophy upon systems that must do their job in war. The last tendency has contributed to a deemphasis of command and control issues, generally in favor of comparing American and Soviet nuclear power by their inventories of weapons. There is little reason to believe that the information processing systems of either the United States or the Soviet Union could survive very long in a nuclear conflict, and the lack of attention to this vulnerability, compared to
weapon vulnerabilities, illustrates the danger of imposing peacetime design criteria on wartime systems.

Knowledge of circumstances of time and place in war often does not exist in concentrated or integrated form, but exists as fragmented, incomplete bits of information possessed by many groups. A usual peacetime assumption is that dispersed information can be coordinated by something like the net assessment process. Peacetime net assessments certainly have difficulty doing this adequately even without the stresses occurring in war. Distortions, misestimates, and misperceptions can creep into any assessment. But the peculiar difficulties introduced by dispersal of knowledge are distinct from these obstacles, and are seldom appreciated.

The reason for a lack of concentrated information about wartime conditions is not difficult to understand. Communication lines can be cut or degraded, sensor systems can be knocked out, and information processing mechanisms can fail. In one form or another these have been ever present features of battle throughout the history of warfare. Equally important, the confusion and chaos of battle are often such that it is hopeless to even try to tie together all of the pieces of a force in a centralized way. Instead, military forces can be organized explicitly to operate in an environment of imperfect information. This often means giving more autonomy to local units, and to relying upon centralized plans that do not attempt to control every detail of the battle.

At Pearl Harbor, for example, the Japanese decided not to regroup their bombers on their aircraft carriers for an immediate reattack of the United States' fleet because they feared attack from American
Most American planes had been destroyed on the ground, a fact known to the Japanese only after they carefully studied the intelligence photographs taken during the initial strike. During the battle, it was not possible to gather information systematically on damaged and surviving American aircraft. Communication among the attacking Japanese planes was available, but not in a way that permitted each plane to transmit its local assessment of destroyed American aircraft to a central commander. Each Japanese pilot could choose to reattack particular ground targets based on his own evaluation of their vulnerability, and on operating constraints such as fuel status, visibility, and remaining ammunition. Information on each of these factors was available only to the pilot, and consequently the assessment of the immediate situation was left to him alone.

The Pearl Harbor example points to two common phenomena in wartime assessment. In the absence of an integrated assessment a devolution occurs in which assessment in battle is carried out by local commanders. At Pearl Harbor the information acquired in battle by attacking pilots was of a fundamentally different sort than the knowledge of strategic planners who designed the overall attack. No matter how accurate the planners' intelligence information was on American ships in port, number and location of aircraft and air defense batteries, they could not impose direct control over the attack because they lacked information on the immediate battle situation of the moment. Each Japanese pilot had unique information on time and place that could not be easily communicated for centralized decision making. Chapter 7 explains

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1United States Strategic Bombing Survey (Pacific), Interrogations of Japanese Officials, Naval Analysis Division, Vol. 1, No. 113, p. 124.
why devolution of authority over using nuclear weapons is one of the most important phenomena likely to be associated with this kind of conflict. Decentralization of command authority was also found to be fundamental to both deterrence and warfighting for theater nuclear forces, as explained in Chapter 3. The devolution of assessment described here is a major contributing factor to this decentralization of authority. Authority decentralizes because information availabilities dictate that it must.

The second assessment phenomenon illustrated at Pearl Harbor was the use of what can be termed "preplan attacks." Preplan attacks describe who does what against whom, and are formulated in their entirety prior to wartime operations. In battle, forces attempt to carry out their preplanned assignments, but without direct control or communication from a central planning unit. Japanese aircraft squadrons were provided with a direction of attack on Pearl Harbor, but they were not guided to attacking particular American aircraft on the ground. No information on damage, retargeting opportunities, or opposing strength was given to the pilots during the course of the attack either from Tokyo or from the aircraft carriers in the Pacific.

An important feature of preplan attacks is that they economize on communicated information in the course of battle. The more that a military force deviates from preplan attacks toward direct, or hierarchically controlled, attacks the greater is its dependence on communications networks and information processing mechanisms whose job it is to coordinate local assessments into an overall assessment capable of yielding centralized strategies. This is very hard to do in wartime. Consequently, a reliance on preplan attacks, such as the Japanese.
did at Pearl Harbor, removes a large information processing burden from the command system. There is usually a sacrifice in military effectiveness in a preplan attack as opposed to a plan that controls units both prior to and during battle. But this additional effectiveness is often impossible to attain in a world where the processing and communication of information are neither perfect nor free.

Devolution of assessment to local commanders and resort to preplan attacks are two responses military organizations use to manage their forces in battle. There are many other responses as well, but the reason for raising the issue is to distinguish and contrast wartime with peacetime assessment, and to note that some features of a nuclear exchange are likely to reinforce these differences. If the direction of this comparison is correct, it suggests an even greater reliance on assessment by local commanders in nuclear war, and also helps to explain why American war plans are organized as preplan attacks.

The destructive power of nuclear explosions is so unprecedented that they make communications and command systems vulnerable to disruption as never before. As the prospect of communication and information processing failures increases, so does the likelihood that assessment will devolve downward in a military organization as a matter of necessity. This downward thrust of assessment always has been a feature in battle, but in nuclear war it is likely to be even more pronounced. A second feature of nuclear war encouraging decentralized assessment is that there is no experience of what such a war would be like. Even if fully centralized assessment could be counted on it is not clear that a central command unit would be able to make good choices because it has no experience about what constitutes a
good choice in the first place. Typically, senior military commanders learn battle skills by repeated testing of their decisions in exercises or actual combat. With nuclear weapons there have been no such tests, and the type of conflict is so different from high explosive wars that central command units cannot be relied upon by local commanders in the way that has characterized historical battles of the past. One could expect great internal searching within the organization for instructions following the shock of nuclear attacks, and an inability of central commanders to specify these instructions because they possess no experience about what to do. With communication failures this will create a necessary requirement for local assessment, especially when events are not covered by standard operating procedures.

Finally, the great reliance in peacetime on net assessment type evaluations of conflict can create an expectation among war planners that comparable information will be available in wartime. This can amount to nothing more than their assuming that the military organization following an attack will be connected, so that the different parts of it can communicate with one another. Or it may amount to more sophisticated assumptions, such as that very complex calculations can be undertaken after repeated nuclear attacks. War plans may be drawn up which are more appropriate for a peacetime information regime where integrated knowledge is communicated to a single mind. The many refinements to American declaratory strategy for nuclear war appear to have precisely this feature, as described in the next chapter, especially when contrasted to strategies offered in the 1950s. In the 1950s American war plans were organized as a single preplan attack that consisted of launching the entire nuclear arsenal against
the Soviet Union in one massive salvo. The war plan was even named the single integrated operational plan (SIOP).

Beginning in the 1960s additional options were added to the SIOP, and in the mid-1970s wholesale revisions were incorporated to permit limited nuclear war, controlled responses, "building block" options, regional nuclear options, and a menu of other alternatives.1 The distinctions among these different options need not concern us here. What matters is that they all require detailed assessments about what is occurring in a battle, and they require complex coordination strategies for American nuclear forces. Most of the added alternatives to the SIOP amount to specifications of which weapons are to be fired, and which withheld. For these specifications to be feasible a communications network must survive to transmit messages, as must a damage assessment system that tells what is happening to whom. The damage assessment information itself must be a concentrated summary of many local assessments, so that centralized choices can be made over which SIOP option is to be used. Here is an example where a peacetime net assessment philosophy of integrated knowledge is imposed on a plan that must operate in wartime. And there are good reasons to believe that the required damage assessment system will be unable to operate in wartime, a subject we examine next.

**IMPLICATIONS AND EXAMPLES**

If there is a strong likelihood that knowledge in nuclear war will be dispersed among a large number of local commanders, and not

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1 These are described in Chapter 5.
concentrated in a single location, it is natural to ask what difference this might make. The answer is that it makes a great deal of difference, largely because much of American nuclear doctrine is so fundamentally based on centralized knowledge of damage inflicted and received, and on relative numbers of residual warheads after attack available to each nation. The idea of stability in nuclear war, that an initial attack will not lead to a quantum jump to all-out escalation, depends on the ability of each side to calculate what it can do, and what can be done to it. The importance of ascertaining reasonably valid estimates of damage and remaining forces is a core issue of politically directed nuclear attacks.

Imperfect estimates of damage and available forces have figured large in many campaigns. The Japanese kamikaze attacks of 1944 and 1945 were thought to have inflicted enormous damage on the American fleet. Intelligence reports in Tokyo presented the "success rate" of these attacks as the percentage of kamikazes which hit and damaged American ships, but failed to report that most of the struck vessels were small and replaceable.¹ Not a single American aircraft carrier was sunk by kamikaze attack. On the strength of this "success" the Japanese ignored the advice of their technicians who urged that a larger explosive charge be carried. If this had occurred, along with an expansion of the kamikaze program, there is good reason to believe that the war would have been extended for a considerable time.² Imper-


²Ibid.
fect damage assessment prevented the most effective use of highly limited Japanese aircraft resources, and the overestimate of military damage clearly illustrates how battle outcomes are affected by assessment information as well as by numbers of weapons.

A cursory acquaintance with military history shows how frequently this phenomenon occurs. The Japanese kamikaze example is not an isolated one. At the battle of Jutland in 1916, Admiral Jellicoe of the Royal Navy had little clear idea of the disposition of German vessels or of the hits taken by his own fleet. All he saw was flashes of light and splashes of water from bursting shells without the knowledge of the damage being caused. The German aerial bombing of Rotterdam in 1940 was initially thought to have inflicted over 100,000 civilian fatalities, when in fact only about 900 Dutch citizens were killed.¹ And the later city bombings of Germany were notorious for their overestimates of damage inflicted on the Nazi war industry. These examples show the consequences in how governments misdirected their war resources. Given this experience it is surprising how little attention has been devoted to the subject of assessment in nuclear war. While imperfect information about any of the components of a net assessment could produce equally significant influences, one only has to consider damage assessment to illustrate the difficulties that could occur.

As noted earlier, many additions to American nuclear doctrine since the 1960s require greater control, precision, and selectivity in the application of force. A prerequisite for this control is knowledge

of battle outcomes that can be concentrated in a single mind, or at least in a single committee or office with easy communications among its members. If this communicated knowledge does not exist or is greatly distorted, then the centralized decision makers would have little basis on which alternatives to choose. While needed information could probably be gathered eventually, there is unlikely to be much time for this in the course of an attack.

A reliance on wartime damage assessment would be necessary. The fragility of the American system needs elaboration. Most of the sensors used in damage assessment collect evidence of electromagnetic or nuclear radiation. The sensors cannot count casualties, nor can they certify that military targets have been destroyed. As obvious as this may be, it is not fully appreciated. Exactly how estimates of damage to military, urban, and other targets are determined is a very complicated process involving communications systems, computers, and mathematical models. All of these must be coordinated for a reasonably accurate assessment of damage to be made. Raw data from airborne and space-based sensors is transmitted to ground stations, where it is correlated and synthesized with other information, on meteorology for example. It is then processed and transformed into formats which are meaningful to humans. Because of the great quantity of information, involving reports from thousands of sensors and weapons, and the very limited time available to make retaliation decisions, this raw data is fed into on-line mathematical computer models whose outputs estimate civil and military damage. Political leaders would receive authentication of nuclear attack because of the flashes of light and weapon burst noises, but they must rely on computer estimates of civil and
military damage if they are to make calculated decisions about what to do next.

Presently in the United States a mathematical model known as "Sidac," for Single Integrated Damage Assessment Capability is used for damage assessment purposes.\(^1\) Nuclear damage modeling is considered one of the most difficult problems of military operations research. This is because of the many factors that must be included, and the uncertainties for each of them. Enormous uncertainty exists concerning radioactive fallout damage estimates, which are determined by wind conditions over the United States and the Soviet Union. Wind patterns must be forecast in advance to develop these patterns, and this requires the use of numerical weather prediction models, which are very large computer codes. Because of the uncertainties involved, statistical samplings of many different weather patterns are averaged for use in damage estimation models.

The "Sidac" model that performs these many tasks is a computer program stored and operated at the National Military Command Center in the Pentagon and at the "hardened" underground Alternate National Military Command Center.\(^2\) The sensors that would detect light flashes and radiation are deployed aboard satellites and aircraft. It is well known that many of these platforms are not survivable, a subject examined in the following chapter. It is much less appreciated that for this part of the damage assessment system to be effective it must


\(^2\)ibid.
concentrate data from hundreds of such sensors in one centralized place. There it must process the data through complicated filtering programs that sort out noise from data. This must be done on a computer, and this centralized computation is clearly a delicate operation that would be vulnerable to disruption in a nuclear attack. Presently, most of this computation is performed on computers at the North American Air Defense Command inside of Cheyenne Mountain, in Colorado. This facility was constructed in 1966 and is now highly vulnerable to nuclear destruction, a fact admitted by NORAD commanders.¹ The large fragile computers at NORAD needed for data processing of sensor information are unlikely to survive long in a nuclear war. Even if NORAD were not targeted for destruction, something contrary to Soviet doctrine and common sense given its total vulnerability, the computers there would be subject to many stresses in a nuclear attack. For one thing, despite its nearly twenty year existence NORAD still lacks an uninterruptable supply of electricity. According to one account, NORAD's computers automatically shut down when the power supply weakens, and they have recently stayed inoperative in excess of an hour.² This shutdown took place in peacetime and one can only infer that the additional stress of a 20-megaton Soviet warhead bursting atop Cheyenne Mountain would expose the pretense of what passes for a wartime damage assessment system in the United States. NORAD's vulnerabilities also illustrate that a key problem in damage assessment lies in coordinating

a large complex human institution, for example, to develop an emergency supply of electricity rather than the acquisition of more complicated electronic processing equipment.

Other crucial parts of the American wartime damage assessment system are equally vulnerable. The key integrating mechanism in the system is a mathematical model whose origins, validity and existence are unknown to all but the tiniest group of specialists. Although we have not studied the "Sidac" model, or its successors, there are good reasons to be concerned about its validity because of widespread abuses that pervade the field of defense modeling.\(^1\) Its operation at the Pentagon and the Alternate National Military Command Center means that it too is unlikely to survive a Soviet attack. The Pentagon is a target offering no protection whatsoever from nuclear attack, and the Alternate National Military Command Center, located at Fort Ritchie, Virginia was built in 1954 for protection from attacks directed at Washington, D.C. Its location has long since been a matter of public record, and its design offers no real protection from nuclear attack.\(^2\)

The handful of additional data and information processing centers are even more exposed to nuclear attack than the ones described. For example, while the satellite sensors which would report light flashes indicating nuclear attack are themselves vulnerable, there are only two ground stations capable of receiving their communications. Located at Alice Springs, Australia and Buckley Field, Colorado, they

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are installations with large vulnerable above ground antennas. A dependence on such overcentralized ground centers is a far greater weakness in America's nuclear damage assessment than is the vulnerability of the sensors themselves, although these sensors leave a great deal to be desired if they are expected to function in wartime.

The facilities and mechanisms described above provide the United States with centralized assessment of wartime damage and residual forces. To understand how American nuclear doctrine depends on this kind of information it is useful to have a way of characterizing who has knowledge about whom in the course of a war. This can be done with a scoring matrix for damage assessment, as indicated in figure 4-2.

FIGURE 4-2
DAMAGE ASSESSMENTS

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<tr>
<td>S.U.</td>
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</tbody>
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Places in the matrix are reserved for whether or not concentrated damage assessment information is available to the leaderships of the United States and Soviet Union about themselves and each other. An

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array of 1's and 0's can be used to signify whether such information does or does not exist.

It would be no exaggeration to say that the matrix which dominates the analysis of nuclear strategy as found in academic articles and government reports look as follows:

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<tr>
<th></th>
<th>U.S.</th>
<th>S.U.</th>
</tr>
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<tbody>
<tr>
<td>U.S.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>S.U.</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Here, complete knowledge is available on damage inflicted and sustained for both the United States and the Soviet Union. The United States would know how many of its missiles, planes, and submarines had been destroyed, and how many the Soviet Union possessed even after repeated strikes. Recalling the fragility of American damage assessment systems, this means that sensors, ground-stations, and centralized data processing all perform their jobs during the war. Communications systems and meteorological support networks must also operate for the conditions of complete information to be met.

Illustrative scenarios of a nuclear campaign waged with such perfect information are not hard to find, and an influential one was offered by Paul Nitze in 1976 to advocate his conception of crisis stability. Nitze's scenario is a poignant example of how frequently

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advocated nuclear strategies are dependent on damage assessments, communicated information, and extensive amounts of computation without recognizing it. The core idea in the Nitze analysis is that the relative throw-weight available to the United States and the Soviet Union following a series of strikes on military targets will determine which side is "superior." Throw-weight is the tonnage of payload (warheads, decoys, etc.) that a nuclear force can deliver against enemy targets, and it is a common measure of the size of a nuclear force.

A Soviet first strike against American military targets is the opening move of the Nitze scenario. This destroys enough American missiles and bombers so that the ratio of throw-weight available to each side shifts in favor of the Soviets. The numerical ratios are less important for our purposes than is the knowledge presumed available to American leaders, consequently we will not reproduce Nitze's numerical estimates. Not only do American authorities know how many missiles and bombers have been destroyed, but they also know which ones, for American targeting plans are reoptimized as the next step in Nitze's scenario, and this requires knowledge about the survival and targeting of each American warhead. Soviet leaders are somehow presumed to know this information as well. American leaders then order a retaliatory strike against Soviet military targets to bring back the throw-weight ratio to a more favorable United States balance. This attack is launched and monitored using a damage assessment system that has already been subjected to thousands of nuclear bursts. Yet the information is passed from sensor to computer to mathematical

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model, using the facilities described earlier, and is presented to American leaders so that they may examine the resulting throw-weights available after this, the second salvo of the war.

The Soviet damage assessment system which has absorbed several thousand nuclear explosions of its own then appraises the situation in both countries. Their computers reoptimize surviving forces against undestroyed American targets, and the relative throw-weight balance is recomputed. According to Nitze, if the throw-weight balance at this point in the war is favorable to the Soviets, a conclusion he advances, then Moscow "wins." His rationale is that a continued sequence of strikes would only drive the throw-weight ratio more in favor of the Soviets. If the United States chose to attack Soviet cities then Moscow could retaliate in kind, making this choice irrational. Implicit in the Nitze analysis, however, is the idea that repeated strikes would shift the throw-weight balance, and that such shifts would be observed by American and Soviet leaders. It is a view of war remarkably similar to that found in net assessments, with their dependence on centralized knowledge. Unfortunately, the information regime in wartime is unlikely to even come close to the requirements of the Nitze scenario, with its dependence on enormous amounts of computation and communicated information.

The burden of computation and dependence on very large amounts of communicated information in the above scenario suggest that these should be treated as vulnerable parts of the defense system every bit as much as the weapons themselves. Just as each salvo of weapons reduces an opponent's surviving throw-weight, so too will it reduce his information processing capabilities. As this ability is destroyed
it will become much more difficult to perform the calculations needed for conducting counter strikes. More precisely, it will be more difficult to do the assessments and calculations in a concentrated manner. If this line of reasoning is correct it suggests then the transformation of information conditions in a nuclear exchange could more reasonably be expected to be:

<table>
<thead>
<tr>
<th>Peacetime</th>
<th>Wartime</th>
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<td>1</td>
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</tr>
<tr>
<td>0</td>
<td>0</td>
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Viewed in terms of throw-weight ratios the first step of this particular example could produce the numerical quantities used by Nitze. But there is a big difference. In this example the United States leaders do not know what fraction of their force has been destroyed, how the surviving force is targeted, how much civil sector damage has been produced, nor do they know the number of unfired Soviet warheads. If a retaliatory strike takes place, American leaders would not know what civil and military damage is inflicted on the Soviets. There could not be any reoptimizing or damage assessment calculations, at least as these are ordinarily understood, because the communicated information and computers needed for this computation would be incapable of operation. Some parts of the wartime assessment system might survive and function, but the point is that explicit statement of which parts survived and which did not is a necessary component of realistic examination of nuclear war. The Nitze scenario makes the
default assumption that the entire assessment system survives unharmed, and there are strong reasons to doubt this. It is an assumption that imposes peacetime information conditions onto a wartime environment.

Understanding that wartime assessment systems are the ones that a conflict will be observed through suggests some reformulation of the critical factors for maintaining stability in war. Instead of focusing on comparative throw-weight advantages, it must be asked what information is available to each side. The complicated multiple strikes of the Nitze scenario are not needed to illustrate this point, for it can be made with a much simpler example. For a United States attack of Soviet military forces it is more important to know what information Soviet leaders have than it is to know the comparative throw-weight balance. If Soviet leaders are completely blacked out about what is happening to their country they may well presume that an all-out attack is underway, requiring a response in kind.

To the extent an American attack is directed at the Soviet command and communications system there would be greater likelihood that Soviet leaders would not know how many missiles had been fired, which ones survived, or how many citizens had been killed and how much industry destroyed. In some recent studies of American targeting, a subject treated in the next chapter, it has been proposed to measure the fraction of Soviet leadership targets destroyed by an American strike. But for deterrence of all-out attacks to operate in wartime there must be at least some crude awareness of the events that are occurring. Should Moscow, for example, be cut off from communicating with its force of nuclear armed submarines it is hard to see how any American threats, or any degree of American throw-weight superiority could
coerce the Soviets. Cut off submarines would not be aware of either the threats or the throw-weight advantage. Military organizations have developed procedures for operating in this kind of environment, both for coordinating their own activities and for exploiting weaknesses of the enemy. An appreciation of these methods is necessary to understand wartime dynamics, and we now turn to how they influence the targeting of nuclear forces.
SUMMARY

Knowledge of events differs markedly in peace and war, and assessment systems devised for one environment are not readily transferable to the other. In peacetime, net assessments are undertaken in the United States to determine the military balance, effects of technological change, and reactions to changes in national security posture. These assessments are essential, but some of their underlying assumptions have been unthinkingly transferred to analyze wartime problems. A key feature of a net assessment is its integrative value in piecing together goals, strategies, and capabilities of all the nations involved in a conflict. But this integrated approach is often impossible to maintain in wartime. Communication failures, information processing difficulties, and general confusion in battle make dispersed fragmented knowledge a definitive feature of war.

An assumption of concentrated knowledge that can be known to a single mind, or to a single decision-making entity underlies many discussions of nuclear conflict. In narrowest terms, centralized information about missiles surviving and destroyed, and civil sector damage, are essential if choices are to be made along the lines suggested by many modifications to American nuclear doctrine. This places a large information processing and computational burden on these strategies, and there is good reason to believe that damage assessment systems are unable to meet these needs.

Instead of asking how much damage can be inflicted on the Soviet Union by an American attack, measured by throw-weight destroyed or fraction of targets killed, it is more important to ask what information
may be available to Soviet leaders. Even small attacks that deny Soviet leadership knowledge of the damage they have sustained might make any American threats or numerical advantages irrelevant to Soviet actions.
CHAPTER 5

TARGETING

The prospect that critical wartime information about damage and force levels might be unavailable in concentrated form highlights some deep problems about how the United States or the Soviet Union could direct their nuclear forces in conflict. In time, needed information might be collected and analyzed. But compression of decision-making time as described in Chapter 2, and other obstacles detailed here, mean that adequate time and information for analysis and reflection are unlikely to be available in anything like the form we are familiar with in peacetime, or even during crises where there are conventional military operations underway. In a nuclear attack, where hundreds or even thousands of weapons are incoming and bursting, the decision-making system for national security that seems cumbersome even in the best of circumstances, will be subject to a level of disruption that can only be visualized by comparing it to the chaos felt at Pearl Harbor in 1941, or at the Yalu River in 1950. The difference between a nuclear attack and these historical analogies is that in the past there has always been time at the national level, if not in the theater, to assess the situation and plan responses. In the nuclear era, irrevocable national decisions to launch will have to be made, or not made, in only a few minutes.
We know of no literature that takes account of how an American president could simultaneously absorb the information from tactical warning sensors, assess the battlefield theater nuclear situation in Europe (including strikes on the Soviet Union with QRA aircraft and missiles), assess damage inflicted on the United States, and then plan a retaliatory response all in the space of 20 to 30 minutes. Not only do the physical communication and computational obstacles seem overwhelming, but the human behavior in these circumstances defies comprehension. When the fragility of many of these untested systems is added to the analysis, the outlines of what is really vulnerable in a strategic force begin to take shape.

This chapter examines American targeting policy from the late 1940s to the present, and then goes on to emphasize the critical importance of organizational dynamics in targeting. The treatment of American nuclear war plans is an essential first step in this examination because it provides a sense of what operational targeting issues are about. We will develop several arguments about targeting that relate it to the decision system of the nation under attack, but the main result of this chapter is more methodological than substantive. It is the need to distinguish clearly among levels of analysis on the subject of targeting. Some very different perspectives emerge depending on whether a collection of uncoupled weapons and facilities, a group of national leaders, or a command organization is considered to be the object of attack. These distinctions suggest consideration of the more difficult problems in targeting, such as the dynamic reaction of a command organization denied centralized information about what is being done to it. All too frequently, some basic misconceptions
tions have crept into American targeting policy that confuse these different levels of analysis.

AMERICAN TARGETING PLANS FOR NUCLEAR WAR

Authority for targeting nuclear forces rests with the president and his senior officials in the Department of Defense. In theory, at least, a broad outline of national political objectives is drawn up at these levels, and is passed to the Joint Chiefs of Staff for detailed definition and implementation. However, it is a long way from a presidential memorandum on national policy to the selection of nuclear weapon aimpoints by junior Air Force officers. Layers of bureaucracy intervene between these two actions, and hundreds of interpretations must be made. Since targeting decisions affect weapon acquisitions, service budgets, and internal promotions within a service, they are subject to much bureaucratic manipulation.

Complications like this make it difficult to pin down what exactly is meant by "nuclear doctrine" and "targeting policy." For our purposes we shall distinguish between declaratory and action policy. Declaratory nuclear policy consists of the statements made by the president, and by defense officials in public pronouncements about how America's nuclear weapons would be used. The actual policy the United States would follow might be quite different from this, because declaratory policy might be used to convey political messages. Action policies, on the other hand, represent the actual military plans prepared in advance about what the United States would do.
As far as nuclear strategy is concerned, declaratory policies are enunciated by the president in speeches, press conferences, and in official publications. Because these statements need not be coupled to real intentions they are free to change depending on a myriad of political and economic conditions. This can make declaratory strategy seem volatile, and appear that it is being manipulated to conform with many other factors, such as domestic politics. As an example, there could be a switch in nuclear strategy which, as a by-product, reduced the need for some particular weapon, at great savings in the defense budget.

Action policy is interpreted to include the actual targeting of America's nuclear weapons. The weapons in the arsenal must be assigned targets in the Soviet Union or elsewhere. They must also be assigned firing times, so that two weapons will not interfere with each other in the conduct of their mission. This is a technical point, arising from the ability of one missile warhead to destroy another at the target if they arrive too closely together in time. But it illustrates the interactions that can occur, and the need for careful planning by the military in peacetime about how nuclear weapons would be used in war.

Because a declaratory policy may not even be intended for use there is no reason that declaratory and action policies need be coordinated. They may be radically different from each other for many reasons. As an example, French declaratory policy in the 1930s for the Maginot Line asserted that it was a piece of a larger offensive war plan. Yet offensive forces were never organized. This illustrates the complexity of the relationship of declaratory and action policies.
Both influence each other in subtle, and often unintended ways. For the French it showed up as a belief that their declaratory threats to attack Germany could actually be carried out. With this reminder of the complexity of our subject we now review American targeting plans.

**Early Years, 1949-1955**

America's earliest nuclear war plans were influenced mainly by the few atomic bombs available. Only about 50 atomic bombs existed in 1949, and this dictated target selection. The target list of this time, drawn up by American intelligence experts, consisted of only 70 targets, and these were mainly industrial centers. The experience of World War II bombardments still held great sway over strategic thinking, and since the Soviet Union did not possess its own nuclear arsenal there were no time urgent targets that had to be destroyed in order to limit damage to the United States.

There were, however, Soviet forces that could threaten Western Europe and Japan. Large Russian armies and naval forces were then considered the major threat to the West, and they received considerable attention from American nuclear planners. But with so few atomic weapons available it seemed more effective to target Soviet industrial areas than to attack military forces. Consequently, war plans in the late 1940s emphasized strikes against Russian industrial areas in the belief that their destruction would also destroy the supplies

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2 Ibid.
essential for Soviet ground and naval operations.¹ One 1949 war plan, known as "Dropshot," called for SAC to mount 6,000 sorties against the Soviet Union and occupied territory, involving 300 atomic bombs and 20,000 tons of high explosives.² Targets for nuclear attack were in the 100 largest Soviet cities.³

As the Korean war build-up of 1950 made available larger budgets for nuclear forces a rapid expansion in the number of atomic weapons became possible. Between 1950 and 1953 spending for strategic forces increased from $9.6 billion to $43.3 billion, measured in constant 1981 dollars.⁴ Weapons formerly too expensive to build now fit easily into the new build-up, and in addition major new programs were made possible as well. SAC was modernized and expanded, a growing nuclear role was developed for carrier-based naval aircraft, and research was initiated for an entire generation of Army nuclear weapons.

Nuclear doctrine remained oriented around the counter-industrial targeting plans of the late 1940s as reflected in the action policies of the early 1950s. However, strong countermilitary targeting interests grew as the arsenals grew, and as the services began to think about how to integrate these new weapons into their plans. Plans

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³ Ibid.

existed for counter-industrial attacks against the Soviet Union but other plans were also being drawn up for attack of tactical military targets. Within the Air Force, and especially within SAC, nuclear targeting was viewed as an extension of World War II strategic bombing, but exploiting the more powerful effects of nuclear weapons. Targets included industrial facilities, transportation links that supported operations of the Soviet Army, and the bases of the long range Soviet Air Force. Population damage was viewed as a necessary by-product to such attacks.\(^1\) There was an absence of direct counter-population targeting, as advocated by the British in the Second World War. The distinction was, of course, academic because of the vast population damage that would have accompanied implementation of any of these war plans.

Another aspect of nuclear targeting shows up if we look beyond Air Force plans. In the midst of the confusion and shock caused by the Chinese intervention in Korea, in November 1950, President Truman responded to a press question by saying that the atomic bomb was being considered for use there. When questioned about targets the president responded that "It's a matter that the military people will have to decide. I'm not a military authority that passes on those things...the military commander in the field will have charge of the use of the weapons, as he always has."\(^2\) The statement expresses the view that


targeting decisions belong to the military commander on the scene, because only he will have detailed knowledge about what is going on, and only he will be able to evaluate the military consequences of its use. It is a statement that follows a long tradition of political control of the American military, wherein battlefield choices are left to the military. Although the momentous consequences of using nuclear weapons would be thought to change this tradition, this begs the question about detailed knowledge of local conditions and military consequences. Demanding that a president retain tighter control over nuclear targeting does not circumvent these obstacles. Indeed, by 1950 and 1951 strong pressures had developed for giving American military commanders more direct physical access to these weapons.

At the time of President Truman's remarks, nonnuclear atomic bomb components were deployed aboard aircraft carriers in the Mediterranean. The nuclear components, which were under the physical control of civilian employees of the Atomic Energy Commission, were to be flown to the carriers immediately prior to weapon use where they would be assembled for delivery by the new AJ-1 "Savage" and the P2V-3C aircraft. Apparently by February 1951 shuttle flights were made between the United States and Morocco with these aircraft and then on to the carriers then on station in the Mediterranean.¹ By the end of 1951 the entire set of nuclear and nonnuclear bomb components were deployed with several American carriers.² These forces were targeted


²Ibid., pp. 19-20.
against Soviet submarine bases and other military targets located within a 600 mile radius of the Mediterranean.¹

Nonnuclear atomic bomb components were also deployed to Britain in 1950, and apparently also to Guam.² Had a decision to go to war been made these components would have been fitted with nuclear components for delivery against targets in Europe and Asian Russia. A very important focus of European targeting plans in these early days was the destruction of bridges, communication lines, and rail transshipment points in order to slow down the advance of the Russian army. An appreciation of the dynamics of a Russian ground attack on Europe was an essential input to these plans. There were hundreds of examples where detailed knowledge of army operations was crucial for understanding how to stop that army. Stockpiles of railroad flat cars, seemingly innocuous in peacetime, might be used to bring Soviet tanks to the front, and this required the targeting of those particular marshalling yards. A particular port on the Baltic might have been designated as a major transportation center in wartime, necessitating that it too be targeted. Targeting plans were closely tied to intelligence, because this was the only way to determine which ports, and which rail yards, were intended for use in war. As best they could, American targeteers would piece together scraps of information from defectors, captured documents, electronic and communications intelligence, and any other sources they could find about how the Soviet army planned to wage war. This knowledge was put into targeting plans, and

¹Rosenberg and Kennedy, Strategic Arms Competition, p. 1-175.
²Polmar, Strategic Weapons, p. 13.
represented our best understanding of the dynamics of war. Had American plans been revealed to the Soviets, they would have been provided with a picture of their own intelligence breakdowns, as well as our action plans against them. For this reason, targeting information became highly sensitive, and the targeting process was subjected to rigid compartmentalization in order to prevent security breakdowns. It also became difficult, if not impossible, for political leaders to understand the process and plans. Only the broadest guidance could be given at the political level; and for what was given it was difficult to verify that it had been put into effect. Targeting plans thus assumed enormous complexity because they attempted to capture the dynamics of combat, of how one thing affected another in wartime. The outlines of these interdependences were specified in the "Dropshot" war plan of 1949, and were a major component of NATO war plans.\(^1\) This meant, for example, that atomic bombs were to be dropped on the downtown sections of Warsaw in order to destroy the bridges over the Vistula River which would in turn slow down a particular army for days. Other East European and Soviet urban areas were targeted for similar reasons, to destroy important military supply and industrial facilities.\(^2\)

Although Korea was the trigger to a nuclear weapons build-up, there is no doubt that Europe was the main concern. The defense of

\(^1\)Brown, Dropshot, p. 200. Interview with two former NATO planners.

\(^2\)Ibid. American targeteers assigned to NATO in the early 1950s were so pessimistic about the West's chances of stopping the Soviet army before it reached the English Channel that they systematically collected data on targets in Western Europe so they could better attack Soviet units that had smashed through NATO's defenses.
Europe attracted the attention of American planners, and tightly coupled plans for conflict there governed most general war plans. Even attacks planned by SAC against urban-industrial areas in Russia were seen as one element of this concern for Europe. Nuclear attacks were designed to blunt a Soviet ground force's advance into Europe, while others were intended to destroy Soviet industrial war-making capacity. Nuclear attacks from SAC bases in Europe and aircraft carriers in the Mediterranean each had their own objectives, but were shaped by this military necessity to blunt a conventional Soviet attack into Europe.

There was no realistic way that political leaders in Washington could decide the targeting of Soviet submarine bases and of rail lines in Poland. Only the responsible military organizations held the necessary knowledge about target vulnerabilities, campaign dynamics, and intelligence to engage in the complex targeting process. The campaign dynamic of greatest interest was the relationship of Soviet industry to supporting a large ground advance into Europe. This interaction was critical to the American plans of the day. Consequently, nearly all of these decisions were delegated to the military with only the broadest guidance provided from political authorities. Plans between 1949 and 1956 did not call for exclusive targeting of cities as a deterrent to Soviet aggression. Despite widespread myths to the contrary, and statements by political and military leaders who should know better, such "countervalue" attacks were not a part of early war plans, and have never been a part of war plans at any time. More will be said about this later.
The middle 1950s were a time of large increases in the number of nuclear weapons relative to 1950, and more importantly, in the development of delivery vehicles that could get the weapons to their targets. Chiefly, these were the B-47 and B-52 bombers stationed in the United States, but capable of staging through Britain, Turkey, Italy, Libya, and other bases in the Far East. The advent of the H-bomb, with its substantially greater killing radius also produced major changes in targeting because it allowed the easy destruction of entire urban areas. The facility with which cities could be destroyed accomplished the one objective of neutralizing Soviet war supporting industries. It consequently freed up weapons for other kinds of attacks, especially for blunting attacks of a Soviet invasion of Europe, and for attacks on the nascent stockpiles of Soviet atomic weapons.

War plans in the late 1950s divided targets into three classes: Alpha, Bravo, and Delta targets. Alpha targets were the time urgent nuclear and projection forces of the Soviet Union. Long range air armies, submarines in port, and medium and intermediate range ballistic missiles were all Alpha targets. Their chief vulnerability was in the prelaunch time period, before they could be used against NATO and the United States. The only realistic way to destroy them was to fire at them as soon as was practical. This necessity produced

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Ball, Return to Counterforce, p. 10; Interview with NATO war planners. The Ball piece confuses some of the nomenclature but as this is unimportant we use his terminology here. More seriously, the Ball piece does not seem to appreciate that the command implications for destroying Alpha targets were far more important than their targeting implications.
consequences not so much in targeting, as in command and control. For it meant that action had to be taken very quickly in a war, and this meant that certain kinds of command mechanisms were needed, a subject discussed in Chapter 6.

Bravo targets were the less time urgent military forces of the Soviet Union usable in a ground advance into Western Europe. Typical targets here included army divisions and logistic centers. Delta targets were the war supporting industries, chiefly in urban areas. The large yield of American nuclear weapons in the late 1950s meant that it was impossible to avoid massive collateral damage in the event of war against any of these classes. Even Alpha targets, generally thought of as pure military targets could, and indeed were, in major urban areas. Moscow itself was the foremost Alpha target of all because of its important function as a command and control center for directing armies and defending Soviet air space.

As far as we have determined there were no plans drawn up for firing at one class of targets while withholding fire from others. In this sense the action policies of the United States matched its declaratory doctrine. For in 1954 Secretary of State John Foster Dulles announced the doctrine of "massive retaliation" whereby the United States would respond with large scale attacks at a time and place not necessarily commensurate with the Soviet provocation. The "massive" nature of this threat was construed by one and all to mean a full scale nuclear attack, although Secretary Dulles never specified the details of his threat.

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As the 1950s came to a close there were increasing criticisms of American nuclear doctrine on the grounds that it was too extreme ever to be put into practice. One estimate of the results of implementing the American war plan in 1960 was that it would inflict 500,000,000 fatalities on Russia, China, and Eastern Europe. The mechanism of such incomprehensible destruction was the fallout produced by the large yield weapons then in the arsenal. But beyond this, the growing criticism was directed less at the technical make-up of the nuclear weapons arsenal than it was against the strategic mind set of those politicians who accepted massive retaliation, and the military organizations who advocated massive and essentially uncontrolled nuclear attacks on the Soviet Union. It was clear to critics like Herman Kahn and others that SAC in particular had turned the military plans into an all-out deterrent. The SAC view of the late 1950s was to have such an overwhelming and stark ability to wipe out the Soviet Union that there would not be one iota of doubt in the minds of the Kremlin about the consequences should they attack the West. Destruction would be prompt, overwhelming, and total, encompassing military and urban targets alike. This was as pure an expression of massive retaliation as could be had. Yet it suffered the defect of being so total that it did not appear credible either for dealing with lesser provocations, or with a Soviet Union capable of returning a massive attack of its own.

1Ball, Return to Counterforce, p. 11.
2Interview with Herman Kahn, February 13, 1981.
The Search for Options, 1961-1977

One of the very first actions taken by Secretary of Defense Robert S. McNamara after taking office was to review American plans for waging a nuclear war. The intercontinental missile was just beginning to be phased into operation in 1961, and a near consensus criticism of existing war plans inherited from the 1950s was voiced by analysts from the RAND Corporation who were now working in the Pentagon. Both events created unique opportunities for restructuring war plans. In addition, a new targeting plan that integrated all of America's nuclear weapons into a single plan had been organized in 1960, known as the SIOP, and this created a single framework for making changes not previously available.

Many of the changes implemented had to do with command and control, a subject examined in the next chapter. As far as targeting is concerned the basic change was to select weapon aimpoints that did not overlap with Soviet cities, and to establish withholds from the basic overall plan which could be executed later in battle.

The structure of the new arrangement can be thought of compared to the procedures used in the 1950s. The key difference compared to plans of the 1950s was the organization of different packages of targets, and provision for not firing the unselected options. It is known that packages were drawn up in 1961 and 1962 for attack of each of the East European nations, China, Moscow, Soviet industrial-urban areas, Soviet nuclear military targets not located near cities, and all Soviet nuclear military targets regardless of location. Other

1 Ball, Return to Counterforce, p. 11.
2 Ibid., p. 12.
options were also included, but the fundamental distinction throughout was the ability, if desired, to avoid firing at Soviet cities. The reason for this was the belief that the best way to limit damage to the American population was to hold Soviet cities hostage to attack. This idea had been central to many of the academic writings on nuclear strategy of the late 1950s. As long as the United States was unable to actually destroy Soviet nuclear forces before they fired, the best hope for avoiding escalation to urban attacks in atomic war was to bargain with Moscow during the war. The instruments of bargaining were to be the weapons exploded on an enemy's territory, and those not yet exploded but which held his cities hostage to follow on attack.¹

Although Secretary McNamara ordered that limited options be put into the SIOP, they were not as far-reaching as is generally believed. Even the smallest SIOP options against the Soviet Union consisted of thousands of weapons in the 1960s and early 1970s.² It was left to Secretary of Defense James R. Schlesinger in 1974 to complete the McNamara program by organizing a large number of "small" options in the SIOP. The thinking behind this was that as the Soviet nuclear threat grew it became increasingly difficult to limit damage by destroying the Russian nuclear forces that could attack the United States. The declaratory rationale for so-called "limited nuclear options" was that America needed the ability to attack target sets which would influence the actions of Soviet leaders, especially for supporting

a war in Europe. As an example, a nuclear strike against the Soviet petroleum industry and its supporting facilities would help to blunt an attack by conventional forces which depended on it for fuel. Special attention was given to minimizing urban damage in these attacks, in order to encourage Soviet reciprocal behavior.

The full implementation of limited nuclear options into targeting plans in the mid 1970s represented a fulfillment of the bargaining and escalation control view of nuclear war. The conclusions following from this view were partially implemented by Secretary of Defense McNamara in the early 1960s, and the new options developed ten years later by Secretary Schlesinger can be interpreted as a fine tuning of the idea. Whether or not we accept the assumptions of this strategy is less important than understanding that it was a reaction against certain of its tenets which has shaped contemporary targeting policies. Specifically, there has recently been a renewed emphasis upon war winning rather than bargaining, and on damage limitation rather than escalation control.

A Search for Advantage, 1977-1982

By the late 1970s, the American arsenal had grown to over 9,000 nuclear warheads and a disillusionment over the entire subject matter of targeting was apparent. The technologies were no longer new, and neither were the issues. Even the number of people who paid any attention to these matters declined, and the subject of targeting was attended to by literally a handful of persons.

Against the relatively small Soviet arsenal of the 1950s, it appeared possible to achieve some advantage in a nuclear war. Yet even by 1958, the Soviet build-up of long range air armies and M/IIRBMs against Europe would have made any conflict devastating to the West. As a response to this, American target planners incorporated certain bargaining concepts into war plans. Soviet cities were not targeted for initial attack in hopes of holding them hostage; China and the East European nations were also withheld as a move to dissuade them from joining in any Soviet-led attack. By the mid 1970s, the bargaining notion was refined to incorporate smaller limited nuclear options against a large number of target sets. This limitation and restraint in target planning was an American recognition of the insurmountable difficulty of significant damage limitation against the Soviets. As their forces grew in number, and were protected in concrete silos, the chances of destroying a number significant enough to reduce American urban damage to "only" ten or twenty million fatalities vanished.

The official declaratory reaction to these trends in the late 1970s was the promulgation of Presidential Directive PD-59, signed in July 1980. Although the text of PD-59 has not been released, it can only be concluded that it is an ambiguous statement of declaratory policy. There is a view that PD-59 represents a mandate for a nuclear "war winning" strategy, and that it further contains the idea of how to achieve such a victory. Such a shift represents a change in outlook about nuclear conflict compared to the declaratory

1960s and 1970s. However, it is a change that was predictable, because of the resistance to imposing civilian directed constraints on military operations. The dismissal of General Douglas MacArthur in 1951, the charge of "civilian interference" in military planning lodged against Secretary of Defense McNamara in the 1960s, and the failures of the American military in the Vietnam war all produced demands in some quarters for all-out military victory as an objective. Applied to PD-59, the renewed call for victory in nuclear war is more a reaction to perceived failures within the national security establishment than it is to any breakthroughs that would permit advantage in a nuclear conflict.

The interpretation of PD-59 is complicated by the fact that it has also been treated as representing only a marginal change to past declaratory policies by responsible officials in the Department of Defense.¹ Whether really significant changes in action policy arise as a response to PD-59 remains to be seen.

What is worth noting about PD-59 is the idea offered as the key to victory over the Soviet Union in a nuclear war. The idea advanced is to target the political and military control system of the Soviet Union, as well as its military forces. The thread of this strategy was already expressed in targeting revisions undertaken in 1975, where the SIOP was broken into four classes of targets: nuclear forces, conventional military forces, military and political leadership, and economic and industrial targets.² These have become known as "building blocks."

Although military and leadership targets of the Soviet Union had always been included in earlier plans, for the first time with PD-59 there were declaratory threats against them. As a consequence, a spate of academic articles appeared about the benefits of "knocking out the Soviet control system." Most of these were highly superficial, to the point of being silly, for they did not even define "control system," nor did they address what happens if the Soviets shoot back. But the more important point expressed in this bizarre debate is the search for advantage and victory conveyed by PD-59 to some people in the defense establishment.

The long term implications of PD-59 may be that it is just one more statement of high level guidance that does not get implemented for any of a number of reasons, chiefly because no one knows how to implement it. Or it may indicate a renewed search for advantage in nuclear war, one that produces changes in operating procedures and weapons acquisitions.

**TARGETING POLICY IN A BROADER PERSPECTIVE**

This summary of U.S. nuclear targeting raises the question of just how we should think about this subject. Broadly speaking, most histories of targeting, and even most studies of contemporary American nuclear strategy, define the problem to be one of selecting "things" for destruction. Typical questions include "Should we target Soviet cities or military facilities?" "Will destruction of 'control targets' deter Soviet escalation?" Within this style of reasoning "counterforce"
and "countervalue" doctrines have arisen, reflecting the belief that in the event of a war America should aim to destroy military (counterforce) targets or urban and industrial (countervalue) targets. Some large, and mushy, intellectual debates have arisen on how best to answer this question. The very idea of deterrent effectiveness is seen as hinging on whether counterforce or countervalue doctrines are chosen, with a school of strategists (and brief writers) organized behind each of these alternative doctrines. New weapons are advanced on this basis as well.

The approach taken here does not follow this path, even though it is a legitimate avenue of analysis. We could, for example, review targeting plans and conclude that counterforce attacks have always been the basis of American action planning. This is true even when declaratory doctrine placed nearly total emphasis on countervalue attacks, as it did under Secretary of Defense McNamara in the mid 1960s. The reason for not pursuing this kind of analysis further is that it is unable to account for a richer, and more important, collection of targeting phenomena. Nonetheless, we readily acknowledge that most writers on nuclear strategy, and most political leaders who have given any thought to the subject, understand targeting to be the selection of things to be destroyed.

The counterforce versus countervalue analytical approach to targeting is deficient because it fails to say anything about coupling effects among targets, how knowledge about damage would be concentrated so that the consequences of a targeting plan could be assessed, how a political leader could absorb the vast quantity of needed information.
in only a few minutes, and how dynamic responses of the system attacked would interact with the targeting plan.

Three levels of targeting analysis can be distinguished in the development of American plans for nuclear war. At one level, cities, missile sites, buildings, stockpiles, dams, bridges, airfields, and other "things" are identified for destruction. Nuclear weapons are then selected on the basis of their accuracy, yield, reliability, location, delivery speed, and other technical factors so as to optimize the allocation of discrete weapons to discrete targets.¹ For example, an arsenal of 100 nuclear weapons might be "applied" to 200 Soviet military facilities, and decisions would have to be made on which facilities to target, how many weapons should be assigned to each target, and similar kinds of questions depending on the detail considered.

At a different analytical level, targeting plans can be directed at a group of people, not to obliterate them, but to influence their behavior. The term "group" is used here in a rather technical sense, to mean a number of persons, or members, each of whom interacts with each other. Because of the need to interact with each, such a group must be "small," and the term is used here to describe an entity like the Soviet or American leadership which would make decisions in a crisis. There is no fixed number of people in this group, but it is likely to be small enough to be manageable when time is in short

supply. Even one person, the national leader, can be considered a group in this definition.

The reason for targeting intended to influence the Soviet leadership group might be that it is impossible to actually destroy them in a militarily useful way. In the early 1960s, as the Soviet nuclear arsenal grew in size, American targeting plans were revised so that Soviet cities would not be destroyed. The logic of this move was that the Soviet leadership group would observe American self-imposed restrictions, and would be more likely to impose similar restrictions on their military use of nuclear weapons. In this image of a nuclear war, the two nations, or more precisely the two leadership groups, would bargain with each other before and during a war. The motivations for bargaining were thoroughly explored in the literature of the day, and arose from mutual interest in survival, a desire to control escalation, and many other considerations. This image of nuclear war was not merely an academic description unrelated to the military world, because the American SIOP was actually revised to conform to this model, as described in the preceding section.

1During the Cuban Missile Crisis President John Kennedy relied on an "Executive Committee" of 15 persons. The Soviet Politburo today consists of 14 persons. Both are examples of leadership groups in the sense intended here. See also Graham T. Allison, Essence of Decision (Boston: Little, Brown, 1971), p. 57.

2Plans were also explicitly revised to withhold attacks against the Soviet leadership, in order to preserve their existence so that the American leadership would have an entity to bargain with. See Ball, Return to Counterforce, p. 12.

Targeting at this group level depends on the physical destruction of particular sites, as at the individual level. However, there is more to it than this. Destruction of a bridge, for example, will produce direct military consequences in that it can no longer be used for river crossings. But it also shapes the perception of Soviet leaders. It has military value, and in addition, symbolic political value which can easily outweigh the military significance. If in a conventional confrontation with the Soviet Union the United States fires a single nuclear weapon at a bridge in Eastern Europe, the physical destruction of the bridge will pall in significance to the fact that a nuclear weapon had been used for the first time since 1945. Speculation about how the Soviet leadership would respond to different kinds of nuclear attack has filled volumes, most often concentrating on the perceived value of different kinds of things targeted. Military, or counterforce targeting might induce one type of behavior, while urban, or countervalue, targeting another. Soviet leadership reactions would depend on many factors in addition to the destroyed military value, such as psychological perceptions, cultural heritage, and social psychological dynamics like "group-think."

A third analytical level of targeting is organizational. An organization is used here to mean groups of people and machines where explicit procedures for coordination have been established in order to achieve specified objectives. Unlike a group, an organization has no necessary requirement for each member, or machine, to directly interact with every other member or machine. The key to an organization, and especially for a military organization, is its dependence on explicit procedures for conducting its operations. Whereas the
Soviet or American leadership groups likely in a nuclear crisis are small, say less than 20 persons each, the size of an organization for waging nuclear war is large, indeed, it is very large compared to a group. It is not at all clear how to even measure the size of a nuclear warfighting organization, whether to count people, machines, weapons, or computers. The United States has over 9,000 strategic nuclear warheads on alert, 7,000 theater nuclear warheads in Europe, and probably over 10,000 other nuclear weapons in stockpiles. The Strategic Air Command alone operates over 400 bombers, 1,000 missiles, 600 tankers with manning by 120,000 persons, including 40 generals in charge of the different parts of SAC.¹ These forces are operated worldwide, from Guam to Omaha, and from Alaska to Turkey. Yet this only conveys the size of SAC, and does not account for tactical Air Forces in Europe and the Pacific, Army units in Europe, and Navy units all with procedural responsibility in nuclear war. Organizations of similar or greater size exist in the Soviet Union.

Thinking about targeting in organizational terms suggests some very different questions then as a small group to be influenced, or as a set of individual facilities to be destroyed. And one of the most compelling reasons for asking questions at this organizational level is that it comes closest to how military targeting plans are actually devised. Recalling the plans for blunting a Soviet ground attack on Western Europe illustrates this. There, the problem was not to destroy a number of bridges, ports, railyards, airfields, and stockpiles, it was rather to stop a Soviet ground invasion before

it could penetrate deeply into Western Europe. Targeting for this purpose depends upon detailed understanding of the Soviet military organization, of how its logistic branch supplies forward units, of whether rail or truck transportation would be selected for moving tanks into staging areas, of how ground armies coordinate with Air Forces, of whether tank armies advance with mechanized infantry, of how long before second echelon units exploit the breakthroughs achieved by advanced units, and of hundreds of other similar issues.

Targeting decisions about these matters can only be undertaken by the military services, because they alone understand the details of military organization. And they alone have been tasked to stop a Soviet offensive into Europe. Targeting is not an exercise in killing Soviet bases and military units, it is instead an intelligence based activity that seeks to turn an understanding of combat dynamics into a plan that breaks up the attack into manageable pieces. If this goal influences Soviet leadership to change its behavior, then so much the better. But at the military intelligence level where targets are selected, this is not likely to be an overriding concern.

Considering a target, or collection of targets, as an organization suggests certain kinds of questions which are generally not posed if targets are understood to be either a set of uncoupled facilities or a collection of sites that have only symbolic utility to a leadership group. Reaction dynamics are an example. During World War II the British and American strategic bombardment of German industry and urban areas was based on the idea that destruction of factories critical to war-making would demonstrably slow down the German armies in the field, and might further "crack" the morale of the German people.
and lead to a prompt capitulation. The actual results were quite different. As more bombs were dropped on Germany, production of war goods actually increased.¹ This was because the target system was not an inert collection of buildings, locomotives, and shipyards, but was a reactive organization directed by human beings. Although individual locations were destroyed by bombardment, the German decision-making system and its physical apparatus was never destroyed until very late in the war, when ground armies had overrun most of the country.

A similar phenomenon showed up in the air war in Vietnam. There, American attacks were unable to make any significant reduction in North Vietnamese combat capability because there was always time to regroup after a bombing attack, no matter how intense, and because there were very few targets whose destruction made much of a difference to ground operations.²

In both of these examples an organizational response more than compensated for the damage inflicted in air attacks. Plants were rebuilt, substitute materials were used, bridges were repaired, and alternate sources of supply and methods of production were found. Different parts of the organization under attack made decisions and took compensating action, and one of the reasons for the success of this approach was that it did not require detailed direction from political leadership. People in the organizations reacted to attack

¹Mancur Olson, "The Economics of Target Selection for the Combined Bomber Offensive," Journal of the Royal United Services Institute, November 1962, p. 308.

by making decisions based on their own knowledge and authority. The aggregate effect of these thousands upon thousands of actions was to offset the consequences of the bombardment.

We cannot predict the reaction dynamics in a nuclear war, but can point out that this is an important question which is unlikely to arise if targeting analysis attends only to individual facility destruction, or to the reactions of Soviet leadership. With the long-standing mission of halting a Soviet attack into Europe, it does seem that any analysis of American targeting policy would have to consider the consequences of launching several thousand theater and strategic warheads at Soviet armies and logistic nets dispersed over a large part of Central Europe, including Russia west of the Urals. Many of these Soviet units have nuclear weapons under their physical control, and one very plausible reaction dynamic is that many of these weapons would be fired in return, again based on detailed military reasoning about unit survival and suppression of NATO's military capabilities. It seems far-fetched to believe that military units would behave like inert buildings and other facilities if attacked.

This line of analysis raises another interesting question. One of the ways both Germany in World War II, and North Vietnam in the 1960s, overcame the effects of strategic air attacks was to make adjustments and institute countermeasures in the way they carried on their activities. The adjustments and countermeasures were, at bottom, procedural changes for coordinating the different wartime activities. Procedures are the essence of organization, and the modification of an organization's procedures takes time. In the bombing of Germany and Vietnam there was time after each attack to assess the situation.
and institute adjustments. But the destruction in a nuclear war may be so vast that time will not be available if the pace of reaction is not speeded up enormously. In past air wars there were usually at least a few days, and more often a few weeks, between major attacks. In a nuclear exchange, either in Europe or intercontinentally, there may only be a few minutes, or at most, a few hours.

An organization's response in this "speeded up" environment will most likely have to take account of its most important missions. In the bombardment of Germany and Vietnam this had to do with producing needed war equipment and supplying front line combat units. In a nuclear war such economic and production requirements are likely to be far less significant because of the expected short duration of such a conflict. However, the issuing of nuclear weapon usage orders and authorizations throughout the various military hierarchies is something that may have to take place very rapidly, because if it is not done early on there will be a distinct possibility that the necessary orders and codes could be isolated from the weapons by enemy nuclear attack. This may create a fear that a nuclear equipped Army could be paralyzed into inaction if appropriate orders are not issued at the earliest practical time. Indeed, this threat may be so great as to force issuance of contingent authorizations to use nuclear weapons, a subject discussed in the next chapter. The reaction dynamics of a nuclear armed military organization may be described by other adjustments in the procedures for command and control over nuclear weapons, just as procedural changes characterized Germany and Vietnam when they were attacked. In all of these cases, it is an oversimplification to analyze the consequences of strategic attack only in terms of "things
destroyed' or effects on political leadership. This misses the critical
dynamics of response, and the changes forced on procedures.

Chapter 4 strongly implied that there were deficiencies in nuclear
wartime assessment capability. The gaps were discussed mainly in terms
of an ability to determine damage levels and numbers of remaining
missiles and bombers. If concentrated knowledge on these matters
is lacking, information about procedural changes induced by nuclear
attack (or even alert) is a subject about which almost nothing has
been written. Yet these may be every bit as important for controlling
escalation, or winning, a nuclear war as are armament levels. What
does seem clear is that in the 20-30 minutes it takes for missiles
to reach their targets there will be almost no feasible way to discuss
and coordinate procedural changes among senior military commanders
and political leadership groups. The one exception to this would
be for the nation which strikes first. The nation firing first can
do so with a carefully prepared SIOP, and the nation attacked may
have to undertake extensive calculations and assessments about what
has happened to it, how the enemy target system has changed, and about
who has survived. The longer this takes the more opportunity the
first striker will have to reattack, disrupting again the reactions
of the attacked state.\(^1\) We see here some very different targeting
implications than those suggested in the bargaining approach at the
group level of analysis. Targeting for optimal bargaining would lead
to aiming at enemy missiles if a state were subjected to a first strike.

\(^1\)Edward W. Paxon, *Computers and Strategic Advantage: Games,
Computer Technology, and a Strategic Power Ratio* (Santa Monica, Calif.:
This tactic would even up the firepower ratios. However, at an organizational level a retaliatory response would be more likely to aim at the enemy's command and control system, which embodies his information processing and procedural operating rules. The reason is that the state struck first would be threatened by follow-on attacks by an enemy who has an undamaged assessment and information processing system which could be used to exploit the disruption of the first strike. Thus, an attacked state would have a strong incentive to disrupt, mangle, and confuse the attacker's ability to engage in optimally planned restrikes. Here, a first strike would be met with a retaliatory attack against sensor and warning systems, command sites, and communication systems, as well as against military forces. Furthermore, such a retaliatory attack would have to be launched very soon after the first strike, or even during it, in the case of launch on warning.

The implications of targeting policy lead automatically to an analysis of command and control. For it is in the area of command and control that problems of nuclear war are "put together," and solved to the extent they can be. We now turn to this subject.
SUMMARY

This chapter began by summarizing American nuclear weapon targeting plans. In the late 1940s and early 1950s the need to defend Western Europe from invasion induced targeteers to concentrate their attention on blunting the Soviet Army. In addition, counter-industrial attacks were also planned to destroy Soviet war supporting capability. This coupling of nuclear targeting to the defense of Europe has continued to the present time.

As Soviet nuclear weapon capability grew in the 1950s and 1960s, the American reaction was to embrace the possibility of bargaining in a war, for example, by not firing weapons at urban areas. Appropriate changes in targeting plans were made, a process that was fine tuned in the mid 1970s. Most recently, a search for some way to gain advantage in a war, possibly even to "win" a nuclear war, has manifest itself in declaratory policy. Whether action plans are modified and new capabilities are developed to attain this objective remains to be seen.

Three levels of analysis are offered to describe action targeting policy: uncoupled individual targets, groups to be influenced, and organizations. The second of these corresponds to use of nuclear weapons to cause the Soviet leadership to change its behavior, and decisions, by destroying certain "things" that it values. The organizational level suggests more explicit consideration of reaction dynamics, such as return nuclear fires by decentralized military units, and coordination of changes in procedures for controlling these weapons. Finally, it is argued that some very different targeting implications follow depending on which level of analysis is chosen as a framework.
A description in any detail of the dozens of command and control systems deployed by the United States would be a difficult and overwhelming task. It would be difficult because there has not yet appeared any scholarly account of these systems, and also because each individual system is so complex, representing multi-year efforts involving thousands of people. The Strategic Air Command monitoring system, for example, began in 1957 and came into initial operation in 1965, but has never really been finished to date. Over the years, its missions have changed, as have the forces it was originally intended to monitor and the threat with which it dealt.

A complete account of America's command and control system would be overwhelming since it is not clear that any single individual understands how the parts interact, how they would function under stress, or what mechanisms could be used to coordinate the component systems toward an overall objective. We are faced with the same difficulty that appeared in Chapter 3 on theater nuclear forces. Because the complexity of command and control is so great we could ignore it altogether and jump into a discussion of "policy" issues. Alternatively, we could provide an overview of some command and control developments to convey a small sense of the complexity of these systems--a complexity
which we will argue in the concluding chapter is at the heart of any policy concerning modern strategic forces. The former path is attractive because it seems more comprehensible and less likely to get bogged down in excruciating detail. However, as with theater nuclear forces, it is just this detail which most determines the broader policy issues.

We begin with an overview of America's command system for nuclear war, emphasizing a functional approach that illustrates the connections and interactions among different parts of the system. To the extent possible the overview will be structured along the line of the targeting description given in the preceding chapter.

It is useful to recall the definitions of strategy and command structure used in this work. By a nuclear strategy is meant a set of specific actions for the assignment of warheads to targets, usually but not always accompanied by the associated objectives of a particular attack. Unless otherwise specified we are keying the discussion of American nuclear strategy to the discussion of targeting in the preceding chapter.

Command structure refers to the organization intended to administer or execute a nuclear strategy. It includes the lines of authority and communication among the various administrative centers, the information and data flows through the lines of communication and authority, and the specification of the coordinating procedures used to control and integrate the different parts of the organization. "Command structure" thus is a more encompassing term than "command and control system," because the latter is generally used only to describe the special physical facilities that allow civilian and military commanders to communicate and direct the nuclear forces.
Early Years, 1949-1955

America's command system for nuclear war began to take shape soon after World War II. In the late 1940s British and American aircraft initiated overflights of the Soviet Union and its East European satellites.¹ Many of these flights were for the purpose of dropping propaganda leaflets, or for parachuting agents into Soviet territory. But the lack of success in stirring up anti-Soviet revolts in the Ukraine and Eastern Europe created a disenchantment with this objective, and gradually these overflights became more and more used for monitoring of Soviet military radio traffic and radar signatures, photographic observation, and general intelligence collection.² Pieces of information were put together about operating patterns so that the United States could detect when Soviet forces were preparing for war. Once such patterns were established, intelligence probes of this kind could be used to supply warning and targeting information, and in the event of war, damage assessment, back to American nuclear commanders. Flights over or near the borders of the Soviet Union have continued to the present day.³

In 1949 following the detonation of the first Soviet atomic bomb the Department of Defense began a systematic program of scheduled flights around (and sometimes inside) the Soviet border in order to

² Ibid.
monitor Soviet radio transmissions. This kind of information served many purposes. It sometimes gave clues about testing programs and weapon developments, and over time various scraps of information would be pieced together to permit American intelligence experts to map the positions of Russian Army and Air Force units. This was well before the ICBM era of 15 minutes warning of attack, and monitoring of Soviet radio transmissions was most useful for detecting preparations for war. This warning function could be relayed to American military commanders for action, providing days of advanced notice that would be essential because of the cumbersome preparation features required by the American strategic forces of the day.

As previously described, the Korean War was an impetus for expanding the size of America's nuclear weapon stockpile, and also for giving direct physical control of these weapons to the military. Although the expansion and physical dispersal of nuclear weapons is not a command and control issue per se, the direct physical possession of the weapons is. By late 1951 nuclear weapons were deployed to Navy aircraft carriers and selected Air Force units. Prior to this, nuclear components of the bombs were retained by civilians employed by the Atomic Energy Commission. Throughout the early 1950s there was an evolution of operational control over nuclear weapons from civilians to the military, as the threats of general war increased.


because of Korea, and Soviet belligerence in Europe. This transfer of physical control is not generally even recognized as a major event in the development of command and control. Yet it meant that the United States would be prepared to initiate strikes in only the time it took to flash word from the president to a military commander. And it also meant that the military could now fully integrate this radically new kind of weapon into their own organizations.

The emergence of a Soviet nuclear capability stimulated the United States into a full-scale air defense protection system, which was studied and planned in the early 1950s. In 1952 the Pinetree Line of radars in Canada was started in construction, to be followed in 1953 by the Distant Early Warning Line (DEW). These radar systems with their rearward transmission networks would provide the American Strategic Air Command with about 1-2 hours of warning time of approaching Soviet bombers. This could be used to get SAC airborne, and to launch it on its retaliatory mission, subject of course, to positive control procedures whereby actual advance against Soviet air space would come only after a direct order to proceed. It seems clear that the intelligence collection flights around the Soviet border begun in the late 1940s constituted another source of strategic warning of impending attack on the United States, in addition to the DEW and Pinetree Lines. These might have given days of advance notice.

The DEW and Pinetree Lines themselves served as the primary components of what was in the 1950s a fantastically complex system of air defense known as SAGE (for Semi-Automatic Ground Environment). SAGE

\[1\text{Ibid., p. 14.}\]
was the largest data processing system ever devised at the time of its operation. Its basic function was simple: to use digital computers to coordinate the most efficient use of air defense fighters and missiles. In a very real sense SAGE was a technologically updated version of the air defense control system used in the Battle of Britain in 1940. However, the speed of modern jet aircraft cut down on the ability of human operators to make needed allocation decisions quickly enough. Only through computer driven decisions could air defense assets be used in the most effective way against high speed Soviet bombers.

SAGE revealed a number of important features of large scale man-machine information processing systems. An oral history of the project written in the early 1960s stated that major problems occurred with SAGE because of the nature of military doctrine. Whereas automated command and control systems require explicit written statements of doctrine (in this particular case for air defense) the designers of SAGE found experienced military officers extremely reluctant to state in great detail the doctrines they followed. A great deal of military doctrine was found to be unstated, and was part of the culture of the military officer. This caused the doctrine which was written about air defense to appear confusing to the uninitiated planner, because it was not accompanied by a complete description of necessary procedures.

Another finding from the SAGE experience was that informal working arrangements among commanders and system operators soon developed

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to compensate for the systems deficiencies, and for unexpected events.¹
For example, the mid 1950s SAGE system was confused by even small
degrees of electronic warfare.² Informal work-arounds were established
for many of these problems, although some of these could also have
been automated had the designers known about them. The lesson from
SAGE was that the role of man in such a highly automated system was
an extremely complex and subtle subject.

As SAGE came into operation in the mid 1950s the United States
was also building large underground command posts around the Washington,
D.C. metropolitan area. Ft. Ritchie, Maryland was an emergency facility
built inside a mountain, and was fully completed in 1954. In 1955,
President Eisenhower participated in a full scale test of this facility
by actually operating out of it for three days.³ The function of
Ft. Ritchie, and similar facilities built around Washington in the
1950s, was to provide protection for a cadre of needed leaders and
specialists in the event of a Russian atomic attack. This continuity
of government function required that Congressional and Executive branch
leaders survive any strike on Washington, D.C., which was presumed
to be a very likely target. Undoubtedly, communication existed between
Ft. Ritchie and SAC during the 1950s, but the post was not designed
to permit the president to exercise detailed control of the military.⁴

¹Ibid., p. 31.
²Ibid., p. 10.
³Robert Walters, "Going Underground," Inquiry, February 2, 1981,
p. 13.
⁴Interview with a former Air Force intelligence civilian employee.
Rather, the sites around Washington were built primarily as bases for directing postattack recuperations and recovery.

At about this time there were significant extensions of the radio monitoring begun in the late 1940s. In the winter of 1954-5 American technicians began work on a listening post and line of site radar installation at Samsun, Turkey, on the Black Sea, and a little bit later at Meshed and in the Elburz Mountains of Iran.¹ These sites provided full time observation of Soviet missile tests at nearby launching sites, and they also permitted more extensive monitoring of Soviet military radio traffic, an invaluable advantage for improved warning. More significantly still, in June 1956 the first U-2 overflight of the Soviet Union occurred.²

These listening posts, and the U-2, provided SAC with a better picture of the deployment of Soviet military forces, and gave a better indication of changes in military activity, which could be used for warning of attack. Such targeting and warning functions tend to be forgotten when attention is given to the intelligence function of verifying the technical characteristics of Soviet missiles and bombers as needed, for example, in an arms control agreement. As important as the technical determinations were, the listening posts and U-2 also represented a forward deployment of warning sensors, which followed by a few years the forward deployment of nuclear weapons. The U-2

¹ Freedman, Soviet Threat, p. 69.

² Ibid. It is not known when the last non-U-2 overflight of the Soviet Union took place. Soviet advances in surface-to-air missiles would have made non-U-2 overflights dangerous by 1956, but the B-36 bomber was widely available and had been initially designed for high altitude operations.
and the many listening posts around the Soviet border served the needs of SAC every bit as much as they did those of the CIA. And fierce jurisdictional battles were fought between SAC and CIA for control of them.¹

By the mid 1950s the American command and control system for nuclear war was still in the stage of experimentation and integration of new technologies into the military organization. The command function receiving the greatest emphasis was warning, closely followed by intelligence about the deployment and characteristics of Soviet forces. The build-up of the American nuclear arsenal led the development of the command systems designed to manage it because it was so much easier to expand bomb production than it was to build complex systems like SAGE and the DEW line. The command and control emphasis on warning and tactical intelligence made sense because the small size of the Soviet nuclear threat to the United States, in the form of Long Range Air Armies, made it possible for SAC to plan a swift counterforce attack with some hope of destroying a large fraction of Soviet bombers before they could take off. But this could occur only if very early word of attack was provided to SAC. The offensive striking power of SAC, plus the defensive capabilities of SAGE, and the DEW and Pinetree Lines stood a good chance, in the estimate of senior planners, of limiting nuclear damage to the United States.

Middle Years, 1956-1961

Alone, a description of the technical command and control systems and their functions provides an essential, but incomplete, picture

of the evolution of the command of nuclear forces. For one thing, it does not account for the procedural changes that were being worked out. The nature of these procedures and the security around them make it difficult to convey an accurate description of their consequences. In the mid to late 1950s SAC was developing sophisticated tactics for aerial refueling, bomber dispersal, rapid launching of bombers, and airborne alert operations. In addition, plans for using forward staging airheads in Spain, Italy, Turkey, Britain, Guam and Morocco were also underway. Any one of these tactics would be difficult for an organization to absorb, yet SAC in the 1950s was experimenting with all of them at the same time. One is hard pressed to recall another example of such rapid technological and tactical change being incorporated into an organization in so short a period.

In addition to procedural aspects of command and control there are events that occur which illustrate problems that had not been thought about ahead of time. One such example took place in 1956, as a multiple overlapping crisis illustrated the complexity of warning and force management, and the propensity of Soviet-American interactions to be a major source of instability. In early November 1956

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1 The addition of the ICBM to the arsenal in the late 1950s came just as these other tactics were being worked out. Conventional wisdom has it that the U.S. Air Force has always been enamored with bombers rather than missiles. Yet one reason for SAC's seeming aversion to missiles, relative to bombers, is that the vast operating changes arising from the need to manage the threat of missile attack may have been the straw that broke the camel's back. Organizations can absorb only so much change in a limited period of time. But the pace of technology in the late 1950s did not give SAC a breathing space, and the ICBM followed on the heels of the enormous changes being worked out for intercontinental atomic bombing. The Soviet command did have this breathing space, and this can account for some of the differences in the two organizations.
the Hungarian uprising was taking place at the same time as the British and French attack on Suez. Tass, the Soviet press agency was drumming up fears of worldwide nuclear war. Moscow had issued a communique to London and Paris which strongly hinted that rocket attacks against them were being contemplated, and in a separate communique to Washington suggested that joint American-Soviet military action should be taken in Suez.\(^1\) This last message was received at the White house in the late afternoon of November 5.

Against this context, on the night of November 5 the following four-fold coincidence took place. Headquarters of the American military command in Europe received a flash message that unidentified jet aircraft were flying over Turkey, and that the Turkish Air Force had gone on alert.\(^2\) There were reports of 100 Soviet Mig-15s over Syria, and further reports that a British Canberra bomber was shot down also over Syria. Only Soviet Migs had the ability to shoot down the high flying Canberras.\(^3\) Finally, there were reports of a Russian fleet moving through the Dardanelles. This was long considered an indicator of hostilities, because of the Soviet need to get its fleet out of the Black Sea where it had been bottled up in both world wars.

The reaction to these events in the White house is not fully known, but it has been reported that General Andrew Goodpaster was afraid that they "might trigger off all the NATO operations plan."\(^4\)

\(^1\) Herman Finer, *Dulles Over Suez* (Chicago: Quadrangle, 1964), pp. 418-421.

\(^2\) Ibid., p. 421.

\(^3\) Ibid.

\(^4\) Ibid.
From our earlier analysis of American targeting plans it is not difficult to imagine what this might have meant.

As it turned out, the "jets" over Turkey were actually a flock of swans picked up on radar, and the 100 Soviet Migs over Syria was really a much smaller escort returning the President of Syria from a state visit to Moscow. The Canberra was "downed" by mechanical difficulty, and the Russian fleet was engaging in long scheduled exercises. The detection and misinterpretation of these events, against the context of world tensions from Hungary and Suez, was the first major example of how the size and complexity of worldwide nuclear force management could, at certain critical times, create a crisis momentum of its own.

The sensor and communication systems used in the Suez crisis were primitive compared to what was to follow in the late 1950s. These critical years witnessed the start of construction of systems that have shaped command and control for the next twenty-five years. By 1957, the U.S. Navy's Sound Surveillance System (SOSUS) was in operation. This was a collection of underwater acoustic sensors that could detect the movement of Soviet submarines. SOSUS has been expanded and improved over the years, and is now deployed off the American Atlantic and Pacific Coasts, in the Barents Sea, throughout European waters, and in the seas of Northeast Asia. It provides

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important warning information to the U.S. Navy about Soviet naval build ups, and is also used to pinpoint enemy submarine locations for destruction.

In addition to SOSUS, the other major phenomenon of the late 1950s was the construction of the Air Force's "Big L" systems. These were the names of over a score of computerized command and control systems designed to accomplish a wide variety of tasks. Table 6-1 provides a selective list of some of the major ones.

TABLE 6-1
AIR FORCE "BIG L" SYSTEMS

<table>
<thead>
<tr>
<th></th>
<th>Name of System</th>
</tr>
</thead>
<tbody>
<tr>
<td>117 L</td>
<td>MIDAS (Missile Defense Alarm System), Satellite Based Missile Warning</td>
</tr>
<tr>
<td>416 L</td>
<td>SAGE (Semi-automatic Ground Environment), Air Defense</td>
</tr>
<tr>
<td>425 L</td>
<td>NORAD (North American Air Defense), Warning and Assessment</td>
</tr>
<tr>
<td>465 L</td>
<td>SACCS (SAC Control System), Status Monitoring of ICBMS and Bombers</td>
</tr>
<tr>
<td>474 L</td>
<td>BMEWS (Ballistic Missile Earning Warning System), Missile Warning</td>
</tr>
</tbody>
</table>

The stimulus for many of the "Big L" systems was the threat of intercontinental missile attack. In particular, the successful launching of Sputnik in October 1957 led American planners to take the threat of ICBM attack seriously for the first time. BMEWS (Ballistic Missile Early Warning System) consisted of large radars deployed in Alaska, Greenland, and Great Britain, along with a complicated system of rearward communication lines. They could detect Soviet missiles, and provide SAC and the White house with about 15-30 minutes warning of attack.1

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1BMEWS is described in Stanley L. Englebardt, Strategic Defenses (New York: Thomas Crowell, 1966), pp. 105-122.
Construction of the radars began in the summer of 1958, and the first radar (in Greenland) went into operation on December 31, 1960. The output of BMENWS consisted of radar estimates of the number of incoming Soviet missiles.

This information was coordinated with the output of the SOSUS program, and other warning and assessment information from SAGE, intelligence channels, etc., into the 425 L system, NORAD. NORAD was to be the principle information processing center which "fused" the outputs of other systems. Over the years this has indeed taken place, as most of the added command and control systems that had a warning or assessment function were built to supply information to NORAD. For example, in the late 1960s ABM tracking radars were connected to NORAD in order to supply information that could be processed and analyzed in comparison with indications of Soviet submarine, bomber, and missile activity.

The SAC control system, 465 L, was designed to rapidly provide the SAC commander with available information about the status of his forces. Prior to 465 L this information was collected and transmitted manually, mainly by voice over telephone lines from all the SAC bases to the central command headquarters at Offutt Air Force Base in Nebraska. By the late 1950s it was clear that this manual system would not respond quickly enough when there was only 15-30 minutes warning time. Furthermore as SAC operations expanded worldwide the amount of transmitted information grew disproportionately, effectively overloading the central command with status information. The 465 L system was also intended

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1Ibid., p. 118.
to control the SAC force, including the alerting, dispersal, deployment, and flight following for each aircraft and missile. The procedures for operating a bomber force described earlier made it necessary for SAC to move to a more automated command system because the complications of worldwide weather, electronic observation of enemy radars, and aerial refueling, all had to be solved in only a few minutes time, if SAC was to be optimized for attack.

BM EW S, SACCS, and NORAD were conceptualized in the late 1950s, but they actually went into full operation in the early to mid 1960s. The most important feature of these systems was the reliance on computers to process information. This requirement was necessary because of the extremely short flight times of the ICBMs. The information processing speeds of humans, unaided by machines was just too long, and too error prone to be of much use in the missile age.

Another feature of the "Big L" systems worth emphasizing is that they were all constructed to be soft targets. The point is worth clarifying because it is widely misunderstood today. The SAC Headquarters in Nebraska is built about 30 feet underground, and it might survive a hit from a high explosive bomb. It would not survive even a gross miss from a nuclear missile or bomber. The BM EW s radars in Canada, Greenland, and England are all large above ground metal structures. The most important BM EW s site in Greenland is supplied with electric power from oil fired generators aboard a ship in a nearby harbor, with the electric lines carried above ground on poles to the


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radar site. The NORAD processing center was, until 1965, located in above ground cinder block buildings in Colorado Springs. Nearly all of the communication lines connecting BMEWS to NORAD, and SAC bases to headquarters, were chosen to be AT&T telephone lines, which obviously were not designed for withstanding nuclear attack.

The philosophy behind the soft design was that the purpose of all of the command and control systems was to get warning of attack in order to launch SAC. In the 1950s, as described in the previous chapter, there were no plans to fight a limited or controlled nuclear war. War plans were written for a single massive salvo of weapons. The assumption in the United States was that the military command posts had no function after they launched their missiles. When proposals appeared to build NORAD headquarters in a hardened site, SAC actually opposed the plan as a superfluous waste of resources. The most important function of NORAD, in the SAC view, was to be blown up, for this would provide unambiguous warning of attack.

When NORAD was moved inside Cheyenne Mountain in 1965 it was still not hardened against dedicated attack. A bureaucratic battle between the Air Force and civilian planners, especially from RAND, arose over this. To the civilians, a truly hardened NORAD would be the first of a whole network of hardened command posts for SAC,

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1 Engelhardt, *Strategic Defenses*, p. 115.

2 This information comes from interviews with a designer of the 465 L system, and from RAND employees tasked in the late 1950s with studying NORAD designs.

3 Interview with former RAND project leader on the NORAD design problem.

4 Ibid.
other military commanders, and especially for the president. The RAND civilians wanted hard sites in order to wage limited nuclear war with protected leadership and control. It would be essential to have a headquarters that could provide orders, and conduct assessments in wartime, for this strategy to make sense. The RAND planners argued that NORAD should be built deeply beneath, not inside Cheyenne Mountain. They were overruled, and although NORAD was made harder than before, it was not built to withstand direct nuclear attack.\(^1\)

There appears to be a mistaken belief today that America's command and control systems were built for "nuclear warfighting," and were hard by the standards of the Soviet threat of the day. The logic of this argument seems to be that America's command system has failed to keep pace with the evolution of the Soviet threat. This may or may not be true, but the American command system has never been designed to withstand dedicated nuclear attack.

The mistaken view that America's command system was originally built to withstand direct Soviet attack illustrates another interesting manifestation of the complexity of this subject. The complexity of command and control systems has created an ambiguity over the history of its organization and what it was built for. Not only are the various command and control systems individually complex, and difficult for any one person to understand, but the history of their organization and development is equally difficult to comprehend. Consequently,

\(^1\)Ibid. The exact hardness of NORAD is classified, but it is probably somewhere around 500-700 psi. The RAND civilians in 1959 were arguing for a deep 10,000 psi structure. With Soviet tests in 1961 of 58 megatons it was clear that NORAD could not possibly survive even a close miss when it was finished in 1965.
this history is not easily specified or interpreted. What occurred, why it occurred, and whether it had to occur are all problematic, and understood by few persons.

The Search for Options, 1961-1967

Defense Secretary Robert S. McNamara's revision of American war plans required a number of important modifications to the command system. The new emphasis on limitation in attack, whether manifested in city-avoidance targeting or in the sparing of enemy command and control centers, demanded something far different in concept than a highly effective warning system wired to SAC. It first required a surviving national command authority (NCA) who would make decisions during a war. In the 1950s, the only real function of the president was to give a political release to SAC to use the force. But for flexible response, as the McNamara revisions were called, the president (or his political successor) would make decisions about which war option would be used first; and it was only the president who could engage in political negotiations with Moscow during the war. This bargaining did not actually require hardened communication between Moscow and Washington, because the means of "communicating" messages would be through the characteristics of the nuclear attack option selected.

The flexible response strategy did require surviving communication between the national command authority and the nuclear forces. It also required warning, reconnaissance, and damage assessment to determine what was going on. The necessity of this was described in Chapter 4.
One of the centerpieces of flexible response was the survivability of the nuclear force itself, so that it could ride out a Soviet attack. Many shortfalls in survivable warning and assessment could be compensated for by having a missile force so invulnerable to a first strike that decision makers would not be rushed to make irrevocable choices because they feared for its safety. Finally, flexible response required that civilians pay attention to war planning in peacetime, rather than delegating this problem to military experts. Increasingly, nuclear war planning would have to be done from the top down rather than the bottom up.

In the years of the early 1960s a number of command and control actions were taken to implement flexible response. In addition to the civilian involvement in war planning which led to the restructuring of war plans described in Chapter 5, there was a renewed emphasis on hardened missiles and hidden submarines as the backbone of the American strategic force, rather than emphasis on manned bombers. Bombers were viewed as less survivable and controllable than the new Minuteman missile, which was then coming into the arsenal. Consequently, the entire force of B-47 bombers was phased out by 1966, a force which numbered about 1200 when the Kennedy administration took office in January 1961. The remaining B-52s were maintained at a high state of readiness with about 50 percent on runway alert. Other B-52s,

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1Norman Polmar, _Strategic Weapons_ (New York: Crane, Russak, 1975), p. 54. Unlike the B-52, the B-47 was not easily operated on airborne alert, and was considered less survivable because it had to be maintained on runway alert. During the 1962 Cuban missile crisis B-47s were dispersed to many civilian airfields, including Logan Field in Boston.

fully armed with nuclear weapons, were kept on airborne alert beginning in January 1961.\(^1\) Airborne alerts were reduced in 1966 because of improvements in radar coverage of the Soviet Union, and were eliminated altogether in 1968, when a B-52 loaded with H-bombs crashed in Greenland.\(^2\) Along the same lines of reducing dependence on vulnerable bomber forces, the soft Jupiter and Thor missile squadrons in Britain, Italy, and Turkey were removed by 1963.\(^3\)

The concept that all missiles would not immediately be launched at the outset of conflict led to a redesign of the Minuteman control system. Originally, Minuteman was designed to fire only in blocks of 50 missiles at a time, reflecting the perceived importance of early massive attacks on the time urgent alpha targets. In 1961, Minuteman was provided with a selective launch capability.\(^4\) Other measures undertaken at this time included the SAC airborne command post, an aircraft constantly maintained aloft to guarantee that a Soviet surprise attack would not cripple American authority to issue retaliation orders. The SAC airborne command post is usually interpreted as a hedge against surprise missile attack, rather than as a part of flexible response. But it fit into the new flexible response strategy

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\(^3\)The precise timing of this was mixed up by the Cuban missile crisis, see Barton J. Bernstein, "The Cuban Missile Crisis: Trading the Jupiters in Turkey?," *Political Science Quarterly* 95 (Spring 1980): 97-125.

because it guaranteed that SAC could be launched even after a direct attack on the SAC underground command center. This concept of an "alternate" command post, to take authority upon destruction of a "primary" command post (such as SAC underground), became the key to ensuring that the more complicated flexible response strategy could not be trumped by a Soviet attack on the American command system. This subject will be detailed in the following section.

The Moscow-Washington Direct Communication Link (the so-called "hot line") began operation in 1963 as did construction of NORAD Headquarters in Cheyenne Mountain.\textsuperscript{1} Furthermore, plans were drawn up for a large buried transmission line system to use extremely low frequencies (ELF) to talk with submerged SSBNs.\textsuperscript{2} Known as Project Sanguine, it was later canceled, but was indicative of command and control programs started in the 1960s.

Creation of a means to tie together the growing number of warning, assessment, and command systems, and to integrate them with other defense and civilian communication networks also took on momentum in the 1960s. There were many purposes behind this, but certainly one of the major ones was the conviction that centralized political control of the nuclear forces was essential for flexible response, and that only through an integration of the different information


\textsuperscript{2}\textit{"Command and Control of the Sea-Based Nuclear Deterrent: The Possibility of a Counterforce Role," in SIPRI Yearbook 1979 (Stockholm: Stockholm International Peace Research Institute, 1979), p. 401.}

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systems could this centralization be achieved. Another reason was the common sense one that a better appreciation of events could be obtained if information from many sources could be assessed all at once, providing a more complete picture of what was happening. In a sense, this integrative step was inevitable, because the armed services were developing such large information processing systems like SAGE, 465 L, BMEWS, NORAD, and SOSUS that they cried out for integration. The expenditures for the individual systems were so large, and their competing demands on AT&T so great, that policy direction for them became essential. Although some system integration was evident with NORAD, the creation of the National Military Command System (NMCS) for defense, and the National Communication System (NCS) for other government communications were steps that fused together individual communication and control systems of vast complexity.

One of the principle motivations for NCS was the Cuban missile crisis, where the necessity of tight central political control of the military was learned. At the time of the Cuban crisis, President Kennedy was unable to notify South American ambassadors of his proposed actions because the State Department communications system literally broke down. Moreover, when the ambassadors were informed, after action was taken, they were unable to notify their governments because of bottlenecks in the communication lines between North and South America. The NCS was created by an executive order in 1962 to exploit

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1 And was applied, disastrously, in Vietnam.

all available civilian communication systems in the United States, such as AT&T and ITT, for emergency purposes. The American communication system is itself enormously redundant, and the availability of many potential channels for the NCA to communicate with the military or with foreign allies via international channels, gave the president the physical means to control American and allied military operations, regardless of his location, and even under conditions where considerable amounts of communication had been destroyed in attack. The procedures for using the NCS in this kind of emergency are among the most highly classified secrets possessed by the American government.

The NMCS was also created in the early 1960s, and forged together in one system the network of airborne command posts, Minuteman, and Polaris command systems.¹ This was to be the key portal through which a president could exercise command of all of the nuclear forces. It was essential, given the doctrine of flexible response, to have an avenue for centralized political control of the military, and this was NMCS. Eventually, the concept of the World Wide Military Command and Control System (WWMCCS) evolved later in the 1960s as the system that would tie together the NMCS with all other military command systems.² The NMCS is the means by which the NCA interacts with the nuclear forces and essential intelligence and support agencies. WWMCCS ties together NMCS with the remaining universe of military command and control.

WWMCCS has had an enormously complicated history, and is replete with truly major failures in its implementation, yet the concept of a network that ties together all of the many pieces remains unchallenged. By 1967, this policy thrust toward centralized control of the nuclear arms, and more broadly, for crises management operation of all military forces was taking on momentum. Yet other forces were at work as well, pushing for a very large expansion in the number and capability of the underlying information systems.

System Expansion, 1967-1977

Many of the command systems deployed between 1967 and 1977 were described in Chapters 2 and 4. A full description of activities in this period would be a monumental task and only an overview will be provided. The Soviet missile threat, exceedingly primitive in the early 1960s, gradually expanded by the late 1960s, and surpassed in number of missiles those of the United States force in the early 1970s. Also, with the deployment of the Yankee class SSBNs, the Soviets possessed a modern high performance SLBM force. These two developments placed renewed value on warning, at first to protect the B-52 bombers and soft command and control centers, and later to protect SAC's Minuteman force.

Bombers needed warning for survival so that they could fly away from targeted areas. The Soviet Yankee submarines were first built in 1968, and in 1970 there were reported to be ten Yankee-class submarines at sea.¹ Since 34 Yankee-class submarines were eventually built when the program ended in 1974 it is reasonable to assume that

¹Polmar, Strategic Weapons, p. 50.
about 16 operated in 1971, and about 22 in 1972. With this many SSBNs the Soviets had the ability to continuously station SLBM forces off the Atlantic and Pacific coasts of the United States, and this is precisely what they did. From these positions, armed with their SS-N-6 missiles with a range of 1200 miles they could threaten targets deep in the interior of the country, and more importantly could threaten the major command and control sites in the Washington, D.C. metropolitan area. Depending on firing distance and trajectory, a missile from an offshore Yankee could strike Washington in about 300 seconds. Interior SAC air bases, or other targets, could be struck in 420 to 445 seconds. This compression of time completely changes the nature of command and control, and we would estimate that somewhere around 1971, the American design for command of nuclear war no longer made any sense. Beginning about this time, enormous stresses were put on the system as a whole, and most especially, on the people in the command.

Throughout the late 1960s and early 1970s there was a concerted attempt to manage the SLBM warning problem. In 1971, warning satellites possessing infrared detectors were first placed into orbit. This program was known as the Defense Support Program (DSP), and it offered considerable advantage for all kinds of missile warning. ICBMs or SLBMs could be detected shortly after launch from the heat of their boost plumes. This increased ICBM warning time to almost


2This is substantiated in several interviews with retired Air Force officers.
30 minutes, but the short flight time of SLBMs fired near the U.S. Atlantic coast still presented major problems, because even if detection occurred immediately after launch there were still only about 300 seconds left. Special SLBM radars known as FSS-7s were built along the U.S. east and west coasts to give the best warning possible. This information, along with that of the DSP satellites, was provided to NORAD and other command centers.

The automation of intelligence developed greatly in this period. In the early 1970s the United States was extensively listening into many parts of Soviet military communications, and this provided even more warning of attack. Special ferret, telemetry, and photographic satellites flew over Soviet territory, providing enormous amounts of information. Although useful for general intelligence and verification of arms control agreements, it undoubtedly had direct military functions as well. The Holystone program (described in Chapter 2), for example, apparently tapped into undersea Soviet telephone lines. Other technical intelligence systems monitored millions of Soviet military radio and radar transmissions, and organized them according to predetermined subject specifications. No one, probably even no one inside the government, has a very good overview of the many technical collection efforts that go on because of the security and strict compartmentalization that surrounds these programs. In particular, the highly secret National Security Agency (NSA) became one of the largest intelligence organizations, filtering and processing

[1] The FSS-7 radars are being replaced in the early 1980s with the new Pave Paws phased array radars.
information from all over the world to military and civilian commanders in the United States.

The flood of information generated by the many sensors and the speed with which it had to be processed, forced a much greater reliance on computers. During the period "data fusion centers" began to appear. These were centers where information from diverse sources was synthesized by computers. For example, the U.S. Navy's ASW effort at sea became linked with computers ashore, vastly improving its ability to locate Soviet submarines.¹

Outside of intelligence, the Navy began its TACAMO (for "take charge and move out") aircraft flights to provide an airborne communications relay between SSBNs and ground stations. TACAMO represents a key last ditch means for sending firing orders to the submarine force. For the ICBMs, there is the last ditch emergency rocket communication systems (ERCS). This is a rocket borne transmission package that beeps a formatted message ordering surviving forces to fire.

Support of all of these new systems required major expansion in satellite communication systems. The Fleet Satellite Communications System, for example, was built to tie together the Navy's ASW destroyers, undersea sensors, shore-based computer facilities, and towed acoustic sensors. Exchange of information is done in near real time.² Meteorological satellites feed information into this system to increase knowledge about sea conditions, and other ground-based radars and cameras warn American fleets to shut off their radars when

²Ibid., p. 35.
a Soviet satellite is about to pass overhead. The command systems have become incredibly complex, because ASW is only one activity of many that are constantly in process, all feeding information to command posts and to each other.

The maturation of the Soviet threat in the 1970s has greatly compounded the problems of command and control. American efforts to offset Soviet nuclear expansion with improvements in force management clearly fell behind in the race. The Soviet nuclear expansion was able to threaten our command and control much more quickly than protective countermeasures were possible. For example, one American response to the threat of SLBM attack on Washington was development of the National Emergency Airborne Command Post (NEACP), a converted Boeing 747 aircraft fitted with special electronic equipment. It is intended to carry the president and other leaders aloft so they may escape destruction from incoming missiles. But how could a president get out of the White House and into an airplane, and have the airplane take off, in only about four minutes?

As another example, in 1968, the planned Sanguine system to talk to submerged SSBNs would have required one-third of the Soviet nuclear warhead inventory for its destruction. But by 1978 the system could have been destroyed with only a tiny fraction of the Soviet arsenal. Indeed by the late 1970s the Soviet Union was gaining the ability to destroy directly the backbone communications system of the American nuclear forces: the Bell telephone network. There are only about 1,200 long distance switches in the U.S. which interconnect the long

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distance Bell telephone network. These are completely vulnerable to attack from blast, radiation, and heat. The failure of any significant part of the Bell network would paralyze the entire military and civilian communication apparatus of the United States.

Additionally, in the late 1970s a full appreciation of nuclear weapon effects was beginning to make itself felt. In particular, electromagnetic pulse (EMP) was recognized as a source of destruction for electric power grids and communications networks. EMP has been extensively discussed elsewhere, but suffice it to say that five or six high altitude bursts over the United States could knock out simultaneously the electric power grid and communications system of the nation. Although the physical principles underlying EMP had been understood for over two decades it is only recently that the educated public, including Congress and the Executive branch have appreciated the implications of these exotic nuclear weapon effects. What is remarkable is the extent to which discussions of nuclear strategy in academia and within the government have advanced independent of such facts. Although EMP is now appreciated as a major problem, no one quite knows what to do about it, because of the immense cost of shielding the power and communication systems affected.


Command and control has always been a stepchild to the more visible weapon programs it is intended to support. And a reasonable case can be made that fundamental decisions for providing a command system with the capabilities to carry out American war plans have never really been faced up to. In a recent Ph.D. dissertation by Bruce G. Blair at Yale University just this argument is developed in an especially persuasive way. Blair analyzes the many pieces of the American command and control system, and demonstrates that there are serious vulnerabilities contained in them. These are both of a physical nature, and more importantly, of a human institutional character. Airplanes are not protected against EMP, antennas at missile sites cannot survive blast effects, communication procedures for coordinating geographically dispersed forces have not been worked out under realistic conditions, and emergency electricity supplies are unavailable for major command centers. The list of failures is long, and indeed so overwhelming that serious doubts are raised that a step by step fix up program would ever get the command system into a position where it could enforce the sophisticated war plans that have emerged from the limited nuclear option studies of the 1970s, or the PD-59 policies of 1980.

The command and control deficiencies catalogued by Blair parallel many of the shortcomings described in earlier chapters of this book. But we will argue here that until the mid 1960s many of these deficiencies had been recognized, and factored into the command organization's

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2 Bruce G. Blair, "Headless Horseman of the Apocalypse, Command and Control of Strategic Forces" (Ph.D. dissertation, Yale University, 1982).
procedures for war. The complexities, potential for confusion, and vast uncertainties posed by a nuclear attack were not "solved" in the sense of actually resolving them, but rather procedures matched to the environment were developed so that work-arounds were possible, and one could reasonably speak of a match between strategy and command structure. We argue that after the late 1960s a series of mismatches developed that have continued to the present time.

The logic of this argument is simple, but the details are complicated. A schematic overview of it is given in figure 6-1. At the broadest level of description, we make a case which goes beyond a simple characterization which states that command and control has never been treated adequately, and has always been subservient to the weapons themselves. This would be our description of the conclusions developed by Bruce G. Blair. The conclusion is sometimes an accurate description of affairs, and sometimes not. Since the failure to adequately consider command organization is thought to have important strategic consequences it is important to be as clear as possible on the relationship of American nuclear strategy and the command organization built to carry it out. John D. Steinbruner, for example, concludes that failure to consider the details and shortfalls in command and control, as identified by Bruce Blair, probably means that even a small use of nuclear weapons would rapidly escalate into all-out, uncontrollable exchanges. With such important implications as this riding on the analysis of command and control, it behooves us to appreciate that simple descriptions of the relationship of strategy

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FIGURE 6-1

SCHEMATIC OF STRATEGY, STRUCTURE, AND PERFORMANCE RELATIONS FOR THE AMERICAN COMMAND SYSTEM

LATE 1950s

STAGE 2 STRATEGY
STAGE 2 STRUCTURE

ADOPT STAGE 3 STRATEGY IN 1961

MISMATCH IN 1961

STAGE 3 STRATEGY
STAGE 2 STRUCTURE

MONOPOLY OF NEGOTIABLE ENVIRONMENT?

NO

RETAIN MISMATCH
PERFORMANCE DECLINE

YES

CHANGE TO STRUCTURE 3

1965

PERFORMANCE RESTORED
STAGE 3 STRATEGY
STAGE 3 STRUCTURE

MONOPOLY OF NEGOTIABLE ENVIRONMENT?

YES

PERFORMANCE ADEQUATE

NO

ADOPT STAGE 4 STRATEGY IN 1974

LATE 1970s

PERFORMANCE DECLINE

ATTEMPT TO CHANGE STRUCTURE, e.g. PD-58

NEGOTIATE ENVIRONMENT e.g., SALT

ADOPT STAGE 5 STRATEGY e.g. PD-59
to command structure are incapable of capturing the dynamic evolution of the American command system, and thus they cannot hope to clarify approaches to command redesign and change.

As illustrated in figure 6-1, in the 1950s there was a congruence between strategy and command structure. We have denoted the nuclear strategy of the 1950s as stage 2 strategy, and the command organization as stage 2 structure. The stage 2 strategy was described in the preceding chapter, and consisted of plans for all-out attack of Soviet targets, codified as alpha, bravo, and delta targets. The stage 1 strategy of the United States is not shown or discussed here, but it refers to the 1949-1952 era when stockpiles of weapons were relatively small, and direct presidential control of atomic weapons was correspondingly great. The stage 2 command structure of the 1950s around (and over) the Soviet Union, and in a network of ground emphasized warning of Soviet attack, and was manifested in the DEW and Pinetree Lines, intelligence flights and undersea (SOSUS) listening posts.

The greatest possible failure of stage 2 American nuclear strategy could have arisen from either an unexpected Soviet attack that crippled SAC on the ground, or through a surprise attack that did not allow America to destroy the time urgent alpha targets, such as long range air armies, medium range missiles, and submarines in port. Consequently, the stage 2 American command structure emphasized warning, both of a short term tactical nature as with the DEW and Pinetree Lines, and of a longer term strategic nature, as with listening posts and aerial reconnaissance overflights. It was essential to get advance information on early preparations for war so that SAC could strike at the earliest practical moment.
Two features of the stage 2 command structure that were not considered essential for implementing the stage 2 strategy were a hardened command system and a detailed control mechanism for employing the nuclear forces. A hardened command system wasn't required because there was no need for the command system to do anything but get the war order to the forces. After it had accomplished this mission its existence was superfluous. There was reluctance to actually admit openly that the command system had no function but to launch SAC once and for all, but the operative system built did just this. And those planners who argued for a hardened command system were disappointed at the designs forthcoming. For example, one internal RAND Corporation report on the subject in 1960 lamented "Since present plans do not envision adequate protection for the Big L systems it is relevant to ask whether it might not be better to abandon all attempts at protection and simply accept the fact that the systems will be disabled by the first wave of enemy bombs."\(^1\) The planning of NORAD especially brought the dispute between civilian planners and the Air Force to a head, with the Air Force eventually winning the argument against truly hardening the sites.

Since the strategy of the 1950s was to attack with all weapons at the outset of conflict, there was also no need to have a command system for exercising detailed control. The war plan was simple and massive, and this translated into a simple control system unburdened by the need for detailed coordination procedures exercised by civilians.

\(^1\) J.B. Carne, "Protecting Big L Systems--Should We Do More or Are We Doing Too Much?," RAND Corp., D-7279, March 1960, p. 3.
The coordination needed in attack was achieved through standard operating procedures of the military, practiced endlessly in drills and exercises. Civilian control merely "released" SAC to wind through its well rehearsed war plan. It is worth emphasizing that the enforcement mechanism of the stage 2 strategy of the '50s was procedural, and not technological; it relied on people taking specified actions, rather than on hardware.

The conclusion from this description is that in the 1950s there was a match, or fit, between nuclear strategy and command structure. This is not to say that the particular strategy would have "worked" in the sense of avoiding surprise and destroying time urgent Soviet targets early in a war. This will never be known. Nor can we say that in a crisis the stage 2 strategy would have been selected by the president. The president could have attempted to switch strategies at the last minute, however difficult this would have been because of command structure constraints. Nonetheless, we can say that congruent relationship existed between strategy and structure. This alone invalidates the thesis that command and control issues have never been treated seriously. In the 1950s, they were treated seriously in the only way that is meaningful, to implement the strategy then in effect.

Changes in strategy introduced in 1961, known as flexible response, by Defense Secretary Robert S. McNamara, created a mismatch between nuclear strategy and command structure. Flexible response required centralized political control of the forces both before and during a nuclear war. No longer would a simple release of authority to SAC meet the requirements laid down in national strategy. The command
system was now required to survive attack, and mechanisms were needed so that detailed presidential control could be enforced.

The main command structure problem in 1961 facing the McNamara group in the Pentagon was not so much to conceptualize and design a command and control system for flexible response, as it was to take a very large and expensive command system which they inherited and to turn it around to support the new strategy. These are very different problems. In 1961, the Big L systems, SOSUS, Pinetree, BMEWs, and others were already partially complete, or well along in construction. Furthermore, the basic decision to use the Bell telephone network for strategic military communications had long since been made. The cost of discarding the command and control system inherited from the 1950s in favor of a totally new one designed for flexible response would have been astronomical, and would have required many years to construct.

The decision was made to use the physical and technical apparatus inherited from the 1950s, but to reorganize control policies for flexible response. In other words, major changes were made in tactics, procedures, and operating rules, and only minor changes were made in hardware. The whole endeavor was exceedingly subtle, and ranks as one of the most clever examples of managerial thinking in American national security history.

The basic problem defined by the McNamara group in the early 1960s was the need for centralized political control of the forces, while at the same time recognizing the inadequacies of this kind of control. The dilemma can be illustrated with some simple diagrams. The ideal command structure for the nuclear strategy of the early
1960s is shown in figure 6-2. Here, outlying nodes represent nuclear weapons. All are centrally connected to a presidential command center, and each weapon could be launched only by direct presidential orders. Control in this network is as centralized as is physically possible. Detailed management of the nuclear forces is maximized, and in principle, the possibility for engaging in elaborate wartime negotiating with the enemy is considerable.

The deficiency of the centralized command system built along the lines shown in figure 6-2 is quite obvious. The entire control system can be disabled by a single enemy nuclear weapon fired at the central presidential command center. Paralysis of the retaliatory force would result, and this form of command system is just too vulnerable to attack to ever be a credible deterrent. An additional failing of this type of structure is that it places detailed military control with the civilian leadership, a leadership which is unlikely to have either the information processing abilities or the management and technical background needed to perform this function. Moreover, as the size of the nuclear force grows, as measured either by the number of launchers or warheads, the span of control of the central command grows excessively. For example, although it is difficult for a central presidential command center to manage a nuclear exchange involving a few hundred weapons, it strains common sense to believe that an exchange with several thousand weapons could be managed in the same way. The only way out of this problem is to organize the command organization away from fully centralized control, and the only real way to do this in a world where military organizations are responsible for security is to structure the nuclear command so that it meshes
FIGURE 6-2

A CENTRALIZED COMMAND SYSTEM
with the innate organizational hierarchy found in the military. As a practical matter, the absence of hierarchy in figure 6-2 means that information overload would swamp the decision making process.

For these reasons, and also because a very expensive physical command and control system had already been started in the '50s, the McNamara idea exploited the more decentralized concept illustrated in figure 6-3. The drawing is not meant to be a faithful depiction of an exact system, but is rather intended as illustrative of the design philosophy selected, in this case, for the National Military Command System (NMCS). Presidential control of the nuclear forces would be exercised through a small number of primary command centers, and from there to secondary centers such as supporting command centers or actual nuclear weapon units. It was a structure that matched the hierarchical organization of the American military, providing layers of administration for concentration of expertise. In particular it closely fit the post World War II military structure codified by the National Security Act of 1947, as amended by the 1958 National Security Reorganization Act.

Briefly, the National Security Act of 1947 created the office of Secretary of Defense and provided for the creation of joint combatant field commands. The law substantially moved the nation toward centralized civilian control of the military by reducing the bureaucratic

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1 Allowance was made for two kinds of field commands in this Act. A unified command is composed of two or more services, while a specified command is composed of only one service. There are at present five unified and three specified commands, of which five are especially relevant for nuclear deterrence: Strategic Air Command (SAC), North American Aerospace Defense Command (NORAD), European Command (EUR), Atlantic Command (LANT), and Pacific Command (PAC).
FIGURE 6-3

A DECENTRALIZED COMMAND SYSTEM

- PRIMARY COMMAND CENTERS
- SECONDARY CENTERS
power of the military departments. The Reorganization Act of 1958 removed operational control of the field commanders from the military departments and service chiefs, further increasing direct civilian control of the military. The key idea in the McNamara command revisions of 1961 and 1962 was to identify the nuclear relevant commands as the primary command centers illustrated in figure 6-3. They would exercise direct control over nuclear forces (including warning and intelligence sensors) from their individual command centers, and would report to the presidential command center. Civilian control would be enforced through a direct link between the president and defense secretary, and the unified and specified commands. Presidential control of nuclear weapons was decentralized compared to figure 6-2, but there was a centralization of authority over the combatant commands greater than in the 1950s because of the direct linkage to the presidential command site. This was, of course, the centralization needed to carry out the McNamara stage 3 nuclear strategy of flexible response developed in 1961.

Before a description of why the National Military Command System developed in the early 1960s was less vulnerable to nuclear attack than a fully centralized control system a digression on the subject of communications is in order. The structure of the NMCS is as suggested in figure 6-3. Primary command centers could be thought of as SAC in Nebraska, EUR in Germany, LANT in Virginia, PAC in Hawaii, and NORAD in Colorado. The presidential command center might be thought of as in the White House, or at some alternate location. By 1961 it was clear that warning of attack might be on the order of 30 minutes, and also, the possibility of enemy attack while the
president was out of the Washington, D.C. area had to be reckoned with. So the need for alternate presidential command sites was quite apparent.

A reliable way to establish communications between the president and at least some of the primary command centers was essential. Furthermore, in the early 60s the size of the theater nuclear forces in Europe was growing as described in Chapter 3. Significant additions were being made to the British and French strategic forces and shared "dual key" nuclear weapons were installed on the homelands of most NATO countries. Many of these weapons could strike Moscow, and so their employment had to be coordinated with the American SIOP if the flexible response strategy of stage 3 was to have any practical meaning. Centralized political control would also necessitate that the president be able to immediately communicate with the British Prime Minister, the Canadian Prime Minister, and other NATO leaders to coordinate actions, and if necessary, obtain permission to use nuclear weapons on or over their territories.

A communications system for the president would also have to be sufficiently capable of creating the expectation among unified and specified commanders, as well as NATO political leaders, that it would neither collapse nor lose control after the first few nuclear shots were fired. This is an important point. Communications would not only have to work in conflict, but would have to convince military commanders ahead of time that it had a reasonable chance of survival. This was a sharp difference in design philosophy from the 1950s. If military commanders expected the system to break down, they would be highly likely to interpret any brief disruption in command as resulting
from all-out attack, necessitating a response in kind. Political control would then be all but impossible.

The response to the many needs for survivable presidential communications was to exploit the most redundant, geographically dispersed communications system ever built by man: the American telecommunications network, and especially the Bell telephone system. This philosophy was codified in an executive order in 1962 which created the National Communications System (NCS). Although NCS technically consists only of U.S. Government communications assets, such as those operated by Defense, State, Commerce, Treasury, and other agencies, the fact of the matter is that the great majority of these are based on the Bell network. Consequently, NCS integrates government communications with the highly redundant civilian system.

The exact details of how the president would communicate with the nuclear forces, and foreign allies, is naturally enough shrouded in secrecy. Most likely there are many such ways. In the late 1950s AT&T proposed that its existing and planned automatic switching centers be used for critical military communications. The great redundancy of the Bell network would allow communications from almost any point in the United States to any other point, and it would do so even after

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major communication centers were destroyed by nuclear attack. By routing essential messages over the automatic switching net, any destroyed communications centers in cities could be bypassed automatically, as the system searched for a route connecting the caller and the station sought. This would be, in effect, a "self-healing network" because destroyed elements in it would be replaced by alternate paths around the neutralized junction. Figure 6-4 shows the idea behind such a distributed network. There are many paths connecting any two nodes, so that even if many nodes are destroyed there is reasonable prospect that communications will be established. The idea could also be applied to transatlantic communications in order to bring NATO leaders into the system. In conjunction with the less elaborate radio and telephone network owned by the government, the entire system would offer a great amount of flexibility for presidential communication. There are some defects to this design philosophy, which need not be detailed here, but we can only admire the cleverness of the overall approach.¹

The remaining feature beyond reliable presidential communication that needs description has probably already occurred to the reader. The relatively small number of primary command posts in the decentralized command structure of figure 6-3 mean that these major centers could be destroyed by direct attack, paralyzing the retaliatory nuclear force. At first sight, the decentralized system of figure 6-3 is

¹Ibid. The AT&T system is not, strictly speaking, a distributed network. It is more hierarchical in nature, and there are certain sets of critical nodes. Nonetheless it contains many ports that allow communication between arbitrary points, and is more distributed than point to point military communications that do not use the AT&T system.
FIGURE 6-4

A DISTRIBUTED COMMUNICATIONS SYSTEM
only marginally more survivable to attack than the fully centralized command system. Even in 1962, this was not an undue additional targeting burden on the Soviet nuclear forces.

The resolution of this dilemma was through the control procedure of the presidential command center. Its function was not so much as a direct trigger to launch nuclear weapons, as it was a safety catch preventing the trigger from firing. The primary command centers served as the direct triggers, but their ability to fire was constrained by the viable functioning and survival of the presidential command center.¹ If the safety catch of this system were destroyed, direct operational control would devolve to the primary command centers, in effect, the unified and specified commands of the NMCS.

Such a devolution of control raises the hazy subject of just who can pull the nuclear trigger. The American government has never offered official details on this subject, other than to assert that only the president is authorized to order the use of nuclear weapons. However, despite the absence of official evidence it seems clear that a literal interpretation of this statement is not possible. On a common sense basis, it would make the entire American arsenal vulnerable to paralysis from attack by a handful of nuclear weapons. Moreover, there have been many unofficial reports describing the nature of who has this authority. Since it is absolutely basic to the command

¹This description is also expounded in Thornton Read, Command and Control (Princeton, N.J.: Center for International Studies, Princeton University, 1961). The collaborators of this particular report included those who later worked on the McNamara redesign of the American command system, including Thornton Read, Daniel Ellsberg, and Herbert Benington. Daniel Ellsberg had an especially intimate role as described in Ball, Politics and Force Levels, pp. 190-197.
restructuring of the early 1960s for providing a set of triggers controlled by a centralized safety catch, some details will be provided.

The need for emergency authorization, or predelegation, to use nuclear weapons was reported in 1957 to the Joint Committee on Atomic Energy Commission.\(^1\) The basis for exercising such authority was to be presidential incapacitation or the breakdown in communication during an emergency.\(^2\) In October 1958 a former commander of NORAD, General Earl E. Partridge in a newspaper interview told that he also had been given certain emergency authority to use nuclear weapons.\(^3\) Apparently the reason behind these measures was the conviction that there might be no president surviving if the United States absorbed the first blow in a nuclear war.\(^4\) In 1964, Gen. Lauris Norstad, then a former commander of American forces in Europe, broadly hinted in an interview that he also was given such power by President Kennedy.\(^5\)

In 1977 Daniel Ellsberg asserted that such predelegated authority had been given by Presidents Eisenhower, Kennedy, and Johnson.\(^6\) As mentioned earlier, Ellsberg was in an intimate position on these matters. He stated that the authority had been given to the "six or seven 3-

\(^2\) Ibid.
\(^3\) "Just Who Can Push the Button?" *Philadelphia Inquirer*, August 19, 1981, p. 15. See also footnote 5 below.
\(^5\) Ibid., pp. 47-49. This citation also reprints the original interview of General Partridge from 1958.
and 4-star generals," and this could only correspond to the unified and specified commanders.¹

We are less interested in the existence of such predelegated authority than we are in its structural form in matching the decentralized command system devised in the early 1960s to implement the stage 3 nuclear strategy of flexible response. Perhaps the most articulate reasoning behind the necessity of such predelegated nuclear authority was given by General Nathan F. Twining in 1966. General Twining was a 4-star Air Force general, and former Chairman of the Joint Chiefs of Staff. As such, General Twining was clearly in a position to speak with some authority:

How will the President, upon whose shoulders rests the ultimate decision, elect to exercise his ultimate authority over the control of rifle fire, mortar fire, fire from ships at sea, fire from aircraft, and nuclear fire power, however delivered?

In terms of basic logic, it would appear that he has only three options:

1. The President can shut his eyes and hope that nothing will happen.

2. He can maintain personal (and detailed) control at all times, making no provision for national response in event of massive damage to the seat of government.

3. He can predelegate authority to be exercised under certain grave circumstances.

With respect to the first option in terms of logic, no Chief Executive could be so derelict in his duty. With respect to the second, the chief executive would be inviting an enemy attack if the enemy knew that the United States would be paralyzed by the delivery of only one nuclear weapon on the seat of the government.

¹Ibid.
On the basis of just plain common sense, therefore, it would appear that the third option—predelegation of authority to take military action in event of certain circumstances—can be the only valid solution to military fire control. This option might assume, of course, that so long as the President or his successor is alive and the government continues to function, that personal and detailed control would be maintained at White House level. But, if the nation were under attack, and there was no Washington, D.C. left, America could fight back rather than die with its own powerful force immobilized.

In summary, it was a formal existence of predelegated authority to use nuclear weapons that protected the command system shown in figure 6-3 from attack of its command and control centers. The presidential center served as a safety catch, holding back the nuclear triggers embodied in the primary commands, corresponding to the unified and specified command centers. The primary command centers were themselves protected from attack by a further devolution of nuclear use authority, and each one possessed a mobile command center that could launch the nuclear forces under the primary command's authority. The function of these alternate commands, be they airborne or in some hidden location, was to ensure that official predelegated orders would be issued even in the event of a massive attack of the American command structure.

It is worth emphasizing that the manning of the alternates of the primary commands are necessarily lower in the organizational hierarchy than are the commanders of the primary sites. Thus, for example, the SAC alternate command post is the "Looking Glass" aircraft, manned at all times by a one or two-star SAC officer, whereas CINCSAC himself is a four-star officer. Consequently, a Soviet

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attack on the American structure, under a stage 3 strategy and structure, would very rapidly decentralize nuclear authority away from the White House to, at least, a dozen or more one and two-star officers of the unified and specified commands. Given the hierarchical organization of the military it seems very plausible that authority would devolve even further from here, cascading downward as the military feared that its retaliatory power would be paralyzed.

What is critical here is the dynamic nature of the authority, so that it is improbable that, for example, individual ICBM launch crews would ever be given such authority. Rather, as an attack developed, authority would be diffused downward through the organization through a layer of top and middle management. Individual weapon crews would probably never know whether they were working from direct, or predelegated presidential orders.

It is this propensity for cascading authority that deters Soviet attack on the command structure, because any such attacks will not only induce a spread of nuclear use authority, but will induce it downward in the organization. Here, the Soviets would face a nuclear war system that gave all appearances of going beserk, and of being impossible to negotiate a war termination agreement with. But this is not considered a defect under the stage 3 strategy of flexible response, because this strategy depends on a surviving NCA, so that if the Soviets attempted to destroy the NCA they would thereby signal their unwillingness to engage in the sophisticated bargaining envisioned by the strategy. In the literature that enunciated the strategy-structure relationship in the 1960s, a Soviet attack on the American
NCA was even called the "anti-game" strategy.\(^1\) It was an apropos term. For flexible response required adherence to certain "rules of the game" as far as nuclear exchanges were concerned. An attack on the negotiating units themselves, the seat of government, violated the rules of the game, and was hence termed an anti-game strategy.

The changes undertaken to transform the American command system from stage 2 to stage 3, and hence capable of executing the stage 3 strategy of flexible response, blended together an understanding of the hierarchical organization of the military, the need for civilian inputs to war planning, and an appreciation of the architecture of the civilian and military communications systems. Moreover, the transformation was managed without radical, and costly, physical restructuring of the command and control systems inherited from the 1950s.

The obvious core question to ask is, would it have worked in the sense of the term used here? This is a hard question, to which a definitive answer can never be given. However, based on the changes that were made, and equally important, the scale of the problem, we believe that it would have "worked," in the sense of providing a fit with the stage 3 strategy. In 1962, the American arsenal consisted of about 4,000 strategic warheads, compared to only 400 for the Soviets.\(^2\) Of these 400 only about 40 were on ICBMs, and these were of dubious reliability. The numerical warhead advantage held by the United States,

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\(^2\) Based on author's calculations from data in Polmar, Strategic Weapons, p. 46.
and the hardened second strike forces it possessed, were sufficient to avert wholesale nuclear preemption. In a wartime or near war crisis, America effectively monopolized the negotiating environment, indicated in figure 6-1. This gave the U.S. considerable latitude in changing over its command structure from stage 2 to stage 3 in the early 1960s.

This is not to say that a nuclear war would have remained limited to counter-military targets at this time. Rather, the changes in command structure were compatible, or congruent with this strategy. Uncontrollable escalation, or presidential selection of fundamentally different strategies, could have occurred for many reasons. Nonetheless, the command changes undertaken, assisted by America's nuclear superiority, conformed to the strategy of flexible response. This is no small result, because nuclear superiority alone, without the stage 3 command structure, would have probably meant that any nuclear exchange was unlimited in ultimate scope. It was this possibility that the McNamara group decided to change, and we believe, did so with success. And it is precisely this difficulty of deploying thousands of additional warheads without modernization of the command structure, that followed after the McNamara tenure, and has led the current situation.

Following the fit between strategy and command structure established in the early 1960s there occurred a substantial build-up of Soviet strategic forces. By 1966 they had deployed over 250 ICBMs, and by 1974 they totaled 1,570.¹ In addition, the Soviets added 44 modern nuclear weapon firing submarines over this same period.² The

¹Ball, Force Levels, p. 58, and Polmar, Strategic Weapons, p. 82.
²Ibid., p. 86.
effect of this was to remove the American negotiating monopoly over its environment, something that existed until the mid to late 1960s. The American reaction to this build-up was described in the previous chapter, and culminated in the limited nuclear options ordained by Defense Secretary James R. Schlesinger in 1974. As described in detail earlier, these were an attempt to match or exceed the Soviets at any level of escalation, and amounted to carrying the political bargaining model of nuclear exchange to its ultimate form of perfection. This will be called the stage 4 strategy, as seen in figure 6-1.

Besides the actual targeting revisions written into war plans in the mid 1970s, very few coordinated changes were made in the command structure that would be tasked with carrying out the stage 4 strategy. Warning satellites were deployed in 1971, to detect launch of Soviet ICBMs and SLBMs. And some retargeting computers were installed into the most modern Minuteman missiles. Aside from these, the system expansions of the 1970s had to do with improving U.S. capabilities in other than a stage 4 strategy sense. For example, improvement in communications intelligence systems, and in NORAD tracking radars all helped to get better warning of attack to U.S. forces. But such improved warning, desirable as it is, does not materially assist in waging a limited nuclear war where information would be needed on damage assessment and surviving forces.

We would argue that the stage 4 strategy of the mid 1970s was not congruent with the existing command structure, and that although major changes to command and control did take place in the 1970s, these proceeded independently of operative strategy. Because a large number of major changes were occurring in the command system, and were uncoordinated
in a strategic sense, the result was a dramatic increase in the complexity of nuclear force management. This was occurring at the same time as a major build-up in the nuclear arsenals of each side. Specifically, three reasons can be given as to why a fit between the nuclear stage 4 strategy of the 1970s was incongruent with command structure: the loss of American negotiating monopoly over its environment, the growth in complexity of U.S. force management problems, and an information overload stemming from the uncoordinated proliferation of technical intelligence sensors and automated command and control systems.

The loss of American monopoly over the negotiating environment was an inevitable consequence of the Soviet decision to expand, and harden, its missile force in the mid 1960s. Short of preemptive attack, the only way to maintain this monopoly was through arms control agreements. However, it was inconceivable as a practical matter to expect the Soviet government to ratify any agreement which permanently placed them at a ten-to-one nuclear warhead inferiority (the ratio in 1962). Arms control could moderate the rate and kind of growth in their strategic build-up, and this was attempted, with mixed results. However, the overall trend of a loss of U.S. superiority occurred throughout the late 1960s and 1970s, as any reasonable observer would have expected.¹

The detailed statistics of the Soviet nuclear build-up since 1966 are now well-known, and need not be provided here. In addition to

¹A handful of strategists assert that the United States should have accepted the Soviet arms race challenge. However, we fail to be persuaded by the arithmetic because we know for a fact that the Soviets are able to deploy about 9,000 warheads (because they have done so). This would entail an American arsenal of 90,000 warheads, in order to preserve the ten-to-one advantage of 1962. This is an impossibly large and senseless level of armament.
the U.S. change to a stage 4 strategy, other significant changes were made, resulting in a major increase in the complexity of American nuclear force management problems. The number of American strategic warheads increased during the 1970s from about 4,200 to over 9,000. Because of the Soviet build-up, this made it extremely difficult to maintain centralized political control, necessary in the stage 4 strategy, in the nuclear campaigns envisioned. Instead of hundreds of weapons being exchanged, thousands upon thousands could be launched by each side. It was not merely that such exchanges might occur, but that they could occur. One of the greatest force management difficulties of the stage 3 strategy was to convince military commanders that the command and control system would not collapse after the first few weapons were fired. With thousands of Soviet and American weapons poised for launch the capability to wipe out the political, and even military, high command increased the expectation of this, so that even "small" attacks might be interpreted as large and all out.

In addition to this, by 1971 Soviet stationing of Yankee class SSBNs off the Atlantic and Pacific coasts meant that the American command's reaction time was reduced from about 25 to 10 minutes or less, in the worst and most important case. With the larger warning time it is still plausible that word could be flashed to the President for a decision to launch prior to the impact of the Soviet warheads. In other words, with 25 minutes the warning and presidential decision system might appear on paper to be workable. Yet with only 10 minutes available it is hard to imagine that even paper plans would be convincing,

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1 Data from *Air Force Magazine*, March 1981, p. 43.
and the expectation is created that the survival of the political high command is in serious doubt. Furthermore, within the confines of a stage 4 strategy, it is required that multiple exchanges involving perhaps thousands of nuclear weapons occur while this connectivity between the president and the forces is maintained.

As noted earlier the increased size of the Soviet arsenal threatens the communications system of the American military, and also the second strike ICBM weapons of SAC. Since communications antennas on land for transmitting messages to SSBNs could be destroyed so quickly in an attack, the military would appear to be under pressure to authorize nuclear weapon use very early on if their retaliatory plans are to have a high probability of being carried out. This also points to the difficulty of constructing a command structure that can execute a stage 4 strategy. A great deal of information on damage assessment and force status must be available to the President, as described in Chapter 4, yet the larger Soviet arsenal can easily neutralize the American communication system's ability to provide prompt information and centralized processing of available data.

Finally, an information overload has made it exceedingly difficult to build a command system for a stage 4 strategy. The proliferation of communications intelligence programs, reconnaissance and warning systems, telemetry intelligence, and force monitoring systems should, in theory, improve overall force management. Yet ample evidence exists that the uncoordinated expansion of these information channels, coupled with necessary restrictions for security reasons, confuses and overloads the command organization's ability to determine what is happening, and why it is happening. This problem is not new, but has been growing
since the mid 1960s when a major move to technical intelligence and automated control systems was begun. From the mid 1960s to early 1980s the environment for strategic war has gone from being information poor to information rich. In the intelligence area a catalog of government reports testifies to this. A study in 1966, known as the Cunningham Report undertaken by the Inspector General, concluded:

Like the rest of the intelligence community, it (the CIA) makes up for not collecting enough of the right kind of information on the most important targets by flooding the system with secondary matter.

The information explosion has already gotten out of hand, yet the CIA and the community are developing ways to intensify it. Its deleterious effects will certainly intensify as well, unless it is brought under control.

The quantity of information is degrading the quality of finished intelligence.

Great technological advances in storage and retrieval of information can do more harm than good if drastically higher standards for what is to be stored and retrieved are not initiated.

Later in 1968 a special report to the Director of Central Intelligence concluded:

After a year's work on intelligence requirements we have come to realize that they are not the driving force behind the flow of information. Rather the real push comes from the collectors themselves—particularly the operations of large indiscriminating technical collection systems—who use national intelligence requirements to justify what they want to undertake for other reasons, e.g., military readiness, redundancy, technical continuity and the like. ¹


² This was known as the Taylor report, after its author Vice Admiral Rufus Taylor, as quoted in U.S. Senate, Foreign and Military Intelligence, p. 346.
In 1970 a special Blue Ribbon Panel on Defense elaborated on similar findings:

There is a large imbalance in the allocation of resources which causes more information to be collected than can ever be processed or used.

Collection efforts are driven by advances in sensor technology, not by requirements filtering down from consensus of the community's products.

Production resources can make use of only a fraction of the information that is being collected. There exists no effective mechanism for balancing collection, processing and production resources.

And, in 1971, the then Director of the Office of Management and Budget, James R. Schlesinger found that it was:

...not at all clear that our hypotheses about intentions, capabilities and activities have improved commensurately in scope and quality as more data comes in from modern collection methods.

There is a strong presumption that additional data collection rather than improved analysis will provide answers to particular intelligence problems.

The reasons behind the proliferation of technical collection and automated command systems have been described in Chapters 2 and 4. The need for very rapid response and the complexity of monitoring and operating worldwide forces are major factors. Yet an overload of uncoordinated information makes it difficult to assess broad trends, and makes it even more difficult to attempt detailed coordination in the circumstances of nuclear war, as envisioned by the stage 4 nuclear strategy.

\[^{1}\text{As quoted in ibid., p. 342.}\]
\[^{2}\text{As quoted in ibid., p. 274.}\]
For the reasons outlined here we argue that in the 1970s a mismatch developed between strategy and command structure. As a consequence, the performance of the strategic force system of the United States declined during this period. In itself, this decline in performance is hardly a new finding. However, our conclusion goes beyond this simple finding in two ways. First, it was not only the relative Soviet build-up in nuclear forces that reduced U.S. performance ability. In addition to this, the growing scale of American forces caused an increase in the complexity of the management problem. This was compounded by an information overload that made coordination and detailed control or even understanding of events extremely unlikely. Second, a basic mismatch between American strategy and command structure occurred, marking a change from earlier eras. This mismatch was retained throughout the 1970s, until in 1980 American strategy was again changed with Presidential Directive 59. This is referred to as a stage 5 strategy in figure 6-1. The possible implementing actions behind PD-59 remain to be seen, but the fact that American strategy has again changed without corresponding command and control changes is cause for concern, as described in the next chapter.

With the loss of American monopoly over its negotiating environment and the substantially increased complexity of the nuclear force management problem, what has happened is that a complicated interplay of strategy, command structure, performance, and the Soviet threat are driving the development of America's nuclear forces. The interplay is complicated because of the tendency of the most important bureaucratic players to seize upon one, or at most two, of these factors to justify proposed changes to American nuclear forces. This is suggested
by recent events shown at the bottom of figure 6-1. Changes to strategy are advanced in PD-59, changes to command and control are contained in PD-58, and attempts to constrain the Soviet threat are embodied in SALT-like arms control negotiations. Aside from these, and not shown in figure 6-1, are efforts to improve the performance of American nuclear forces as manifested in new weapon programs such as MX, the B-1 bomber, and the cruise missile.

In the absence of clear cut goals and a congruent strategy-command structure relationship, the chosen force development will be determined by internal political processes more than has occurred in the past. With greater ambiguity arising from one dimensional analysis which emphasizes only strategy or performance, there will be a corresponding increase on internal political processes to determine future development patterns.¹ This helps explain why the decline in performance of American strategic forces during the 1970s and 1980s has led to such an unproductive politicized debate about what should be done. It also suggests that instead of building either more weapons or more technical command and control systems or of devising yet another "strategy," what is most needed is a congruent match of a strategy with command structure. The intuition that the greatest neglect has been in the area of command structure performance is then partly correct. But it is only partly correct because the command structure must form an integrated whole with the strategy selected, as it has in the past.

Although the logic of the thesis in this chapter is simple, its supporting arguments are complex. No better summary can be given than that shown in figure 6-1. A "fit" or "match" between strategy and command structure existed for American nuclear forces throughout the 1950s, and extended into the 1960s through a clever reorganization undertaken in the early McNamara era. Because of a Soviet nuclear buildup in the late 1960s, and also because of increased American arsenal size and proliferation of uncoordinated technical information and automated command systems, the nuclear force management problem facing the U.S. became much more complex than before.

The revision of strategy in the mid 1970s to undertake limited nuclear options changed little more than strategy, creating a mismatch with command structure. With the enunciation of PD-59 in 1980 strategy became even more removed, or mismatched, with command structure. This mismatch has created an ambiguity about strategic goals, leading to internal political processes determining force development. The peculiar divergence of strategy from command structure displayed in PD-59 is analyzed in the next chapter.
SUMMARY AND CONCLUSIONS

This work attempts to provide insight and explanation of the problems arising from the existence and possible use of nuclear weapons. It does so in a manner different from other works in that it does not try to provide a single overarching theory, or even theoretical framework, for the study of nuclear war. Instead, it advances the discussion of nuclear war, and associated problems, by offering a collection of key processes, concepts, and interactions of the strategic forces with their environment. Thus, as an example, our interest centers upon the asymmetry in information available to two players in a nuclear exchange, dependent on the fact that the side which strikes first can do so with an intact command system, while the retaliator must respond with a disrupted system.

The concept that a first striker possesses an intact command system relative to his opponent suggests that information asymmetry should be thought of as a core idea in discussions of strategic war. It rarely is, as illustrated by the critique of exchange models contained in Chapter 4. But the purpose of this work goes beyond criticism for it is intended to enumerate and describe key concepts, processes, and interactions for the purpose of developing a set of core ideas in strategic war. Instead of positing a theory of strategic war and
deducing conclusions from its assumptions, we start with a series of what can be thought of as conceptual vignettes. These then suggest core ideas, which can have powerful applicability for unpacking the meaning of different aspects of nuclear war.

The point we emphasize is that the core ideas are pieces of a bigger picture, and that it is only through building up from these smaller pieces that an overall understanding of nuclear conflict can advance, or can even be discussed intelligently. As in other disciplines, the study of modern war has tended to be dominated by broad "top down" theories which offer a single widely accepted viewpoint of what the central problems are, how choices are or should be made, and what the implications of different choices will be. The logic of these "theories," and their vocabularies are, by now, well entrenched in the thought of almost everyone who tries to analyze nuclear conflict. Deterrence, escalation, and counterforce and countervalue attacks are some of the dominant themes in these theories.

In recent years a persuasive critique and elucidation of these theories, and their underlying ideas, has occurred.¹ This is a worthwhile activity, both because it offers a refreshing set of new ideas on what we believe has become a stale subject, and more importantly, because it identifies the gaping holes extant in theories dominant for so long.

Before turning to a summary and discussion of core ideas, it is worthwhile to make another point. Although there are relationships between the core ideas developed here, the connections are generally

¹A fine example is Patrick M. Morgan, Deterrence (Beverly Hills, Calif.: Sage, 1977).
tenuous at best. For this reason, we are not attempting to provide an alternative to deterrence theory or escalation-bargaining theory. Rather we register our skepticism about how any alternative grand theory of nuclear decision making could be established in a convincing way. The major defect of extant "theories" of nuclear decision making such as those mentioned, is not their infidelity to behavior in the real world, but their ignoring of vast amounts of important detail. It is remarkable that deterrence and escalation-bargaining theory say almost nothing about how organizations, information processing, decentralized decision making, and simplified decision rules affect what happens and what gets built. The result is that there is a disconnect between thought and action, and more generally between policy and outcome, a problem described at the end of this chapter.

SOME CORE IDEAS

The core ideas summarized here derive from synthesizing concepts and processes described in earlier chapters. They are ordered according to chapter, at least to the extent possible. Some ideas so clearly overlap between, for example, warning and assessment, that it is difficult to precisely categorize them as to where they best belong. Indeed, the most interesting core ideas are just those that transfer and apply to different aspects of strategic war.

Contextual Rationality

In Chapter 2 the subject of warning was analyzed. Here, the most important core idea developed from vignettes about interactions of Soviet and American nuclear forces was what could be termed "contextual
rationality." The nature of the modern warning process is to put together information about activities of different arms of the opposition's military establishment. Unusual activity in only one arm of his forces is not deemed especially threatening if the other arms are dormant, or at least are operating normally. When multiple activities diverge from normal then a truly threatening situation is perceived.

In addition to the detection of multiple enemy activities, political background also influences the warning process. Political context greatly determines perceptions of danger, and in conjunction with estimates of the activity levels of the opponent's forces can actually stimulate a sense of crisis. The Suez crisis of 1956 exemplifies this, and also illustrates the compression of decision time made possible with technical intelligence systems such as radars, listening posts, undersea sensors, etc. All of these were connected, either directly or indirectly, with the central political command center in Washington. When "incidents" were detected by these sensors they were interpreted, at least for a time, as having prima facie relevance to each other. Specifically, they were perceived as precursors of a general attack. The fact that the incidents in question were connected to each other only by the relatively arbitrary accident of their simultaneity, rather than by any coordinated or planned relationship, was perceived against the context of multiple activities of different Soviet forces (air and naval activity) and the political context of the Hungarian uprising and the invasion of Suez. The result was a strong perception that war might be breaking out, a perception that did not likely arise in the incidents dealing with NORAD's false alarms or the Soviet submarine
encroachment close into U.S. waters that occurred in the late '70s and early '80s. The contextual rationality of these cases was entirely different for they were not accompanied by multiple force activities, or by a background of political crisis.

The proliferation of technical intelligence sensors that operate in near real time seems then to suggest the following trend. As more information is picked up and reported to a central political headquarters, the likelihood increases that unconnected enemy military activities will be perceived as related by a coordinated plan for the simple reason that their near-simultaneous occurrence will be perceived as prima facie evidence of such a relationship. As long as the political context of this interpretation suggests that no danger is present a mutually reinforcing series of alerts is unlikely to take place. However, when the political context does suggest danger then such reinforcing alerts may well occur, unless intervention by political leaders dampens the process. The great expansion of Soviet and American technical intelligence systems that have been constructed since the 1960s add to these tendencies. As suggested in Chapter 2, these systems increasingly tap into one other. For all of these reasons a full alerting of both sides' nuclear forces today, in conjunction with a political crisis, could make it far more difficult to control the pace of events that was the case in 1956 or 1962.

Institutional Responses and the Nuclear Environment

The possibility that a first strike nuclear attack could paralyze an unprepared opponent has caused both superpowers to embark on major institutional reorderings in order to meet this threat. Specifically,
both the United States and the Soviet Union have constructed, in peacetime, military establishments which can instantly go to war should the need arise. This is a major change in historical terms, especially for the Soviet Union which did not have a Stavka (military high command) even at the time of the Nazi invasion in 1941. The importance of centralized political control in the shape of the Communist Party has long been recognized by scholars of Soviet history. Yet the demands of the nuclear age, in the form of only short warning of all out attack, dependence on automated alerting procedures, and the need for predetermined war plans, has necessitated that institutions be brought into existence to manage these and other problems. Ordinary military command systems adequate for high explosive wars cannot meet the demands of near instantaneous nuclear war. They cannot fit the plans together, coordinate firing times, cross-target the weapons, and vertically integrate the warning process with the nuclear forces. The only reliable way to ensure that these seemingly mundane tasks get done is to set up special institutions assigned with their responsibility.

The existence of nuclear weapons then creates major political control problems. For the United States doubt is cast on the ability of the constitutionally specified chain of command to be followed. But for the Soviet Union, where legitimate succession of leadership has been a key regime weakness, and where strict Party control of the military has been traditional, the changes introduced by the nuclear age are even more fundamental. Peacetime institutions dedicated to planning and operation of the nuclear forces mean that there can no longer be a military control vacuum at the top of the Soviet national security establishment, as was arranged by Stalin in the 1940s. As
mentioned in Chapter 2, new questions must now be asked about coordination of Soviet political and military objectives, the details of institutional command arrangements, and lines of authority at the top of the military hierarchy.

The issues raised here do not lessen the significance of a desire for centralized political control of nuclear forces, either in the United States or the Soviet Union. However, the tendency exists to consider centralization versus decentralization as if they were independent of time dynamics. The short flight times of nuclear missiles make it impossible to rely on fully centralized command mechanisms that were strained even in World War II, where days, rather than minutes, were available for political decision making. The Soviet emphasis on quick launching weapons, preemption, and the capability for launch on tactical warning are incompatible with fully centralized control.

Integration of Technology and Organization

The above suggests that military institutions have been restructured for the nuclear age, in that fully prepared forces and management need to exist in peacetime. No longer can time early in a war be counted upon to draw up plans and construct forces. The creation of the Strategic Air Command in 1946, and the Strategic Rocket Forces in 1959, signaled the emergence of military organizations built especially to meet the demands of the nuclear age. In both cases, the organization was built around the technology of nuclear weapons. However, the precedence of technology over organization displayed in these examples is not a general rule of how military technology
and organization interact. For with the theater nuclear forces of both sides the direction of integration was reversed.

As described in Chapter 3, theater nuclear weapons were woven into the standard military organizations that had existed for generations. Surface-to-surface nuclear missiles were placed alongside of pontoon bridge brigades, nuclear artillery shells were designed to be fired from standard field pieces, and other nuclear missiles were allocated to division and corps groups for battlefield support. Moreover, the lines of communication and authority controlling the weapons went through the existing conventional force command system. The impracticality of attaching a "red telephone" between each nuclear mine and artillery round to the White House or Kremlin does not need elaboration.

The tenuous character of generalizations about nuclear forces is evidenced here. For it would be simple to conclude that the advent of nuclear weapons had created a "revolution in warfare" that invalidates experience from the past and that nuclear weapons had such immense potential for destruction as to require a complete restructuring of military forces with the political control apparatus. For the intercontinental strategic forces this has been the tendency, but for the theater nuclear forces it has not.

Alternative Threat Enforcement Mechanisms

Closely related to the above distinction between the precedence of technology and organization is the nature of threat enforcement. In the case of NATO's theater nuclear threat, the distinctive features of relying on a highly differentiated command system for controlling
nuclear weapons leads to an enforcement mechanism which exploits both unpredictability and the inherent tendency for loss of control by the command system. This command system solves many of NATO's "impossible" problems.

The first impossible problem solved is the implausibility of any rational political steps taking NATO into a nuclear war. The civilian damage in a European nuclear-chemical war is self-evident to political leaders. What is also self-evident is the bargaining leverage this offers the Soviet Union. To circumvent this bargaining disadvantage, NATO can exploit the very real possibility that any war, and perhaps even any nuclear alert, would set in motion a chain reaction of decentralized decisions downward in the military hierarchy that would diffuse responsibility for carrying out what is otherwise an incredible threat.

Other problems "solved" in what is surely one of the most amazing threat enforcement mechanisms of all time, are Alliance cohesion and the coupling to American intercontinental forces. There is a forced political cohesion in the Alliance because of mutual self-interest, but also because nation A cannot easily escape destruction if its fellow Alliance member, nation B, somehow lets a nuclear weapon fly. Certainly, the dual key nuclear weapons provided to some of the nations in the NATO southern flank are there to ensure Alliance cohesion rather than for their military effect.

Coupling of European defense to the American SIOP occurs for much the same reason. It is hard to imagine thousands of nuclear weapons going off in Europe, including weapons which can easily destroy major Russian cities, without Moscow taking note of the fact that
these are American weapons. The ambiguity surrounding the control of the dual key nuclears especially will make it all but impossible to pinpoint the political intentions of an attack during the 10 to 20 minute flight times of these systems. For the strategies embraced by most NATO members, this kind of "difficulty" actually represents a benefit for it means that the command system is matched with the desired strategy of deterrence.

Asymmetries in Information

This is a core idea which has appliability in many different areas. In Chapter 4 peacetime information requirements were catalogued. Assessments are there made based upon synthesized information from many different sources. This synthesis represents centralized knowledge, and comes close to universal omniscience as an ideal. The nature of this multiple sourced information inherently depends on an elaborate communications system and on equally elaborate computational capabilities.

Wartime assessment, on the other hand, is more likely to depend on information of local conditions, as seen by an observer on the scene. It is more decentralized because a central coordinating mechanism is unlikely to function effectively in the confusion of battle. It is further limited computationally as actions which depend on elaborate and therefore delicate calculations are prone to disruption in the shock and chaos of war.

The differences between wartime and peacetime information conditions are not unrecognized. Military organizations, be they army divisions or wings of fighter aircraft, historically have been designed
so that they do not lose cohesion when operated in confusing circum-
stances. Typically, this is done through extensive training, but
war plans that do not depend on detailed real time centralized control
are also employed to provide needed autonomy to local units who have
direct knowledge of immediate conditions. Just this logic is displayed
in nuclear war plans such as the SIOP. The use of "preplan attacks"
discards any attempt at centralized control during a war. Instead,
preprogrammed attack options are executed which do not depend on con-
centrated information and reliable communications networks.

Over the past few years there has been a desire to establish
greater detailed and centralized control over strategic war operations.
This has lead to the notion that preplan attacks, such as the SIOP,
could be abandoned in favor of war plans which exploit all of the
information available at the moment. As desirable as this objective
may be from the perspective of establishing real time political direc-
tion in a nuclear war, the above line of reasoning casts serious doubts
on the likely success of this effort. Preplan attacks are far more
"information efficient" than centrally directed attacks because they
do not require that vast amounts of information be collected, processed,
and centrally distributed to local units. Such an elaborate information
processing system can be built for operations in peacetime, but its
wartime existence and effectiveness is in doubt, to say the least.
The fact that simulations of nuclear war, such as weapon exchange
calculations, implicitly apply a peacetime information regime to war-
time circumstances only confounds further our understanding of this
aspect of nuclear conflict.
A separate example of information asymmetries arises from the fact that the first side to launch its nuclear weapons can do so with an intact command system. The retaliator may have to respond with a badly disrupted system, leading him to employ highly nonoptimal preprogrammed attacks. Therefore, the above distinctions between peacetime and wartime information regimes may only apply to one side. Depending on particular forces and circumstances, this suggests that retaliatory strikes designed specifically to disrupt the first striker's command and information system may be far more important than targeting to even up some abstract, and unknowable, measure of effectiveness such as throwweight. It is especially in this respect that the more complicated bargaining models of nuclear war are wildly unrealistic. Without knowledge of detailed circumstances there is little to support the workability of such complicated strategies.

Agency and Risk

The decentralized character of wartime assessment described in Chapter 4 and devolution of authority over nuclear weapons discussed with respect to theater nuclear war suggest that "the risk of war" is an especially complicated idea. With nuclear weapons under centralized political control the concept of the risk of war may possess valid meaning if defined in terms of the risk proneness of the national leaders in question. However, once a nuclear force is placed on alert, or once operations begin, there will not be a single determinant of risk behavior. Many risk behavior profiles will emerge in the form of the constituent actors with control over nuclear weapons. Especially in NATO, with its highly differentiated command system, there could
be dozens, or even hundreds, of noncommunicating actors. The interaction of their risk behavior would be all but impossible to comprehend ahead of time.

Not only would separated actors compound the problem of defining risk, but the hierarchical nature of military organizations, together with a wartime information regime where decentralized local assessments were mandatory, implies that risk perceptions would greatly depend upon the level in the organization of the operating actor. A hierarchy of agents would support a politically determined strategy, but the devolution of risk perceptions downward in the military organization would affect not only the degree of acceptable risk, but the more fundamental question of identifying exactly what it is that is being risked in the first place. The "risk of war" may be well-defined in the mind of a senior political executive, but it is likely to have a very different meaning to an artillery officer or a QRA pilot who finds himself in the middle of a highly confused battle.

Rationality in Organizations

This is clearly a vast subject but here we can identify some examples of the questions and explanations suggested by the vignettes drawn from previous chapters. In the area of targeting, for example, American plans drawn up in the 1950s were more or less "bottom up," while in later years they tended to be "top down." As more civilians intervened in the nuclear planning process the plans generated began to solve different problems from those written in the lower levels of the military organization.
What is interesting here is less the bureaucratic conflict between civilian and military groups of actors over what gets into a nuclear targeting plan, than it is the ability of an organization to produce a single plan that conceptualizes radically different models of what a nuclear war is going to be like, how it is going to begin, and how it is going to end. Apparently, one feature of organizational rationality is the ability to interpret a targeting strategy as an uncoupled collection of ideas about nuclear war, depending upon where in the organization the interpretation takes place. At the civilian pinnacle of the American national security apparatus there has been an identification of counterforce and countervalue targets as the relevant substance of a nuclear exchange.¹ The categories of "things destroyed" is thought to have great effect on deterrence and escalation, and has lead to high level interventions into the nuclear planning process in order to impose just this image of conflict into actual war plans.

Within the military organizations responsible for nuclear targeting, the driving goal has varied over the years but generally it amounts to either breaking up a Soviet Army advance into Western Europe, or of destroying Soviet military forces before they can damage the United States. This is quite different than selecting counterforce or countervalue (or countercontrol) targets for destruction with the interest of influencing Soviet choices in a war. For one thing, breaking up an attack on Western Europe is likely to be an all or nothing decision,

¹Of course, we are referring to those handful of civilians at this level of government who have given educated attention to nuclear strategy. Even simpler images are likely to determine the beliefs of senior officials who do not have the time or inclination to attend to these matters.
because the pieces of such an attack are dynamically coupled. Failure to engage in part of the attack may jeopardize the entire objective, as the German Kaiser was informed by his generals in 1914. The point made here is that the mere act of maintaining an agreed-upon SIOP does not produce internal coordination about what is to be done in the event of war, because simultaneously incongruous interpretations of plans can, and do, exist even in peacetime.

Provincialization of Authority and Information

One very key idea that repeatedly emerges in many parts of this work is the need for a detailed description of how nuclear weapon usage authority devolves through an organization, and of how information on what is happening to the different parts of the organization is distributed to its constituent members. Compression of decision time, for example, requires that warning sensors be vertically integrated with the nuclear forces, and that automatic alerting procedures be established. But this means that many parts of the organization are informed of an incoming attack, and also of its details. This warning information could be the last information ever received, because an incoming attack would likely break up the warning communication system, provincializing information about what is happening to the organization being attacked.

In a theater nuclear war the threat of provincialization of nuclear usage authority actually enforces NATO's deterrent strategy. This arises both from the distribution of authority in a top-down way from senior commanders, and from physical destruction from enemy attacks.
that provincializes the NATO organization, turning it into a collection of disconnected islands of independent action.

In Chapter 4, the role of information on damage assessment in wartime was described by using a two row and column matrix, describing whether the U.S. and U.S.S.R. had information about what was happening to the other. As pointed out there, the real world situation is quite a bit more complicated than this. A larger matrix listing the disconnected islands of forces following nuclear attack in each nation would be needed for detailed understanding of the provincialization of damage assessment information. Of course this information, along with knowledge about the number of unfired missiles possessed by the disconnected commands, would greatly influence the decision of those isolated units with nuclear usage authority.

In both targeting and command and control, provincialization of usage authority and information are also critical to discussing the dynamics of exchanges. A targeting plan designed to achieve minimal provincialization of the enemy command system, while drawing down his stock of missiles and bombers would hold more promise of restraining escalation than a plan written merely to maximize the body count of military targets. Indeed, it is the core idea of provincialization which joins targeting and command and control together.

Information Impactedness

We use the term "information impactedness" to pull together some concepts and processes which bear on the procedures used at the highest levels of government for going to nuclear war, something which deserves much more attention. The term has been used in microeconomics to
describe a condition involving two actors, where one has an exploitable advantage over the other because of information available to him alone, and where the opponent faces a high cost of achieving information parity. Of course, the information of interest here concerns detailed conditions of nuclear predelegation authority and of how emergency war messages would be communicated from political to provincial commanders.

In Chapter 6 the description of how the NCA could use the Bell Telephone System to communicate with the nuclear forces implied that the exact location of the President, or his successor, would necessarily be kept highly secret. Later, some broad description of the structure of nuclear predelegation authority was provided, including the alternate command posts of the primary command centers. The "Looking Glass" aircraft, the emergency rocket control system (ERCS), and other alternates could be used to send out firing orders in the event of an attack on the primary command centers. The detailed description of the procedures for using these control mechanisms are among the most secret of information held by the American government. Information about which location the NCA would go to, which communication lines it would use, the extent of predelegation authority given to provincial commanders, and the communication system selected for sending firing orders are all shrouded in secrecy to a much greater extent than surrounds the technical characteristics of the weapons themselves.

The reason for this secrecy is not hard to fathom. It gives an asymmetric advantage to the United States in that a Soviet attempt
to destroy our command system would need just this information. For example, if the exact location of ERCS missiles were known, this avenue for sending out launch orders could be foreclosed by an appropriately designed Soviet attack.

At the top of the government the procedures for spreading out authority to issue firing orders represents, potentially, the weakest link in the retaliatory chain. A tailored Soviet precursor attack that could isolate the nuclear forces from the authority needed to use them could paralyze the American arsenal. If all of the procedural and predelegation details were known an optimal isolating attack could be launched, to be followed up by a massive attack on the weapons themselves. The reason this kind of attack is extraordinarily difficult is only because the Soviets do not precisely know who has nuclear authority in an emergency, and more importantly, how the flow of this authority would take shape at the highest levels of government. They cannot readily know whether CINCSAC would go down with the ship if attacked, or would make secret preparations to evade destruction by moving to a secret location that only he and a handful of assistants were aware of, and where the redundancy of the Bell system could be used to couple him to unlaunched weapons. The Soviets also cannot easily know whether a long dormant commercial satellite is actually a disguised "dark satellite" that contains coded firing messages for ICBMs and bombers, and which could be activated from any one of numerous secret transmitters located at innocuous military posts or civilian locations.

Were all of this information available to Soviet targeteers they could plan a potentially paralyzing precursor attack on America, to
be followed by more standard attacks on isolated military units. The point is that information asymmetry, in the form of knowledge about predelegation, authority flows, secret locations, dark satellites, alternate command post arrangements, and other things, and an inability of the Soviets to acquire this knowledge at a reasonable price creates a condition of information impactedness. And it is this information impactedness which protects the command structure, rather than any hardening of command and control systems to withstand the physical effects of nuclear attack.

Information impactedness helps to explain why there is such an intense secrecy surrounding the subject of command and control. Without it, a parity of information could develop, permitting carefully designed attacks to destroy the ability to retaliate by isolating forces from their needed authority. Moreover, the core idea of information impactedness also suggests different ways to protect a command system, relying more on a smooth flow of authority than on improvements in or expansion of elaborate communications hardware.

Relationship of Strategy and Command Structure

Chapter 3 argued that from the NATO European perspective of deterrence strategy that there was a compatible fit with the command structure built to control the theater nuclear forces. In Chapter 6, a more complicated description of the evolution of the strategy-command structure relationship was given, with the conclusion that since the 1970s a mismatch between the two had developed. Since the strategy-structure relationship was developed in detail in previous chapters, we need only observe here that too frequently
nuclear strategy is discussed independently of command structure. This omission assumes away the organizations which must carry out a strategy, and creates other unusual difficulties, something to which we now turn.

POLICY IMPLICATIONS

What follows is not a traditional statement of policy alternatives for designing and using strategic forces. We do not believe that this is yet possible given the unorganized complexity even of the questions to be asked, let alone the alternative answers to be offered. The very idea of a "policy" for nuclear forces is not even clear, despite widespread overuse of the term. As a first cut at assessing policy implications of the work discussed in this volume, we suggest that "policy" be thought of as a coordinated intervention into a very large complicated system which has a peacetime, and probably also a wartime, dynamic of its own. This system involves at least: weapons and their performance characteristics, command structure, one or more strategies, and a negotiating regime. Other elements or factors could easily be added to the list.

There is a point worth making about this use of the term "policy," and that is the absence of coordinated intervention which we believe has characterized most of the years since the late 1960s. The absence of coordinated intervention has not meant that no one was thinking about nuclear war, but rather that for one reason or another strategy, command structure, negotiating regimes, and weapons have not been
coordinated with each other. Rather they each evolved from a complicated dynamic of internal and interactive effects.

Over the years in both the United States and the Soviet Union, the nuclear arsenals have grown large. They have reached levels where they now contain the potential for unimaginable destruction, and where there is little reason to believe political direction could be imposed on a nuclear conflict, and perhaps even on a high alert. The nuclear forces have been overbuilt in an unbalanced way at least since the late 1960s. Proliferation of warheads has far outstripped an ability to manage them in conflict. An array of compartmentalized technical intelligence systems has been added, along with warning, status monitoring, reconnaissance, and other command control systems as well. These have introduced a flood of information and raw data into the nuclear force management problem. Far from reducing the complexity of the problem, however, they have added to it.

No one has offered a good idea on how to involve political leaders in life and death decision making when only a few minutes are available, so automated response mechanisms have been installed as a substitute. While not turning over the decision to launch nuclear weapons to a computer, the unintended result arising from mutually reinforcing alerts may not be much different. As in 1914, the function of a political leader may be more to dampen the reinforcing cascade of events as best he can, rather than attempting to direct it in a fine tuned way. With strategic arsenals of 10,000 warheads, and theater arsenals of 7,000, this is no small task. In the European theater, the chances for fine tuned control are even less because flight times are shorter.
and control inherently more difficult since multinational coordination problems abound.

If a war were to begin in the theater or with intercontinental forces, serious obstacles to assessing what was happening would exist, as discussed in Chapter 4. The prospect that automated warning and command systems might interact with each other to take on a momentum of their own, and that concentrated information on what was happening to an organization under attack would not be available are overlaid onto the problems of lack of decision time and human behavior. Command structure arrangements can, and have been, made to work around these problems, but only through delegating control, relying on simple pre-programmed attack plans, and depending on local provincialized assessments of what is happening.

Given the dimensions of the complexity of designing and conceptualizing the use of a nuclear force, it is not hard to understand that coordination of strategy, command structure, negotiating regimes and the weapons themselves is extremely difficult. The resultant tendency has been to discuss the forces only in terms of one or two of these elements, say weapon performance and arms control negotiations. For more than a decade command structure especially has received little or no serious attention. "Policy" in this definition stands for weapon development choices and arms control negotiations. But because of the neglect of critical command and strategy elements, there is little prospect that "policy" in these areas can direct the evolution of an overall nuclear force posture.

Eventually, as highly differentiated but uncoordinated command and control systems were overlaid onto a growing arsenal, and as incon-
gruent strategies were advanced in the 1970s and 1980s, the difficulty of establishing a connection between thought and action became insurmountable. Complexity reached such a level that no one any longer understood the entire system of how the pieces fit together, of how it would interact with an opponent's alerted forces, or of how a cease fire could be imposed on a theater nuclear war. It is as an intervention into this immensely complex problem that policy must now direct itself.

The failure of policy in the last decade to fit the pieces together in a conceptually pleasing way did not slow down the development of more nuclear arms, more command and control systems, more strategies, and more arms negotiations. Each of these advanced but largely in isolation from each other. Additionally, there was not really a pressing need to understand how each of these fit together into the larger mosaic of a desirable shape of the nuclear forces, or of how the forces were actually going to be used if this time ever came. This is less remarkable than it first appears because a failure to understand the nuclear forces when on alert or in conflict may not, as a practical matter, be all that important. As a deterrent to attack, the complexities described above may ensure the existence of so many redundancies, and so many interacting parts that to start even a "small" nuclear (or conventional) exchange may be to guarantee that the internal dynamic of the forces unwinds to its witless and apocalyptic conclusion. A reinforcement of deterrence may have been occurring precisely because of the overbuilding of arsenals without any coordinated thought as to how they would be used. The NATO theater nuclear deterrent seemed designed to closely fit just this model. It may be that the evolu-
tion of the American-Soviet nuclear regime is toward this status, which could be referred to as "de facto mutual assured destruction." It is a de facto relationship because it results less from conscious design than it does from the overbuilding of arsenals in an unbalanced manner, where weapons are deployed without corresponding command and control, and where strategies are imposed which are incongruent with command structure.

From the deterrence point of view, the above is consoling, but from the policy perspective it is depressing. It means that what is usually thought of as policy has little to do with directing the development and possible use of nuclear forces. Targeting policy, arms control policy, and all the other policies overpresent in the world of national security may represent little more than incremental changes from past policies driven by bureaucratic factors, accidents of simultaneity, and incorrect or ambiguous understanding of history, goals, and causality. But such a pessimistic interpretation of the role of policy for nuclear forces fails to account for several things. It does not reveal that in the past, coordination of strategy and command structure has taken place. More broadly, it fails to incorporate the tendency in discussing the role of policy in almost any area, whether it be for nuclear forces, irrigation, or criminal justice to be either overly pessimistic or overly optimistic about the possibilities for managed intervention to coordinate the pieces. Especially in an area whose study is as morally contaminated as nuclear war, there is an almost innate orientation to pessimism about the prospect that "the volcano can be capped," or at least that it be capped short of relying on anything but good luck.
Stated simply, there is little real alternative to placing a lid, or at least some controls, on the unimaginable destructive potential residing in these forces. The problem is too important to depend on good luck. Given this, there is a clear need for policy intervention into the complex dynamics shaping the American-Soviet nuclear regime. The argument offered here is that broad general theories about this regime, stripped of detail about organizations and command and control, are today especially likely to fail as policy tools because the nuclear forces themselves have become so much more complex than they were in the past. Instead, new conceptual tools are required based upon just those details which most previous theories have neglected. That is what this volume has been about.
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