

THE U.S.-SOVIET LONG-TERM MILITARY COMPETITION VOLUME II - PLANNING AND ANALYSIS

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June 5, 1990

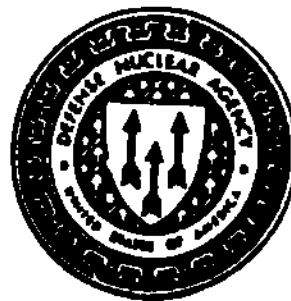
Technical Report

CONTRACT No. DNA001-85-C-0268

**This work was sponsored by the Defense Nuclear Agency
Under RDT&E RMSS Codes 4691 C RO RB 10002 NASF
2430 A and 4695 C RO RB 00002 NASF 2430 A**

**Prepared for
Director
DEFENSE NUCLEAR AGENCY
Washington, DC 20305-1000**

**Director, Net Assessment
OFFICE OF THE SECRETARY OF DEFENSE
Washington, DC 20301**



UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 104, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.			
1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE 800805	3. REPORT TYPE AND DATES COVERED TECHNICAL REPORT, 800805 TO 800805	
4. TITLE AND SUBTITLE THE U.S.-SOVIET LONG-TERM MILITARY COMPETITION, VOLUME II - PLANNING AND ANALYSIS			5. FUNDING NUMBERS RO RB 10002 RO RB 00002
6. AUTHOR(S) J. J. MARTIN and J. GRANGE			8. PERFORMING ORGANIZATION REPORT NUMBER SAIC-89/1454
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) SCIENCE APPLICATIONS INTERNATIONAL CORPORATION 10280 CAMPUS POINT DRIVE SAN DIEGO, CALIFORNIA 92121			10. SPONSORING/MONITORING AGENCY REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Director, Defense Nuclear Agency, Washington, DC 20305-1000 Director, Nat assessment, Office of the Secretary of Defense, Washington, DC 20301			11. SUPPLEMENTARY NOTES This work was sponsored by the Defense Nuclear Agency under contract number DNA001-85-C-0288, RDTE RM88 Code 4881 C RO RB 10002 NASF 2430 A and 4886 C RO RB 00002 NASF 2430 A
12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.			12b. DISTRIBUTION CODE
13. ABSTRACT (Maximum 200 words) This three-volume report examines the nature of the U.S.-Soviet long-term military competition and sets forth improved means for developing and implementing strategies for the competition. This research encompasses broad national strategy as well as specific military missions and is directed at planning concepts and methods, rather than at devising specific strategies. Volume II describes a structured process for devising and implementing strategies for the long-term military competition, evaluates current analysis tools in terms of their adequacy to support competitive strategy development, and recommends improvements in these tools.			
14. SUBJECT TERMS Combat Models, Competitive Strategies, Gaming, Military Balance Assessments, Strategic Planning, Strategy			15. NUMBER OF PAGES
			16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18. SECURITY CLASSIFICATION OF THIS PAGE UNCLASSIFIED	19. SECURITY CLASSIFICATION OF ABSTRACT UNCLASSIFIED	20. LIMITATION OF ABSTRACT SAME AS REPORT

NSN 7540-01-886-5500

Standard Form 298 (Rev. 5-89)
Prescribed by ANSI Std. Z39-18
298-102

SECURITY CLASSIFICATION OF THIS PAGE

UNCLASSIFIED

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UNCLASSIFIED

SUMMARY

Volume II describes a four-tiered approach to development and implementation of U.S. goals and strategies for the long-term military competition with the USSR. It then shows the demands that competitive strategy development makes on analysis tools, and evaluates current analysis tools in terms of their adequacy to meet these demands. Four major tools are identified for the primary support to competition planning -- military balance assessments, Soviet-style planning analyses, competition planning games, and military contingency analyses. While these tools can support competition planning now, we identify research on specific topics that should be carried out in order that they can realize more fully their potential for competition planning.

The U.S.-Soviet competition fundamentally is a contest for power and influence in world affairs in which the national security dimension currently bulks large and probably will continue to do so. This competition currently is slowing, and the risk of direct U.S.-Soviet military competition currently is low. Increasingly, the competition is emphasizing the political and arms control aspects of security, although the possibility remains that the military competition once again could become more confrontational over the next decade or more. Another salient trend is that the U.S.-Soviet military competition is now carried out in a multipolar environment in which additional competitors to each superpower are playing more important roles than in the past.

Developing long-term strategies to guide peacetime planning and resource allocation for military competition under these conditions is difficult. A framework of concepts and analytic methods is needed to help move development of strategies for the military competition from the realm of intuition to a structured domain that is more accessible to DoD staffs. Building

on material developed in volume I, this volume describes such a framework, centered on a layered planning process in which competitive actions in particular subareas are subordinated to higher-level competition goals and to integrated strategies for the competition as a whole.

Chapter 1 describes the essential functions of a layered approach to U.S. competition planning, both to provide a basis for evaluating current analysis tools and to recommend a more structured process for DoD use. This layered approach to competition planning is not intended to supplant current PPBS or operational planning processes. Rather, it is intended to suggest ways in which current planning processes can be enhanced, so as to allow the United States to compete more effectively with the Soviet Union and other potential competitors in the national security arena.

This layered approach to planning consists of four essential functions:

- A periodic survey of the competitive environment to validate or revise the assumptions underlying current planning for the competition.
- Development (or update) of a high-level strategic plan that would provide guidance to competition planners and align U.S. commitments and resources in the competition. This would be done by specifying subareas of the competition to which significant resources should be devoted, by setting competition goals, and by stating a broad strategy for achieving these goals within available resources.
- Statements (or updates) of more detailed goals and strategies in each subarea of the competition to which significant resources are to be committed.
- Formulation (or revision) of detailed actions to implement the strategies developed in higher layers. By and large, these actions would be selected and implemented through the established weapon system

acquisition, operational planning, foreign policy, and arms control processes, which are not addressed in detail in this report.

Chapter 2 describes a generic sequence of analyses to support these four functions of competition planning. This sequence of analyses consists of the following iterative steps:

- Diagnosis of the current state of the competition, in light of trends in the competitive environment.
- Formulation and evaluation of alternative U.S. goals and strategies for improving the state of the competition, in an iterative process of winnowing and refinement that arrives at a single preferred set of goals and strategies. Analytic support to this process consists of projecting future states of the competition likely to result from specific goals and strategies by considering a range of plausible U.S., Soviet, and third player moves and countermoves.
- Support to the projection of future states through development and analysis of Soviet and third player goals, strategies, and actions in the military competition.
- Evaluation of alternative future states of the competition in terms of combat outcomes in various war scenarios, using contingency analyses. This evaluation of alternative future states contributes to the selection of goals and strategies.
- Synthesis of a portfolio of strategies and actions from the above analytic steps.

In chapter 2 we discuss several aspects of this analysis sequence in detail. Determining U.S. goals is a key part of competition planning and analysis, but it is not easy to develop statements of goals that effectively guide planning without overconstraining the planning process. We suggest a number of ways to help determine useful planning goals. Feedback and iteration are essential elements of competition planning, both the monitoring of Soviet and third player actions (with provision for correcting

U.S. goals, strategies, and actions based on the results of this monitoring) and iteration in the evaluation of alternative U.S. competition goals and strategies (to arrive at a preferred set). We discuss specific feedback and iteration techniques. Chapter 2 also reviews portfolio management techniques relevant to competition planning; these techniques can help the Department of Defense deal with risks and take advantage of unforeseen opportunities that may arise in the highly uncertain environment in which military competition takes place. (See the appendix at the end of this volume for definitions of portfolio management and other terms).

We then examine in some detail nine classes of analysis tools, techniques, and data bases in terms of their suitability for support to competition planning:

- Techniques for modeling and analysis of discrete military systems, military operations, and military support. While we conclude that such techniques as operations research and systems analysis and models of discrete weapons and operations have little applicability to competition planning, we find that modeling of combat operations, especially at the theaterwide campaign level, is quite important. Therefore, a separate category of combat modeling is listed below.
- Strategic planning tools for businesses.
- The classical analysis tools of logic and expert judgment.
- Regional political-military analyses.
- Forecasting techniques.
- Military balance assessments.
- Analysis of Soviet threats and capabilities.
- Gaming techniques.
- Combat modeling.

Four of these tools can provide major analytic support to competition planning -- military balance assessments, Soviet-style planning analyses, competition planning games, and military contingency analysis.

Military balance assessments should be the primary tool for carrying out diagnoses of the current state of the competition. Balance assessments also can contribute to the identification and evaluation of changes in the competitive environment, to the determination of Soviet competition goals and strategies, and to the formulation of U.S. competition goals.

Soviet-style planning analyses should be the primary analytic tool for determining Soviet competition goals and strategies, for determining likely impacts of U.S. competitive actions on Soviet weapons acquisition and on Soviet doctrine, and for identifying a plausible range of Soviet moves and countermoves in the military competition. Soviet-style analyses also can contribute to identifying and evaluating changes in the competitive environment, insofar as these changes arise in the USSR or impact strongly on Soviet planning. Further, Soviet-style analyses can help to diagnose the current state of the military competition.

Competition planning games and military contingency analysis should be the primary tools for setting U.S. goals in the military competition, for evaluating alternative U.S. strategies for the competition, and for evaluating portfolio management alternatives. Competition planning games also can contribute to a number of other analytic functions, including evaluation of changes in the competitive environment, diagnosis of the current state of the competition, and determination of Soviet and third player goals and strategies. Military contingency analysis can contribute to diagnoses of the state of the competition as well.

Many of the other types of analytic tools and data bases we reviewed can support these four major tools for competition planning:

- Projections and assessments by the intelligence community can aid in understanding Soviet and third player goals and strategies, but the limitations of intelligence projections for long-range planning must be kept clearly in mind (see chapter 3.8 for further discussion of this point).
- Regional political-military analyses can contribute to understanding of the changing competitive environment, aid in making U.S. assumptions about the behavior of other countries explicit, help to offset the U.S. tendency to attribute U.S.-style perspectives to other nations, and improve the understanding of the regional constraints and opportunities associated with U.S., Soviet, and third player moves and countermoves. These analyses also can contribute to the improved U.S. ability to explain its competitive goals and strategies to allies and third players and to implement U.S. competition strategies.
- Forecasting of economic, demographic, technological, and military trends can contribute to understanding the competitive environment. Further, forecasting can aid in understanding the constraints and opportunities associated with future U.S., Soviet, and third player competition goals and strategies, and therefore can help in projecting move/countermove sequences. Forecasting of future military force posture costs can serve as a feasibility check on U.S. goals and strategies.
- Logic and expert judgment in the form of analytic essays can contribute to identifying and evaluating key trends in the competitive environment, to characterizing the state of the military competition, to formulating and resolving issues about goals and strategies, and to achieving consensus on goals and strategies.
- Artificial intelligence and expert system software has the potential to support Soviet-style analyses, competition planning games, and military contingency analyses.

- Modeling of military manpower resources may contribute to feasibility checks on goals and strategies in light of demographic trends.
- Operations analysis and engineering trade-off studies are important tools for the PPBS and operational planning side of the interface between competition planning and the current DoD planning processes.

We found only limited applicability of business planning tools and analysis methods to military competition planning. Most helpful were broad analogies for planning approaches to the military competition; we have drawn on these analogies in developing the planning concepts and methods described in this volume. The major analogies from business planning that we found useful are the following:

- The need to understand the strategic environment in which competition is taking place.
- The use of models and analysis tools to help identify the most important variables in the strategic environment and to help formulate goals and strategies.
- The use of gaming to help identify a plausible range of future strategies and moves by one's competitors.
- The concept of portfolio management.

We also found that the details of these concepts needed to be reworked extensively for military competition planning. Consequently, we found no business planning tools or methods that can be transferred fairly directly to planning for the U.S.-Soviet long-term military competition.

Chapters 4 through 7 discuss the four major analysis tools in greater detail. Military balance assessments can be used to analyze trends and asymmetries in opposing force postures in subareas of the competition, focusing particularly on the

implications of these trends and asymmetries for war outcomes in various scenarios. As such, these assessments can play a major role in diagnosing the current state of the military competition. More specifically, balance assessments can serve three purposes that are important for competition planning:

- Balance assessments can translate the current U.S. and Soviet force postures in a given subarea of the peacetime competition into war outcomes in various scenarios.
- Further, they can provide an understanding of what it is about the current U.S. and Soviet force postures that is responsible for these war outcomes, as a diagnostic aid to support decisions about which aspects of the balance the United States should try to preserve and which it should try to improve.
- Finally, balance assessments can set these diagnoses into the context of historical and projected trends and asymmetries, so U.S. planners can understand the ease or difficulty of preserving or changing aspects of the current military balance.

While balance assessments are a natural and important diagnostic tool for competition planning and can provide this support now, a number of improvements are needed. Chapter 4.3 discusses the following areas for improvement and outlines research approaches that appear promising:

- Extension of existing balance assessments to more regions and topics.
- Methods for applying military balance assessments to diagnosis of the U.S. and Soviet competitive positions.
- Summary descriptors of the state of military balance.
- Techniques for improving military balance assessments.
- Ways to determine Soviet and third player views of military balances.

Soviet-style planning analysis applies reasoning and analytic tools in ways that approximate actual Soviet planning practices as closely as possible, based on an understanding of Soviet organizations, decision making, and methods. This type of analysis can serve a number of key functions in support of U.S. competition planning:

- Identifying competitive areas accorded high priority by the USSR.
- Understanding Soviet perceptions of U.S. actions and options.
- Anticipating Soviet responses to U.S. actions or strategies.

There is only a limited capability for performing Soviet-style analyses in the United States today, primarily because of the small number of people with the required backgrounds and skills. People who can perform Soviet-style analyses fall into five categories or levels, as follows (Level 1 consists of people from the Soviet Union; Levels 2 through 5 consist of Westerners with varying degrees of understanding of Soviet military planning):

- Level 1: Born and raised in the Soviet Union.
- Level 2: Thorough understanding of how Soviet decision makers think, plan, and decide.
- Level 3: Limited understanding of elements of Soviet cultural influences and organizational structure.
- Level 4: Some experience in reading Soviet military writings or observing Soviet behavior.
- Level 5: Doing "If I were Soviet" analysis with a knowledge of the substantive area under examination, but little specific background in Soviet studies.

As discussed in chapter 5.4, people at level 2 are best qualified to support competition planning, but the level-2 population is the smallest of the five (perhaps a few dozen). Chapter 5.5 describes approaches to increasing and institutionalizing a Soviet-style analysis capability in the United States by creating more level-2 experts, using level-2 people more efficiently than is now the case, and increasing the skills of people at level 5.

Competition planning games are path games focused on the future course of the peacetime military competition in one or more subareas. Their basic purpose would be to simulate the decision-making processes of critical countries and the impact of these decisions on the state of the military competition over an extended period of time, in order to help evaluate alternative U.S. goals and strategies. Chapter 6 describes how competition planning games should be organized and illustrates this description with an example focused on Europe. Chapter 6.3 describes several research topics that need to be addressed to enhance the ability of path games to support competition planning:

- Better ways to move players psychologically into the future conditions associated with games moves.
- Ways to reduce the cost, manpower, and set-up times for competition planning games while maintaining the credibility and utility of these games.
- Converting move/countermove games into estimates of the resulting state of the U.S.-Soviet military competition.
- Methods for improving the productivity of competition planning games by increasing the number of variations on U.S. and Soviet goals and strategies that can be examined in a fixed number of games.

- Practical, efficient ways to capture and archive in games the results of past competition planning analyses.

We performed a limited amount of research on the first two topics; the results are summarized in chapter 6.3.

Military contingency analysis would use combat models for two-sided campaign analyses in various war scenarios (or contingencies) in order to help measure U.S. preferences among alternative future states of the military competition in terms of these combat outcomes. In our proposed approach to competition planning, analysis starts with a diagnosis of the current state of the military competition. Based on this diagnosis, a number of alternative U.S. goals and strategies to achieve these goals are developed for evaluation. Each of the candidate goal/strategy sets is subjected to the moves and countermoves of the US&R and relevant third players in one or more competition planning games; one important output from these games is a set of plausible future states of the military competition associated with each candidate goal/strategy set.

At this point, the key analytic step is to rank the states of the competition associated with each candidate goal/strategy set according to U.S. preferences, to provide a basis for evaluating the candidate goal/strategy sets. However, states of the competition are complex, and a preference ranking merely by inspection probably will not be adequate in most cases. Given the prominent role of the U.S.-Soviet military balance in the state of the competition, U.S. preferences among alternative future military balances will be a strong indicator of U.S. preferences for states of the competition. Therefore, combat analysis of these alternative future military balances will be an important measure of the states resulting from move/countermove games and thus one guide to selecting U.S. competition goals and strategies.

We suggest that a contingency analysis test bed be organized in order to test future military balances in combat analyses to serve the foregoing purpose. This test bed could be a separate organization supporting competition planning or it could consist of existing DoD combat analysis capabilities, suitably coordinated. In either case, the test bed should consist of the following components:

- A set of combat models that have the flexibility to be easily adapted to future military balances and to a wide variety of war scenarios. These models also should be credible and acceptable to all major DoD organizations involved in competition planning.
- Data bases to support these models and the associated contingency analyses.
- Experienced modelers and analysts to carry out the contingency analyses.
- A master set of future contingencies or war scenarios for use, with suitable modifications, in specific contingency analyses. Chapter 7.1 contains a sample set of these contingencies.
- The ability to develop new operational concepts for the future U.S. and Soviet forces being modeled in the contingency analyses.

While existing combat models can support competition planning, improvements in the following areas are needed, as discussed in chapter 7.2:

- Increasing the adaptivity of combat models to analyze a wide range of different military force balances in a variety of quite different war scenarios.
- Reducing the time and costs required for contingency analyses, so they do not become a major bottleneck to expeditious competition planning.

- Improved methods to generalize from the detailed analysis of a variety of war scenarios to determine preferences and rankings among alternative future military balances.
- Exploration of Simnet concepts to make a possibly major upgrade in the ability to model and analyze future forces and employment concepts with much more realism than is possible today.

Chapter 8 outlines specific recommendations for the Department of Defense to consider with regard to implementing the foregoing findings of this report.

PREFACE

The term "competition" is commonly used to characterize the relation between the United States and the Soviet Union. Despite the recognition that the two superpowers compete in all the major dimensions of international relations -- political, military, economic, technological, and ideological -- there has been relatively little research on the nature of this competition and on systematic ways for the United States to improve its competitive position in this complex vying for power and influence.

There are many examples of effective U.S. competitive actions, but little attention has been given to explicit planning processes and strategies to help the U.S. Government compete more effectively with the USSR over a long period. In the late 1940s and early 1950s there were discussions of broad national strategies for the competition, especially at the RAND Corporation. But this line of questioning gradually died out by the mid-1950s. In 1969-1970, Andrew Marshall worked on a framework for analyzing the U.S.-Soviet long-term competition, concentrating on strategic forces. Under Marshall's leadership, the Department of Defense began in the mid-1970s to carry out studies of more general strategies for the military competition, drawing on business concepts for strategic planning. In 1986, the Secretary of Defense established the Competitive Strategies Initiative, which addresses specific military missions or tasks.

As part of the DoD examination of how to compete more effectively with the Soviet Union, Science Applications International Corporation (SAIC) has been under contract since 1985 to carry out research on the nature of the U.S.-Soviet long-term military competition and on improved means for developing and implementing strategies for this competition. While the focus of

our research is on the military dimension of the competition, it also takes into account the political, economic, technological, and ideological dimensions. Moreover, our effort encompasses broad national strategy as well as specific military missions or tasks and is directed at planning concepts and methods, rather than at devising specific strategies. Thus, the SAIC work has sought to improve the context and methods for DoD competitive strategies development, but does not duplicate planning efforts being carried out by the Department of Defense.

SAIC's research on the U.S.-Soviet long-term military competition was funded and guided by the Director of Net Assessment in the Office of the Secretary of Defense. The contract was administered by the Defense Nuclear Agency.

The results of SAIC's research are contained in three volumes:

- Volume I describes the general nature of the U.S.-Soviet long-term military competition, including concepts useful for understanding what is important in this competition and for developing strategies to compete effectively.
- Volume II describes a structured process for devising and implementing strategies for the long-term military competition, evaluates current analysis tools in terms of their adequacy to support competitive strategy development, and recommends improvements.
- Volume III contains case studies and other background papers that supplement volumes I and II.

Although these three volumes collectively describe the SAIC research, each is designed to be read independently of the others.

Dr. J. J. Martin was the Principal Investigator for SAIC's research on the U.S.-Soviet long-term military competition and is the primary author of this volume. Judith Grange drafted chapter 5. The following also made important inputs to this volume: Thomas Bush, Henry Herz, Wayne Hughes, Christopher Makins, Joel Resnick, and Dennis Smallwood; Dr. Smallwood drafted parts of chapter 3.3.

Conversion factors for U.S. Customary to metric (SI) units of measurement

MULTIPLY TO GET ← BY → TO GET
 TO GET ← BY → DIVIDE

angstrom	1.000 000 X E -10	meters (m)
atmosphere (normal)	1.013 25 X E +2	kilo pascal (kPa)
bar	1.000 000 X E +2	kilo pascal (kPa)
barn	1.000 000 X E -28	meter ² (m ²)
British thermal unit (thermochemical)	1.054 350 X E +3	joule (J)
calorie (thermochemical)	4.184 000	joule (J)
cal (thermochemical)/cm ²	4.184 000 X E -2	mega joule/m ² (MJ/m ²)
curie	3.700 000 X E +1	giga becquerel (GBq) [*]
degree (angle)	1.745 329 X E -2	radian (rad)
degree Fahrenheit	$T_K = (T_F + 459.67)/1.8$	degree kelvin (K)
electron volt	1.602 19 X E -19	joule (J)
erg	1.000 000 X E -7	joule (J)
erg/second	1.000 000 X E -7	watt (W)
foot	3.048 000 X E -1	meter (m)
foot-pound-force	1.355 818	joule (J)
gallon (U.S. liquid)	3.785 412 X E -3	meter ³ (m ³)
inch	2.540 000 X E -2	meter (m)
jerk	1.000 000 X E +9	joule (J)
joule/kilogram (J/kg) (radiation dose absorbed)	1.000 000	Gray (Gy)
kilotons	4.183	terajoules
kip (100 lbf)	4.448 222 X E +3	newton (N)
kip/inch ² (ksi)	6.894 757 X E +3	kilo pascal (kPa)
kip	1.000 000 X E +2	newton-second/m ² (N-s/m ²)
micron	1.000 000 X E -6	meter (m)
mil	2.540 000 X E -5	meter (m)
mile (international)	1.609 344 X E +3	meter (m)
ounce	2.834 952 X E -2	kilogram (kg)
pound-force (lbfavoirdupois)	4.448 222	newton (N)
pound-force inch	1.129 848 X E -1	newton-meter (N·m)
pound-force/inch	1.751 268 X E +2	newton/meter (N/m)
pound-force/foot ²	4.788 026 X E -2	kilo pascal (kPa)
pound-force/inch ² (psi)	6.894 757	kilo pascal (kPa)
pound-mass (lbmavoirdupois)	4.535 924 X E -1	kilogram (kg)
pound-mass-foot ² (moment of inertia)	4.214 011 X E -2	kilogram-meter ² (kg·m ²)
pound-mass/foot ³	1.601 846 X E +1	kilogram-meter ³ (kg/m ³)
rad (radiation dose absorbed)	1.000 000 X E -2	Gray (Gy) ^{**}
roentgen	2.579 760 X E -4	coulomb/kilogram (C/kg)
shake	1.000 000 X E -8	second (s)
slug	1.459 380 X E +1	kilogram (kg)
torr (mm Hg, 0° C)	1.333 22 X E -1	kilo pascal (kPa)

* The becquerel (Bq) is the SI unit of radioactivity; 1 Bq = 1 event/s.

** The Gray (Gy) is the SI unit of absorbed radiation.

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1. A LAYERED PLANNING APPROACH TO THE MILITARY COMPETITION

This volume describes a four-tiered approach to development and implementation of U.S. strategies for the military competition, shows the demands that competitive strategy development makes on analysis tools and data bases, evaluates current analysis tools and data bases in terms of their adequacy to meet these demands, and recommends an improvement program.

1.1 INTRODUCTION

The United States is engaged in a long-term competition with the Soviet Union in which the national security dimension bulks large, and probably will continue to do so. As discussed in volume I, the U.S.-Soviet military competition currently is slowing and increasingly is emphasizing the political and arms control aspects of security. Moreover, this competition is now carried out in a multipolar environment in which additional competitors to each superpower will play more important roles than in the past.

Nevertheless, the Soviet Union probably will be the strongest competitor to the United States over the next decade or two and, even if tensions between the superpowers continue to abate, U.S.-Soviet relations are not likely to evolve to the point of no competition during this period. Thus, the U.S.-Soviet military competition will continue to be a major planning focus for the Department of Defense (DoD); given the strong downward pressures on DoD budgets, strategies for competing effectively within highly constrained resources are becoming increasingly important for this planning.

Developing long-term strategies to guide peacetime planning and resource allocation is, however, inherently

difficult. It is made all the harder because of the many contending factions in the Pentagon, in the executive branch, and in Congress that potentially are involved in strategy formulation or implementation. Moreover, concepts and strategies for the U.S.-Soviet long-term competition seem to be particularly difficult for DoD planners to grasp. While the goal of building on U.S. strengths and Soviet weaknesses is straightforward to the point of banality, how to develop strategies to accomplish this goal is intuitively obvious to some, but distinctly counterintuitive to others.

Some sort of intellectual framework of strategic concepts and analytic methods is needed to help move development of strategies for the military competition from the realm of intuition into a structured domain that is more accessible to DoD staffs. Such a framework should also facilitate dialogue and debate about strategies, in order that all relevant organizations can be part of the process of strategy development and implementation. Further, this framework should allow the analytic resources of the Pentagon, which currently are directed primarily to supporting the more immediate planning, programming, and budgeting decisions, also to be used in support of strategy development and longer-range planning. As discussed in subsequent chapters, this will require improvements in certain kinds of analysis tools and data bases.

Building on material developed in volume I, the current volume describes such a framework of concepts and analysis methods for devising and implementing strategies to compete more effectively with the USSR and other adversaries, focusing primarily on the military dimension of the competition. This chapter describes a four-layer planning process for the long-term military competition. Chapter 2 discusses the types of analysis needed to support strategy development and implementation,

whether it be carried out through our four-layered process or by some other means, and chapter 3 evaluates the ability of current tools and techniques to meet these analysis needs. Chapters 4, 5, 6, and 7 address in more detail analytic methods that appear particularly promising for competition planning: military balance assessments, Soviet-style planning analyses, competition planning games, and military contingency analyses. Chapter 8 summarizes the conclusions and recommendations of volume II.

1.2 OVERVIEW OF LAYERED PLANNING APPROACH

The discussion of the peacetime military competition in volume I and, more generally, the complex nature of this competition indicate that planning should be a layered process. This is to say, competitive actions in particular subareas should be subordinated to higher-level goals and integrated strategies for the competition as a whole. It also follows that a satisfactory planning process must include feedback and substantiation procedures to ensure that the goals, assessments, and actions determined at one level are compatible with those at other levels. This feedback process is an important element of the planning approach and analysis techniques described in this volume.

We propose an approach to planning for the long-term military competition that is constructed around these characteristics. It consists of a hierarchy of four layers: a survey of the competitive environment, a high-level strategic plan, more detailed strategies for subareas of the competition, and actions to implement these strategies.

We have two purposes in describing this planning approach. The most immediate one in terms of our research is to provide a basis for addressing the ability of current analysis

tools to support competition planning. The other -- more important -- purpose, which is separable from the first, is to recommend a structured process for DoD use in planning for the long-term military competition.

This layered planning approach is described as a free-standing process, without reference to existing DoD or interagency planning mechanisms. This provides full visibility to the four layers as generic functions that our research indicates should be carried out for effective competition planning, providing the basis for determining in chapter 2 what kinds of analysis and data bases are needed to support competition planning.

We also, however, argue that, if the U.S. government is to plan seriously and on a sustained basis for the military competition, the functions described here should be carried out explicitly in the DoD and interagency planning process. One way of accomplishing this is to ensure that these functions are given adequate attention in existing planning mechanisms. Another way is to change existing mechanisms to more thoroughly provide the functions discussed below, particularly the periodic survey of the competitive environment and the high-level strategic plan. Both ways have advantages and disadvantages that are not addressed further in this report.

Figure 1 is a graphic overview of the four-layer planning approach. The first layer is a survey of the competitive environment, probably carried out once during the term of office of an administration. This survey essentially is a review of the international political, economic, technological, and military context within which the competition with the Soviet Union and other adversaries is carried out. Such a survey is needed periodically to validate or revise the assumptions

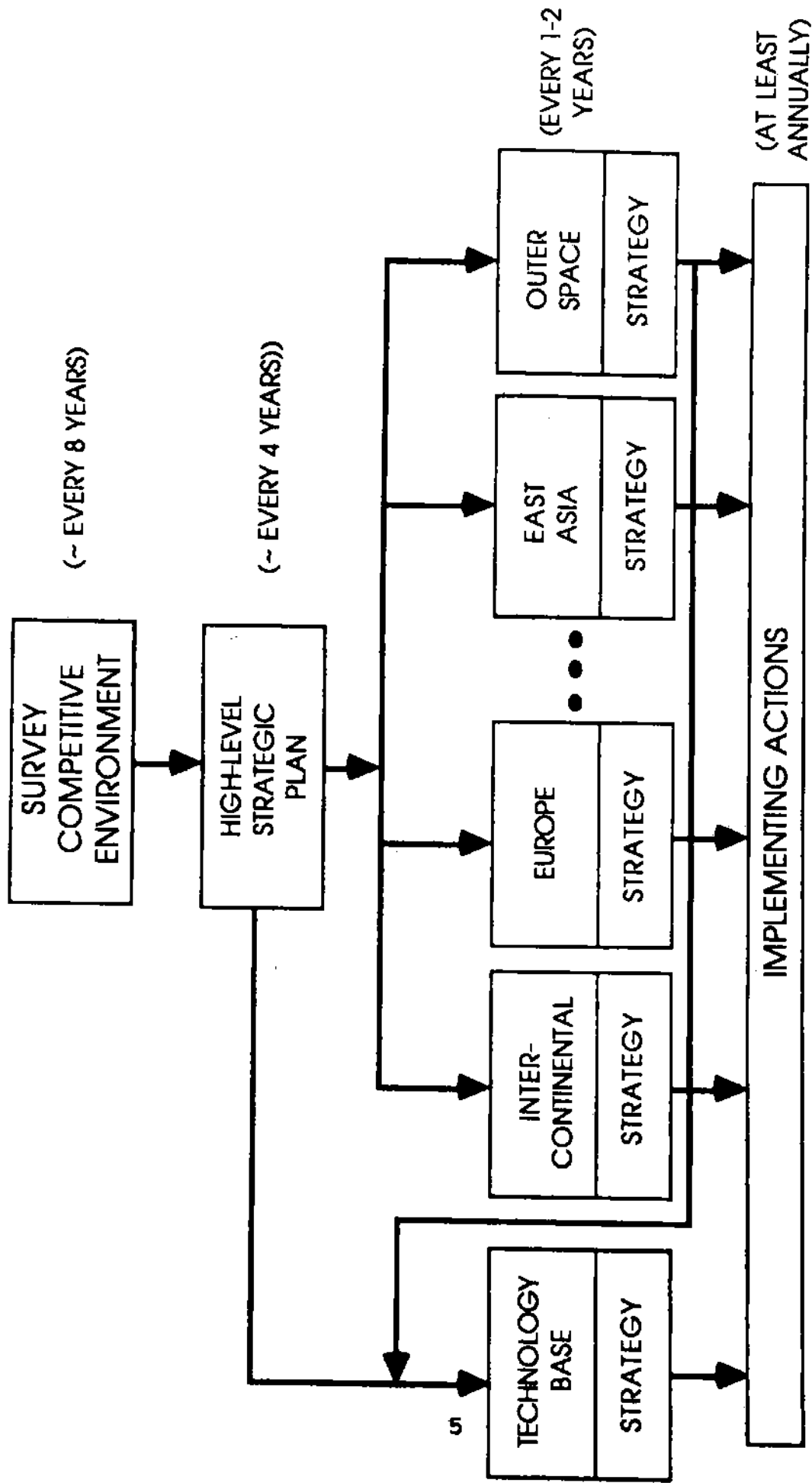


Figure 1. Generic functions in competition planning.

underlying the current U.S. approach to the competition and to update U.S. understanding of risks and opportunities in the competition.

The second layer is a high-level strategic plan that establishes U.S. goals in the competition and sets forth the essentials of U.S. strategy to achieve these goals. This guidance about goals and strategies should be reviewed and if necessary updated more frequently than a survey of the competitive environment, perhaps every four years. The secretary of defense, or perhaps the National Security Council, needs to articulate strategic guidance or a strategic plan to ensure that competition planning supports broad national objectives, to ensure that U.S. commitments in the competition are consistent with U.S. capabilities and resources, and to provide for portfolio management across subareas of the competition.

The third layer elaborates on the high-level plan by formulating more detailed goals and strategies for each subarea in which the United States is competing. As discussed in volume I, it is necessary to decompose the military competition as a whole into subareas like Europe and East Asia to make planning and implementation of competition strategies more tractable. The third layer of planning sets forth detailed competitive goals and strategies for each subarea, with reviews and updates perhaps as frequently as annually. Technology base goals and strategy are also developed in this planning layer. Not only does this third layer facilitate detailed competition planning and monitoring of the state of the competition by subarea, it also provides for portfolio management within each subarea.

The fourth layer translates the subarea strategies into implementing programs, force deployments, employment concepts, exercises, arms control positions, and other implementing

actions, integrating as appropriate across the subarea strategies. Selection and execution of these implementing actions are based upon the goals and strategies of higher layers of planning and upon monitoring of the actions of U.S. adversaries and the consequences of prior U.S. actions. This is a more or less continuous process.

Depiction of this planning process as a hierarchy is not meant to exclude the emergence of new ideas or technological opportunities in any layer, with subsequent impacts in all layers. Implicit in the entire process is feedback and iteration between layers.

This four-layer approach provides for the essential functions of competition planning in an architectural framework that relates detailed military programs, operational concepts, force deployments, arms control, and other political-military actions both to one another and to broader U.S. competition goals and strategies, with feedback to the strategy process based on the moves of the Soviets and other actors and on other trends in the competitive environment. This is in contrast to the more traditional military planning approach that proceeds linearly from policy objectives through missions and threats to requirements and system specifications, with little feedback or consideration of the competitive environment (see Figures 2 and 3).

Viewed from another perspective, this four-layer approach provides for the essential steps in any long-range planning system for U.S. national security, as follows:

- Understanding the planning context in sufficient detail to test current assumptions about the competitive environment, key actors, and the strategies of U.S. adversaries (layer 1).

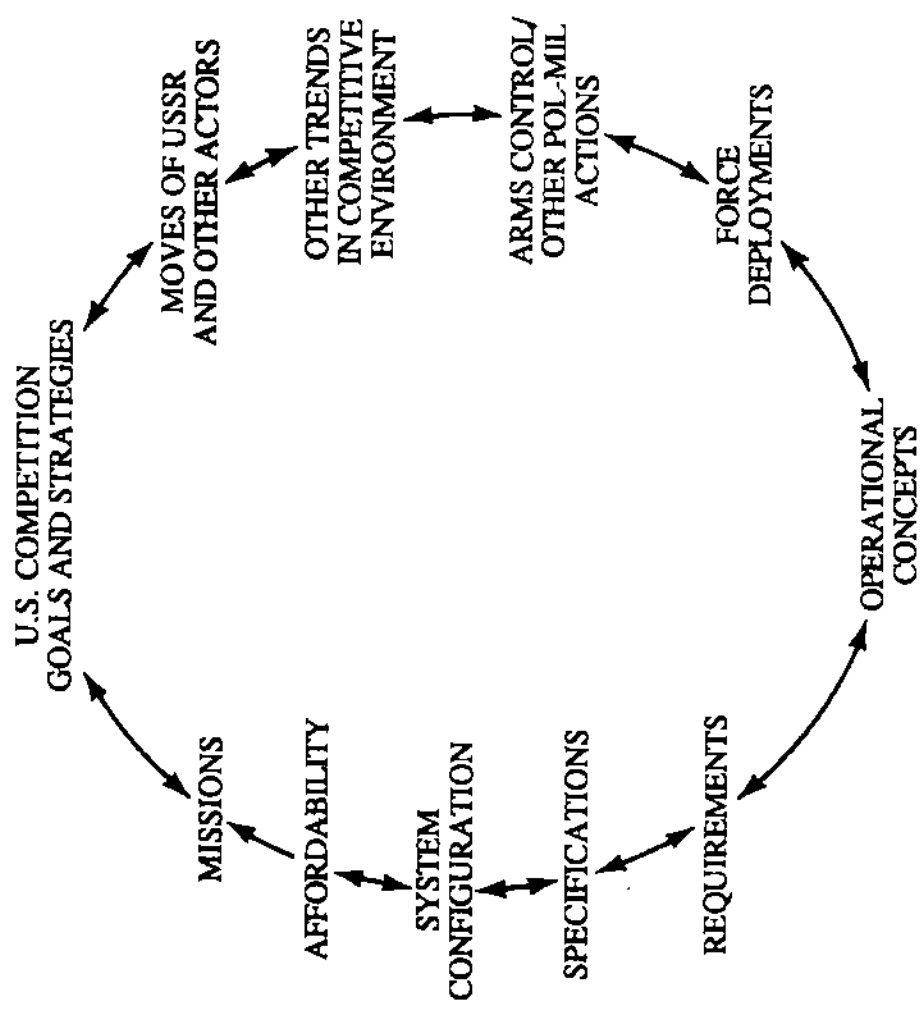


Figure 3. Emerging architectural approach.

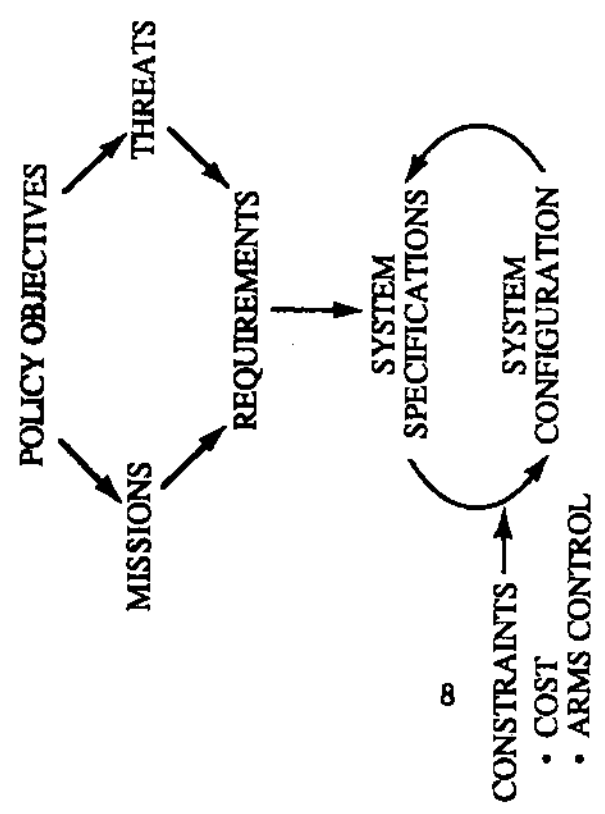


Figure 2. Traditional requirements approach.

- Balancing U.S. commitments with U.S. capabilities and resources by selecting subareas to which most of the U.S. competitive effort is to be devoted and setting competitive goals that are consistent with U.S. capabilities and resources (layer 2).
- Setting broad and specific goals in the military competition (layers 2 and 3).
- Formulating alternative strategies and implementing actions for consideration by U.S. authorities (layers 2, 3, 4).
- Supporting these authorities in their selection from among the candidate strategies and actions (layers 2, 3, 4).
- Implementing these decisions by executing the selected strategies and actions, monitoring the state of the competition over time, and adapting these strategies and implementing actions as necessary (layers 2, 3, 4, especially layers 3 and 4).
- Ensuring consistency among U.S. competitive goals and actions, and between broader U.S. national objectives and U.S. strategies and actions in the military competition (layers 2, 3, 4).
- Focusing planners on long-term (as well as short-term) consequences of U.S. strategies and actions (layers 1, 2, 3, 4, especially layers 1 and 2).
- Building consensus within the Department of Defense, within the executive branch, and with Congress on U.S. goals, strategies, and actions in the military competition through participation of key parties in the planning process (layers 1, 2, 3, 4).

While the focus of the discussion of approaches to competition planning is on the U.S.-Soviet competition, these approaches are structured to ensure that full and proper account is taken of the diverse and fluid international environment in which the U.S.-Soviet competition is carried out and are applicable to planning for military competition with other adversaries as well.

Military planning currently takes place through a number of established means, notably the Programming, Planning, and Budgeting System (PPBS) in the Department of Defense. The purpose of the processes for taking more explicit account of the U.S.-Soviet long-term military competition that we propose in this volume is certainly not to supplant the existing PPBS system or to alter the U.S. national goals to which that process is directed (e.g., deterrence of attack, reassurance of allies, the ability to resolve crises peacefully, and the ability to fight effectively in the event of war). Rather it is to recommend ways in which the process can be modified to enable those goals to be more efficiently attained by exploiting U.S. strengths and Soviet weaknesses more systematically.

Underlying these recommendations is the conviction that actions designed to enable the United States to compete more effectively in the military arena can, at any given level of resources, make the attainment of broader national objectives easier, in part by providing more precise guidance for military investment decisions. It follows that more explicit and thorough incorporation of considerations related to the long-term military competition might result in a changed pattern of investment within the defense budget or in changed operational concepts to maximize the return on investments.¹ But, properly carried out, planning for the peacetime military competition should not result in actions that are incompatible with broader U.S. objectives.

1.3 LAYER 1: SURVEY OF THE COMPETITIVE ENVIRONMENT

The prospective evolution of the competitive environment is central to U.S. decisions about goals and strategies for the competition. Consequently, as the foundation for the entire U.S. planning process, it is essential to

undertake a periodic effort to ensure that the environment is understood and analyzed as well as possible. Since major changes in the environment are not to be expected over a short period of time, this survey does not have to be made often -- once during each U.S. administration would probably suffice, with some provision for updating it in the interim if circumstances warrant. For example, a new survey of the competitive environment would have been appropriate late in the Reagan administration, after the serious, systemic economic problems of the USSR became apparent.

The major purpose of the survey is to validate or revise the assumptions underlying U.S. policy and to help identify risks and opportunities that may present themselves for realizing competitive advantages -- in effect, to make a net assessment of the future U.S. ability to compete effectively.

The time horizon for this survey should not be less than twenty years, since that is the minimum period over which many strategies and actions would make their full strategic impact felt. The output of the survey should be an analysis of the critical trends and asymmetries in the international system affecting the U.S. or Soviet ability to compete and the way in which the competitive environment is likely to change as a result of these trends and asymmetries. Areas surveyed should include, at the minimum, economics, demography, technology, military forces, domestic politics, and international alignments. The survey should focus particularly on Soviet strengths, weaknesses, and strategies, and on the factors that may change the level of the superpowers' dependence on and the scope for their cooperation with other nations. The survey would then provide an assessment of the adequacy of current U.S. competition planning assumptions in light of the analysis, recommend appropriate changes in assumptions, and derive conclusions about future risks

and opportunities for the United States in the prosecution of the peacetime military competition.

A critical element of this analysis would be the incorporation of the perspectives of key actors on the international scene, notably, but not only, those of the Soviet Union, and an assessment of how their goals and strategies might evolve in the future and how this evolution might influence the competition. The primary tools for this analysis would be economic, military, technological, and political forecasting techniques such as those used in the report on the future security environment prepared for the Commission on Integrated Long-Term Strategy.²

There are, obviously enough, serious process risks to be avoided in any exercise of this kind. These include a misguided focus on irrelevant or misleading trends, a failure to uncover important areas of inherent risk or potential opportunity for the United States, and a failure to make critical assumptions in current planning explicit. The principal means of avoiding these risks is to subject the results of the layer 1 analytical process to a broad, critical review by people inside and outside the government so as to minimize bias and error.

In addition, there are major inherent or unavoidable uncertainties associated with a survey of the competitive environment. These uncertainties would manifest themselves, for example, in projections of U.S., Soviet, and third party technological and economic developments, of political discontinuities in key countries (e.g., those affecting U.S. military access), and of unexpected competitive strategies and actions on the part of the Soviets or other adversaries. The primary goal in the layer 1 survey should be to identify and where possible bound these uncertainties so that portfolio

management techniques can be applied to them at the lower layers of the planning process.

1.4 LAYER 2: HIGH-LEVEL STRATEGIC PLAN

In layer 2 of the planning process the layer 1 survey of the competitive environment would be used as the basis for developing a high-level U.S. strategic plan for the conduct of the peacetime military competition. The purposes of this plan would be to set goals for U.S. strategy in the competition, to identify areas of high and low priority for U.S. competitive actions and strategies (including areas in which the United States may decide not to compete), and to enunciate a high-level strategy designed to achieve the goals.³ This strategy would, in particular, indicate which specific U.S. strengths and Soviet weaknesses should be exploited in the attempt to realize competitive advantages and would make explicit which of the risks in the competitive environment should be addressed through portfolio management techniques, particularly those techniques that work across two or more subareas of the competition. The high-level strategic plan would identify improvements that should be made in the U.S. competitive position and might also include efforts to change selected U.S. weaknesses into strengths over time.

The time horizon of this plan should, like the survey of the competitive environment, be twenty years or more. Since U.S. and Soviet moves and countermoves can affect the viability of U.S. goals and strategies, the plan itself should be reviewed and updated periodically, perhaps when a new secretary of defense takes office or every four years for secretaries whose tenures exceed that period.

Three objections might be raised to calling for a high-level strategic plan. One is that such a plan is not needed, that detailed goals and strategies in specific subareas of the competition are adequate or perhaps even more appropriate than centralized direction. This objection is wrong. One of the few valuable lessons for the Department of Defense we found in the corporate strategic planning literature is the importance of clear guidance from corporate management about planning goals and resource priorities for specific business areas. Given the long-term nature of the U.S.-Soviet military competition, the complex nature of the competitive environment, the many alternative moves possible for the Soviets, the interactions among subareas of the competition, and the many demands on scarce DoD resources, it is essential that there be some high-level formulation of U.S. goals, strategy guidelines, and principles for portfolio management across subareas in order to bring coherence to U.S. strategies and actions in the competition.

This is not highly centralized direction of all facets of the competition, which for most competitive actions probably would be ill-advised. But some form of high-level guidance is necessary to ensure consistency among subarea strategies and between these strategies and broad national objectives, and to ensure that resources expended in the competition accord with national priorities.

A second objection is that the development of a high-level strategic plan for the military competition implies an integrated national planning mechanism that does not exist below the level of the president. It is true that such a formal mechanism does not exist, but it is not necessary in order for U.S. leaders to set broad goals and strategies, as has been demonstrated by the success of past U.S. strategies, including containment, flexible response with an emphasis on conventional

forces to deter Warsaw Pact attacks in Europe, and U.S. rapprochement with China. At the minimum, the secretary of defense should have a set of strategic goals and a broad strategy in mind, as has indeed been the case with the most successful secretaries since World War II. The specific means by which a secretary of defense gains consensus for his high-level strategic plan within the administration will vary, but several means are available, including continuing consultation with the president and key administration and congressional leaders, as well as more formal National Security Council processes. Development and implementation of a high-level strategic plan for the military competition cannot and should not be done by the Department of Defense alone, but the Defense Department clearly can take the lead in this effort.

A variant of this objection is that the U.S. government is not a unitary actor. Few governments are, and this is a fatuous complaint. Clearly any effective competition strategy must be consistent with the main stream of American public opinion, must have a minimal degree of consensus within the executive branch and Congress, and must take into account the bureaucratic interests and inertia it may have to overcome. Such problems require leadership and statesmanship, but they are not a reason to forego competition planning.

A third, perhaps more serious, objection is that a high-level strategic plan inevitably will be too general to be useful. It is argued that bureaucratic politics and the risk of leaks to the media force senior members of the national security establishment to keep their specific goals and strategies private. The plan of Richard Nixon and Henry Kissinger to restore relations with the People's Republic of China is an example of a high-level strategic plan for the U.S.-Soviet

competition that could not have been published in a guidance document.

This is a valid issue, but it does not imply there should be no high-level strategic plan, only that parts of the plan should be limited to a small number of advisors of the members of the National Security Council or to a select number of leaders in the U.S. national security establishment. These parts may not even be written in a document. But thinking, debate, and analysis about very private high-level goals and strategy elements are even more important than for more widely-distributed plans, because many of the checks and balances in normal national security planning would be bypassed. Thus, a high-level strategic plan need not be published and widely distributed to be effective, but it should be subjected to the kind of analysis described in subsequent chapters. Further, some parts of a high-level strategic plan probably can be widely distributed without compromising the U.S. ability to execute the plan. Ronald Reagan's decision to make an effective strategic defense a long-term U.S. competitive goal is such an example.

The layer 2 high-level strategic plan should take into account the implications for U.S. goals and strategies of the layer 1 survey of the competitive environment and the U.S. ability to compete in this environment. More specifically, this plan should include at least the following elements:

- Assumptions for planning, based on the layer 1 survey of the competitive environment and assessments of the likely strategies and behavior of the Soviet Union and other key countries.
- A statement of goals in the competition, with specific time frames (and where relevant, intermediate milestones), in a form that can be used to measure progress realized by implementing actions initiated in accordance with the plan. This statement of goals should, for example,

identify desired characteristics of the future military balance at different times in the future and, as appropriate, take account of the roles of U.S. allies and friends in contributing to the achievement of U.S. goals. It should also identify improvements in the U.S. ability to compete with the USSR (the competitive position of the United States) that should be pursued.

- A statement of the military contingencies of importance to U.S. national planning, as a step in translating goals into strategy.
- A statement of broad U.S. strategy for the competition, including notably the identification of subareas on which resources should be concentrated or criteria for the allocation of resources among different subareas of the competition (including criteria for deciding not to compete in particular areas). This statement should, in particular, make plain how the United States intends to try to shape the future of the competition (e.g., by influencing the direction of Soviet military investment, making obsolete their earlier investments, and protecting the advantages expected from U.S. investments).
- Preferred means of portfolio management for implementing this strategy, particularly for controlling risks and taking advantage of opportunities that cut across two or more subareas of the competition.
- A first-order economic projection designed to establish a rough balance between U.S. commitments and U.S. capabilities and resources.

Among the more important inputs to the development of this plan would be the following:

- An assessment of the current state of the competition, including an analysis of the current military balance and the current competitive positions of the United States and the Soviet Union. The assessment should draw upon the planning concepts discussed in volume I (e.g., competitive advantage, competitive initiative).

- An assessment of U.S. and allied strengths and Soviet weaknesses that could be exploited to enable the United States to achieve its goals. This assessment should be broadly based, covering strengths and weaknesses derived from geography, economic conditions, national style and objectives, and dependence on allies or other third parties, as well as the more familiar realm of technology. It should also include an assessment of the ability of the U.S. and allied defense and industrial establishments to exploit the identified U.S. strengths successfully and of their Soviet counterparts to forestall the U.S. exploitation of their weaknesses.
- Evaluation of the multipolar aspects of U.S. strategy, including possible division of efforts among the United States and its allies, possibilities for diverting more Soviet resources into competing with other countries such as China, and ways to help other nations compete more directly and effectively against the Soviet Union.
- Formulation and evaluation of alternative U.S. goals and strategies for a more multipolar competition if the Soviet Union declines as the dominant competitor with the West.
- An identification of likely Soviet competitive goals and strategies, and analysis of their feasibility under plausible Soviet economic conditions.
- An evaluation of alternative U.S. goals, to select those that most effectively serve national policy and offer the most effective use of available resources.
- The results of analyses and games designed to test in an interactive manner proposed U.S. competitive goals and strategies and the adequacy of U.S. portfolio management strategies in light of plausible adversary goals and strategies.
- Analysis of the proposed high-level strategy and possible variants to establish their adequacy for achieving U.S. competitive goals and their consistency with broader national economic, political, and diplomatic objectives (including objectives for closer cooperation with the Soviet Union or other key actors). This analysis should include an assessment of likely support for the

proposed strategy, both domestically and among key U.S. allies and friends.

There are a number of process-type risks to be managed in this layer. They are essentially similar to those discussed in connection with layer 1 and should be managed by similar techniques.

More difficult are the inherent uncertainties with which the U.S. high-level strategic plan would have to contend. These include technological surprise, uncertainties concerning the competitive environment (e.g., the unexpected emergence of new adversaries or problems), unexpected Soviet choices of goals and resource allocations across the areas of the competition, and unexpected changes in third party behavior that would affect the leverage of other countries over the United States or the Soviet Union.

Given the seriousness of these uncertainties, the high-level plan should include a portfolio management analysis that provides ways to hedge against the principal risks and to be able to take advantage of new opportunities quickly, especially risks and opportunities that relate to more than one subarea of the competition. The term portfolio management refers to a set of planning techniques that is designed to limit or control the risks inherent in any one or more of the actions or strategies within a subarea of the competition or across several subareas. Portfolio management techniques should also make it easier to exploit unexpected opportunities for realizing competitive advantages should they occur. The concept implies the active search, as part of the planning process, for more advantageous portfolios of competitive actions and strategies.

There are two types of risk to be considered in competition planning. The first is risk arising from avoidable weaknesses in the planning process itself. The second is risk arising from inherent and unavoidable uncertainties in the information base about the present and future on which decisions must be made. Portfolio management is primarily concerned with the second type of risk, unavoidable or inherent uncertainties.

Specific portfolio management techniques for use in layer 2 include attempting to find robust strategies that could cope with a range of possible future developments (even at some loss in overall competitive effectiveness); prescribing the selection of multiple means for achieving the most important goals, to hedge against surprise failures; selecting higher confidence, but lower payoff, solutions to key problems in order to minimize the risk of dead-end approaches; building in adaptability and intermediate milestones for measuring progress in key areas; and avoiding critical dependence on realizing a specific competitive advantage in any one subarea of the competition.

The image of an investment portfolio is deliberately evoked by the use of the term portfolio management. This analogy admittedly is a loose one, not least because investment portfolios typically consist of a set of more or less readily tradable securities that can be acquired or liquidated at low cost. Such is unlikely to be the normal situation with competitive actions, especially those that require years to come to fruition and offer no prospect of recovering sunk costs if they are terminated before they do so. Nevertheless, the idea that a competition strategy involves an active process of attempting to manage risk through diversification and other deliberate measures is an important one, and justifies using the portfolio terminology.⁶

1.5 LAYER 3: SUBAREA GOALS AND STRATEGIES

The analysis and output of layer 2 of the competition planning process should provide guidance suitable for lower-level planning, monitoring of progress toward the goals of the higher level plan, and revising lower-level plans in light of the results of this monitoring. The purpose of the layer 3 analysis is to develop detailed, time-phased goals to be achieved in each subarea to which the United States is committing substantial resources, strategies to achieve these goals, and portfolio management techniques to be applied within each subarea.

Subarea goals should be designed to provide guidance for operational planning, force deployments, security assistance, and other relevant policy instruments, as well as for acquisition planning. A refined assessment should be made of the technological, operational, and political feasibility of the chosen strategies, in the United States and abroad. These tasks cover some of the area of responsibility of the existing DoD Competitive Strategies Task Forces (although the latter also work in layer 4 of the approach described here).

The planning horizon for these subarea goals and strategies should generally be shorter than that of layer 2, perhaps on the order of a decade. This is because the focus of layer 3 planning is on detailed implementation of the long-term goals and strategy of layer 2, and layer 3 planning would therefore tend to emphasize the nearer-term. In some subareas, however, a longer planning horizon would be appropriate; the technology subarea is a notable example. The whole set of subarea goals should be reviewed at least as often as the defense program itself, that is to say every two years. In each region, account should explicitly be taken of likely actions by U.S.

allies that could affect attainment of the goals identified as of high priority. In relation to the European subarea, the layer 3 goals and strategy should be dovetailed with the on-going process of force planning in NATO.

The principal tools of analysis for this task would be military balance assessments and contingency analyses, both informed by an understanding of how the Soviets and key third countries are likely to behave. Planning games would be another major planning tool. These should be designed to stimulate better insights into the process of moves and countermoves that could be expected to affect the balance of military forces, strategies, tactics, and training in each region in the future.

The profile of both process-type and inherent risks would be similar to that identified in layer 2. The principal difference would be the level of specificity with which these risks would need to be analyzed and managed.

The primary techniques available for managing the process-type risks would be interactive gaming and other analyses designed to improve understanding of the range and significance of likely adversary strategies and actions. Monitoring adversary actions over time would be equally important, with a view to providing feedback on the soundness of the initial assessment.

The management of the inherent risks or uncertainties -- which would include unexpected political developments in key regions, technological surprises, and "improbable" military-operational initiatives by the Soviets or others -- could be addressed by many of the same portfolio management techniques discussed in connection with layer 2. Adaptive planning, with modification of subarea strategies in light of adversary actions and other changing conditions, would

be a particularly important portfolio management technique in layer 3.

The approach to dealing with the technology subarea would be similar to that for any other subarea of the competition. The planning horizon for this analysis should, however, be rather longer -- fifteen to twenty years -- because of the longer time needed to achieve technology goals as compared with the timelines of regional strategies. The purpose of the analysis would be to set goals for DoD R&D programs (6.1, 6.2, 6.3A) and a strategy for attaining these goals that would enable the United States to compete effectively in new areas and to convert some current U.S. weaknesses to strengths. Additionally, some goals in the technology subarea would derive from goals and strategies in the regional subareas (e.g., improve U.S. armor and anti-armor technologies). For these purposes, the analysis would require a sophisticated understanding both of the ways in which U.S. research and development, even if it does not result in specific system acquisitions, casts a long shadow of influence on Soviet planning and of how the Soviet industrial system operates.

On the first point, U.S. R&D programs that were designed solely for the length of their shadow and had no serious expectation of leading to deployments would be unlikely to receive sustained political support. But there may nevertheless be ways of exploiting the long-shadow effect to U.S. advantage in the competition, and to shape the pattern of Soviet investment in ways that are relatively benign from the U.S. point of view.

On the second point, the Soviet industrial system, issues to be considered include the ways in which the Soviets may be able to respond effectively to specific U.S. actions by high-level political "spotlighting" of a number of R&D areas, thus obviating the expected obstacles to such responses, and the ways

in which they may be inhibited from effective responses by particular areas of high "impedance" in their industrial system. Another key issue is the potential Soviet exploitation of foreign technology, whether imported legally or illegally, that needs to be analyzed as a basis for consideration of technology transfer issues in layer 4.

Among the special analytic tools required for the technology subarea would be: net technical assessments of both current and future U.S. and Soviet capabilities; and competition planning games that could foreshadow likely Soviet initiatives or responses to U.S. R&D programs and the time frame within which they could be carried out.

1.6 LAYER 4: IMPLEMENTING ACTIONS

The challenge to be met in layer 4 is to determine specific actions, in terms of procurements, force deployments, operational concepts, training, and diplomatic moves (including security assistance and arms negotiations) that can best serve U.S. goals and strategies for pursuing the peacetime military competition. Beyond that, it is the province of layer 4 to select actions that can be implemented efficiently in terms of both time and resources.

The results of the three top layers of planning should all be focused on the choices to be made on layer 4. In particular, the goals and strategies defined in layer 3 should be designed to provide clear guidance for the work to be done in layer 4, which would integrate actions across subareas and translate these actions into PPBS and other appropriate categories within the existing executive branch and congressional structures. In effect, layer 4 is the interface between competition planning and existing systems for planning and

executing force acquisition, operational planning, and foreign policy.

The planning horizon for layer 4 work should be five to ten years into the future, with the selected actions being structured so that progress toward specific goals can be measured. The whole set of actions should be reviewed at least once in each defense programming cycle, and some individual actions should be reviewed more frequently as appropriate.

The output from this layer should be plans of action for each of the subareas of the competition in forms that will lend themselves to being aggregated and integrated into the defense program, Joint Chiefs of Staff (JCS) operational planning, and ongoing foreign policy processes. They should thus include proposed weapon system acquisitions, R&D plans and requirements, force deployment plans, operational concept development plans, security assistance programs, arms control actions, and consultations with allies.

The analytic tools required for the development of these actions would be simulations and free-form games; cost-effectiveness analyses that would measure not only costs versus benefits for the United States, but also the degree of cost imposition on the Soviets; and the contingency analysis and net technical assessment tools already identified for use in layer 3. In all of these analyses, representation of likely Soviet initiatives and responses in terms of procurement, operational concepts, and diplomatic actions will be critical.

There are a number of process-type risks to be handled in this layer. These include the failure to achieve the expected returns on investments, whether because of cost overruns, inefficiencies or delays in the procurement process, or the

failure to ensure adequate domestic or allied support for particular actions. Although some might argue that these risks are not really process-related, but are inherent, there is little doubt that they could be substantially mitigated by process improvements, including more systematic assessment of the political viability of possible actions; by analysis; and by consultation within the U.S. system and with allies.

In addition, there are some inherent uncertainties in layer 4, notably those associated with the actions of the Soviet Union and key third parties. These can be mitigated by building adaptability into the plans and by improved move-countermove analyses (including the use of interactive gaming techniques).

ENDNOTES TO CHAPTER 1

1. There is a difference between military contingency planning and planning for the peacetime military competition. The former involves decisions about how to fight best with existing forces and analysis of how the Soviets or other adversaries would fight with their existing forces, in order to ensure the most favorable political and military outcome from a conflict today. Planning for the long-term military competition concerns decisions about U.S. military investments and future operational concepts, and analysis of likely adversary investments and future operational concepts, with a view to arriving at a more desirable future state of the military competition.
2. Andrew W. Marshall and Charles Wolf, Jr., The Future Security Environment, Report of the Future Security Environment Working Group, submitted to the Commission on Integrated Long-Term Strategy (Washington: U.S. Department of Defense, October 1988).
3. An example of an area in which the United States decided in the 1970s not to compete is biological weapons. More recently, the United States and the Soviet Union agreed not to compete in the area of intermediate-range nuclear missiles.
4. See chapter 2 for further discussion of portfolio management techniques.

2. ANALYSIS TO SUPPORT COMPETITION PLANNING

The purpose of analysis in competition planning is to support U.S. selection of goals, strategies, and implementing actions for the peacetime military competition. This chapter describes a generic sequence of analyses to support competition planning within the four-layer framework that is described in chapter 1. We then discuss in more detail analysis approaches associated with several key aspects of competition planning: setting competitive goals, feedback and iteration in competition planning, and portfolio management. We conclude chapter 2 with a summary of the requirements or demands that competition planning levies on analysis, to provide a basis for the evaluation of analytic tools and recommendations for improvements in tools, techniques, and data bases to support competition planning that appear in subsequent chapters.

The framework for competition planning is depicted in Figure 1 of chapter 1. Our research indicates that competition planning would be improved if each of the four layers in this framework had a significant role in the process. While each of these layers need not be institutionalized in a formal sense, proper development of strategies for the military competition demands that each be carried out somewhere, somehow. Moreover, analytic support should be rendered in each layer if competition planning is to move from the realm of intuition to become a structured process in which key bureaucratic parties can play a systematic role.

To recap, the competition planning framework described in chapter 1 consists of four layers, as follows:

- A periodic survey of the competitive environment to validate or revise the assumptions underlying current planning for the competition.

- Development of a high-level strategic plan that would provide guidance to competition planners and align U.S. commitments in the competition with available resources. This would be done by specifying subareas of the competition to which significant resources should be devoted, by setting competition goals, and by stating a broad strategy for achieving these goals within available resources.
- Statements of more detailed goals and strategies in each subarea of the competition to which significant resources are to be committed.
- Formulation of detailed actions to implement the strategies developed in higher layers. By and large, these actions would be selected and implemented through the established weapon system acquisition, operational planning, and foreign policy processes, which are not addressed in detail in this report.

The sequence of analyses described below focuses primarily on the top three layers of this hierarchical planning process, since current analysis tools are designed primarily to support the layer 4 process and the new demands of competition planning on analysis occur primarily in layers 1-3.

2.1 SEQUENCE OF ANALYSES TO SUPPORT COMPETITION PLANNING

By combining the hierarchical planning approach of Figure 1 with the concept of the state of the competition and adding cost considerations (which are implicit in the approach of Figure 1), we can outline a generic sequence of analyses to support planning for the peacetime military competition.

This sequence of analyses is shown in Figure 4. It is an iterative process in several respects. First, the analysis sequence should be applied iteratively or repeatedly throughout a multiyear planning period. Not only is this analysis sequence

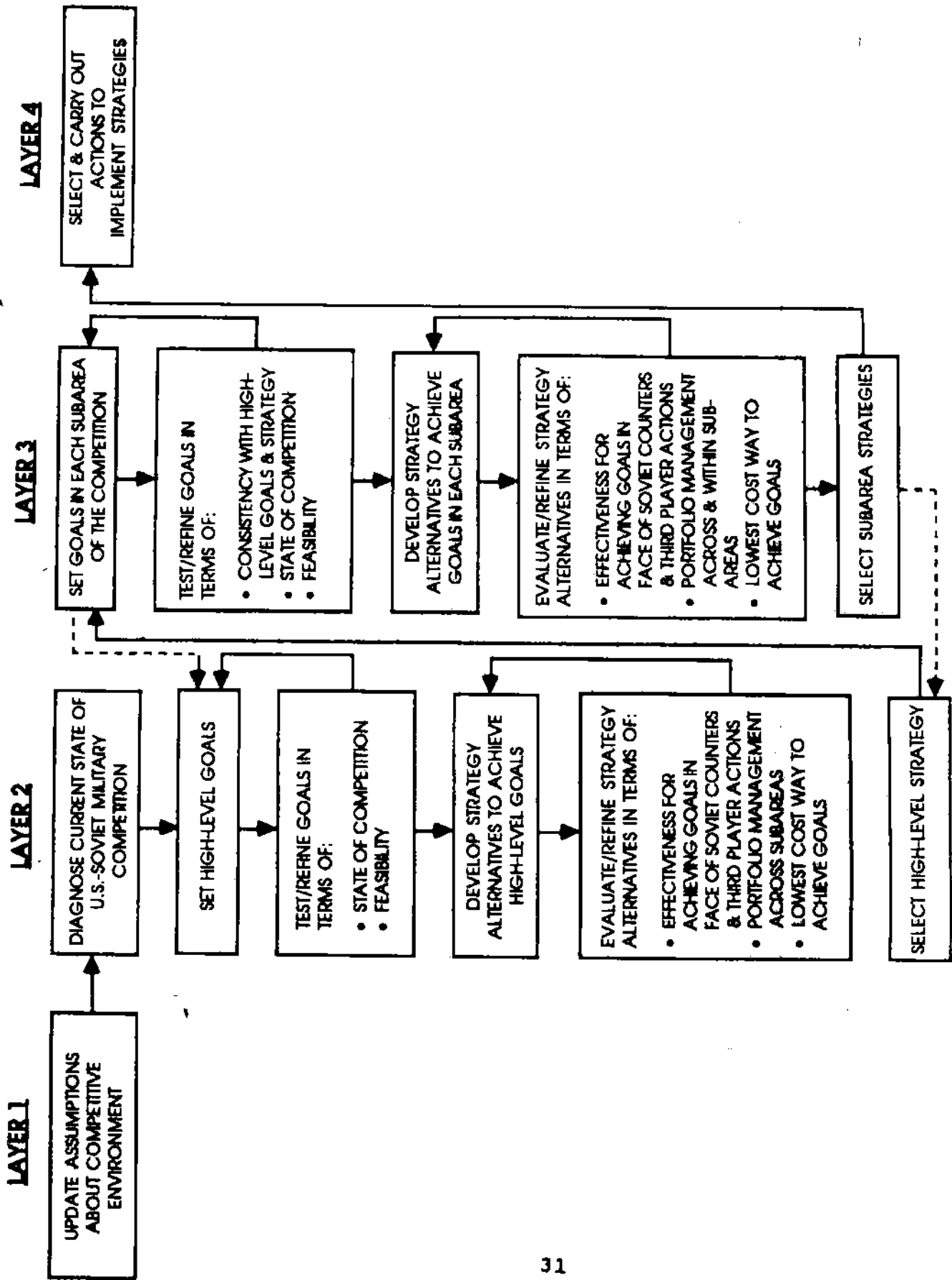


Figure 4. Analysis sequence for competition planning.

applicable to the initial formulation of goals and strategies, it should also be applied iteratively in periodic reviews and updates of existing competition goals and strategies. Feedback and iteration are also key parts of an application of the analysis sequence at a single point in time in the planning process. Such an application would formulate initial versions of goals and strategies; test, evaluate, and refine these initial versions; and iterate the analysis process until satisfactory goals and strategies are obtained. Thus, an iterative approach to the analysis of alternative goals and strategies is at the heart of the sequence depicted in Figure 4. Not only does this technique best suit the intellectual challenges of strategy development, it also suits the organizational challenges by providing opportunities for the preferred goals and strategies of each important bureaucratic party to be considered as alternatives in the analysis process. Feedback and iteration are discussed further in chapter 2.3.

The sequence of analyses shown in Figure 4 starts with the first layer of the hierarchical planning process: the updating of planning assumptions based on a survey of the competitive environment. It then proceeds to the second layer, carrying out three major analytic steps:

- Diagnosis of the current state of the U.S.-Soviet military competition, to provide a basis for setting goals.
- An iterative process to set top-level competitive goals in the second layer, considering the current state of the competition and first-order checks on the economic, political, and technological feasibility of the goals.
- Development and refinement of top-level strategy alternatives and selection of a top-level strategy, based on considerations of how well the strategy alternatives are likely to achieve U.S. goals, on Soviet and third party actions, on top-level portfolio management across subareas of the competition, and on costs.

The sequence of analyses then proceeds to the third planning layer, goals and strategies for each subarea of the competition to which significant resources are to be committed. Three major steps are carried out to set detailed goals and strategies for each of these subareas in a manner similar to the analysis in the second layer, except that in the third layer portfolio management is applied within each subarea, as well as across subareas.

Finally, actions to implement the strategies are selected and carried out in the fourth planning layer. As indicated above, current analysis capabilities for the fourth layer are relatively more advanced than those for the first three layers and improvements in layer 4 capabilities would not be driven strongly by the needs of competition planning. Accordingly layer 4 analyses are not examined in detail in this report.

Before considering the demands imposed on analysis tools, techniques, and data bases by competition planning, we discuss in greater detail three parts of this analysis sequence: the way goals can be more effectively used as drivers and monitors of competition planning; the role of feedback and iteration of the competition planning process; and the techniques of portfolio management.

2.2 GOALS AS TOOLS OF PLANNING

The foregoing description of the competition planning process and supporting sequence of analyses refers at several points to the need to formulate goals in such a way that they shape strategies and facilitate the measurement of progress in the competition. The difficulty of attaining this ideal should not be underestimated.

There are at least two reasons for this difficulty. The first is the problem of translating the ultimate prizes that the United States is seeking in the competition (e.g., influence in Western Europe) into specific operational-military goals (e.g., theater nuclear force improvements). The second is the complex series of steps that must be executed in order for a planning goal to be translated into a viable implementation plan. Such a plan implies:

- Coordinating force posture, force deployment, operational, and declaratory policies related to the goal.
- Coordinating the responses of the military services to the goal.
- Coordinating U.S. and allied actions related to the goal.
- Navigating through the entire PPBS and congressional budget cycle and alliance force planning steps to the point at which approved actions can be undertaken to affect future U.S. and allied force capabilities.

Recognizing these difficulties, there are a number of ways to help make statements of goals more effective as guides to planning. A starting point is to take note of the difference between broad U.S. objectives and more specific, narrower competitive goals. Broad objectives (e.g., deterrence of Soviet attacks) have a certain permanence over time; have applicability beyond, as well as within, the competition planning context; and usually are too broad to serve directly as guides for resource allocation or other planning decisions. In contrast, while competitive goals should be consistent with broader U.S. objectives, they usually will change over time as the state of the competition changes, since they are more narrowly focused; they apply primarily in the competition planning context; and they should be sufficiently specific to help guide force development,

operational planning, and arms control. Some examples of competitive goals are to make existing Soviet air defenses obsolete; to compel the Soviets to dedicate significant numbers of general purpose naval forces to protecting Soviet nuclear-powered ballistic missile submarine (SSBN) bastions; and to undercut Soviet investments in the hardening of strategic targets in the USSR.

Proceeding from this starting point, four aspects of the problem of setting competitive goals warrant attention.

- The requirement for a hierarchy of goals, from the broadest to the most specific, in which the dependence of one on the other is clear and precise. Too often there is a gap between the broad goals established at the level of policy and national strategy and the specific lower-level goals needed to drive force planning and development. Although tolerating this gap may often suit a number of bureaucratic interests, it does not facilitate the U.S. attempt to compete more effectively and efficiently with the Soviet Union.
- The need for implementation milestones to be built into the statement of goals. Only in this way can progress toward attainment of the goals be measured in relation to plausible courses of adversary countermoves.
- Periodic review of existing goals to revise or eliminate those that no longer are valid in light of trends in the competitive environment. The risk of pursuing obsolete goals can be reduced by requiring that each goal be clearly and explicitly linked to those attributes of the competitive environment that constitute the necessary conditions for continued pursuit of this goal to be justified.
- The need for feedback loops in the planning process to facilitate consistency checks between higher-level goals and implementation plans. This topic is discussed further below.

The first layer in which the definition of goals becomes important is layer 2, in which U.S. competitive goals on a world-

wide basis would be set. In this layer, the goal statements must contain at least three elements pertaining to the military balance or to relative U.S.-Soviet competitive positions (or abilities to compete): the current U.S. (and allied) military weaknesses to be corrected, in order of priority; the U.S. and allied strengths and the corresponding Soviet weaknesses to be exploited in making the corrections; and the time horizon for achieving the corrections, with intermediate milestones where possible.

There are two additional requirements for the layer 2 goal statements if they are to be of use for lower-level planning. First, there must be some confidence in the economic, technological, operational, and political feasibility of attaining them. This is the important role played by the first-order feasibility assessments in layer 2 (as described in chapter 2.1 and Figure 4), which would be refined in subsequent stages of the analysis sequence. Secondly, since the layer 2 goals will drive the planning process at layers 3 and 4, some region-by-region considerations will be required even in the high-level goals of layer 2.

In layer 3, the goal statements must be further refined and specified. Here the layer 2 goal statements must be translated into military-operational requirements in specific subareas that have to be met in order to attain the layer 2 goals by the prescribed time, with the dates by which milestones towards their attainment must be reached. These demands imply a need for more refined feasibility analyses if the selection of implementing actions in layer 4 is not to be unduly complicated.

In layer 3 and to some extent in layer 4 the implementing strategies and actions selected must embody at least three elements in order that the audit trail from the high-level goals to the detailed programmatic actions can be maintained. These are:

- Plausible U.S.-Soviet move-countermove sequences over a planning period of at least ten years that show the net competitive advantage the United States would realize or the competitive loss it would avoid by means of the recommended strategies and actions.
- The U.S. or allied strengths or Soviet weaknesses exploited in order to achieve this advantage or averted loss.
- The expected contribution of each strategy or action to meeting the military-operational requirements identified in layer 3 goals, with the timetables for realizing these requirements.

2.3 FEEDBACK AND ITERATION

Feedback, as we use the term here, is the process of monitoring adversary actions and other aspects of the competitive environment, and modifying U.S. competitive goals, strategies, or actions in light of the results of this monitoring, all with a view toward improving U.S. performance in the military competition. Iteration refers to the resultant repetitions of parts of the competition planning process or analysis sequence in order to take advantage of feedback.

Two distinct types of feedback and iteration are important for our purposes. One is the monitoring of relevant aspects of the competitive environment, particularly Soviet and third player actions, and correction of U.S. goals, strategies, and actions in light of this monitoring. A second type is feedback and iteration in the analysis of alternative U.S. goals, strategies, and actions as shown in Figure 4, in order to arrive at the best set, given the current competitive environment.

As discussed below in connection with portfolio management techniques, the process of feedback and iteration is an important way to deal with uncertainties in the competitive

environment. Major sources of uncertainty are the future initiatives of the Soviet Union, other adversaries, and U.S. allies, and responses of these parties to U.S. initiatives. Thus, an essential characteristic of U.S. competition strategies in this complex, multipolar environment is to monitor the actions of the USSR and key third players, plus other major aspects of the competitive environment; feed the results of this monitoring back into appropriate layers of the competition planning process; and iterate the process by revising U.S. goals, strategies, and actions as necessary in light of the feedback. Suitable time periods for these feedback and iteration cycles in various layers of the competition planning process are discussed in chapter 1.

With regard to the second type of feedback and iteration -- that which takes place within an application of the analysis sequence -- the use of goals to drive planning points to the importance of feedback and iteration. Without such procedures, there would be excessive dangers of inconsistencies arising between the layer 2 goals, the layer 3 strategies, and the feasibility of actions planned at layer 4, as well as between the requirements implied at layer 3 and the actions selected at layer 4. In addition, there would be risks of incorrect priorities arising in each layer and of missed opportunities for averting failures and for achieving gains across different subareas of the competition by the selection of appropriate implementing actions. Finally, a feedback cycle is needed to ensure that the strategies and actions determined in layers 3 and 4 for the military competition continue to harmonize with the broader national goals that would be identified and taken into account in layer 2. The feedback loops explicitly shown in Figure 4 indicate key points for this process, but are not meant to exclude feedback between other points in the sequence of analyses.

2.4 PORTFOLIO MANAGEMENT

As described in chapter 1, portfolio management in the context of this report means the use of techniques in all layers of the planning process designed to control potential risks, mitigate the consequences of risks that materialize, and help exploit opportunities for unexpected advantage. Risk control or risk mitigation refers to the risks to U.S. success in the competition because of such events as unexpected Soviet or third party technical-military advances, the emergence of new adversaries to the United States, third party actions inimical to U.S. interests (e.g., denial of overseas bases to the United States), or unexpected Soviet or third party competitive initiatives or counters to U.S. initiatives. Readiness to take advantage of new opportunities refers, for example, to technological advances, unexpected expansion of the U.S. defense budget, reduction or redirection of the defense budgets of the USSR or other competitors, competitive failures or withdrawals by the Soviet Union or other competitors, or unexpected political openings for the United States provided by the Soviet Union or third parties.

Portfolio management applies to both setting goals and developing strategies. The process for setting U.S. competitive goals, and the goals themselves, should be sufficiently flexible that goals can be revised or new goals set in order to take advantage of new opportunities to gain competitive advantage. There also are risks that must be considered when setting goals. For example, some U.S. goals may prove to be infeasible because adversaries can block their achievement or the United States cannot afford them. Other goals may be feasible, but may not be directed at the most important competitive problems or opportunities facing the United States, or they may not prepare the United States for the right military contingencies. Another kind of risk in setting competitive goals is that the time dimension may not be adequately

considered (e.g., adversary countermoves could delay U.S. accomplishment of a goal well beyond the point when achieving the goal is useful).

So portfolio management starts with setting goals -- for example, by formulating goals that have some intentional overlap or redundancy, so that failure to achieve some goals does not seriously or permanently jeopardize the overall U.S. strategy or competitive position. Possibly the most obvious and reliable technique, this approach is vulnerable to the charge that it wastes resources -- a rich man's technique. Only goals of major competitive importance are likely to qualify for this treatment, especially when resources are tight.

Other portfolio management concepts applicable to setting goals include explicit formulation of fallback goals that enable failure to achieve the primary goal to be graceful; formulation of goals that are sufficiently flexible to allow adaptation to new opportunities or information; formulation of goals in one subarea of the competition which, if achieved, contribute to achieving goals in other subareas; and periodic reexamination of existing U.S. competitive goals to ensure they are still consistent with the changing competitive environment.

Portfolio management is also a key part of developing strategies to achieve goals. New opportunities to gain competitive advantage can arise, and good strategies should be able to seize these opportunities without excessive program disruption or bureaucratic inertia. Further, new information about adversary moves, about technology, or about future conditions will become available as time goes on, and strategies should be able to adapt to this information. Moreover, a strategy for one subarea of the competition may, at little additional cost, be able to contribute to achieving goals in other subareas, which can be an important

application of portfolio management techniques to strategy development.

Risks to be considered in developing strategies include the risk that the strategy may prove infeasible because of Soviet or third party moves, because it turns out to be too costly, or because the strategy takes too long to achieve its goals. There are risks that a strategy may, in fact, worsen the U.S. competitive position when the Soviet Union or third parties respond; or that a strategy may fail to realize the greatest possible competitive gains for the United States. Or a strategy may not be able to cope with Soviet or third party initiatives that were not envisioned when the strategy was formulated.

Robustness and adaptivity are two classic means of developing strategies that can control or mitigate risks and readily seize opportunities when they appear. Robustness means selecting strategies that are optimal or near-optimal in a widely diverse set of conditions. It is a technique of affluence that may not be appropriate in most cases when resources are tight; the technique of adaptive strategies is perhaps more suited to the needs of the United States in today's competitive environment. Adaptivity means devising strategies and a planning process that are able to adapt readily to new information and conditions by initiating appropriate responses. One prerequisite for adaptive strategies is a capability to monitor Soviet and third player actions and other aspects of the competitive environment. This capability should be coupled into the competition planning system in ways that permit adaptation within a suitably short time period.

Other portfolio management techniques can complement this basic approach of adaptive strategies that seems fundamental to sound competition planning. One is to select multiple, independent strategies or implementing actions to achieve important goals, so

that a single failure does not invalidate the overall objective. This is a planning principle that is applied in such widely varying areas as aircraft design and the U.S. strategic offensive force Triad, but as a competition planning approach is open to the criticism that it is too costly for all but the most vital competitive goals. Another, probably less costly, concept is to identify modes of simultaneous failure of U.S. strategies across several subareas of the competition (such as Soviet low-observables systems might impose) and try to design U.S. strategies to avoid such simultaneous failures. Some failures in multiple subareas may be unavoidable for both sides. But, at the minimum, the U.S. strategy should be to impose these failures on the USSR before it can impose them on the United States.

Yet another portfolio management concept for strategy development is to seek to exploit opportunities for applying competitive advances achieved in one subarea to other subareas. This implies that layer 4 implementing actions and layer 3 strategies should be reexamined periodically with a view to applying them more broadly.

One additional aspect of portfolio management deserves mention: the consequences of the multipolar competitive environment. Clearly, the periodic survey of the competitive environment in layer 1 should pay close attention to updating institutionalized assumptions about third players such as Germany and other Western European countries, Japan, and South Korea and about the permanence of U.S. overseas bases in order to reduce the risk of overlooking important new developments in the future environment.

Beyond this obvious measure, the multipolar environment for the competition suggests that the United States should include strategies in its portfolio that avoid third player leverage on the

United States and that foster such third player leverage on the USSR. Third player leverage is analogous to the overdependence of large manufacturing firms on small suppliers. Examples of ways that third players can exert strong leverage on the U.S. or Soviet abilities to compete with one another are by imposing restrictive conditions on access to bases in third countries, by engaging in crises or wars that divert U.S. and Soviet resources away from the superpower competition, or by excessively influencing U.S. or Soviet military doctrine or arms control positions in ways that reduce competitive effectiveness. The United States appears to be more subject to this last form of third player (especially Western European) leverage than the Soviet Union. Moreover, since some third players are potential U.S. adversaries, the United States should favor strategies and actions that compete effectively against both the USSR and future third country adversaries (e.g., investment in naval forces that both contribute to the military balance with the Soviet Union and can defend U.S. interests against lesser powers in the Persian Gulf).

Finally, U.S. competition strategies that hedge against calamities associated with third players would help to control or mitigate risks in the multipolar environment. It would seem prudent for the United States to make investments directed toward preventing third player situations that would seriously impair the U.S. ability to compete with the USSR and that would be difficult or impossible to reverse. Obvious examples include a serious U.S. break with Japan and Sino-Soviet rapprochement in ways that are sharply inimical to U.S. interests.

The demands of successful portfolio management on the analytic process are bound to be considerable. But no less considerable are the potential advantages to be gained from ensuring that the defense program is robust against a variety of

possible Soviet and third player actions and flexible enough to adapt to at least some unexpected developments.

2.5 ANALYSIS REQUIREMENTS FOR COMPETITION PLANNING

We now summarize the demands that the four-layer competition planning process would make on analysis tools, techniques, data bases, personnel, and organizations. The discussion is organized along the lines of the analysis sequence shown in Figure 4, addressing demands or needs for analysis in the following areas:

- Updating assumptions about the competitive environment.
- Diagnosing the current state of the U.S.-Soviet military competition.
- Testing, refining, and selecting competitive goals (both high-level and subareas goals).
- Testing, refining, and selecting strategies (both high-level and subarea strategies).

By discussing specific demands for analysis in each of these areas, we can then summarize the requirements or needs for analysis at the end of this chapter, as a basis for evaluating current analytic capabilities to support these requirements. Our discussion summarizes the types of issues that analysis would be called upon to address in competition planning, but does not indicate what specific analytic tools or techniques should be used to address these issues. This topic is addressed in chapter 3.

2.5.1 Assumptions about the Competitive Environment

Analysis will be required to identify and characterize trends in the competitive environment, in order to identify or

forecast important current or future changes that should be taken into account in planning for the military competition. In this process, it is especially important to understand how the competitive "games" the United States and the Soviet Union are engaged in may be changing, in terms of key geographic locations; the major players or other actors who can influence the competition; the most important positive and negative third player influences in the competitive environment; the nature of the military competition during the next several decades; and what future military contingencies should be considered in planning for the competition.

Analysis will also have to help identify the assumptions underlying current U.S. planning that have strong influence on the results of this planning. Frequently, the assumptions that most strongly drive the planning process are implicit and not obvious. Analysis should help to make these driving assumptions explicit, so they can be validated or changed in light of the most recent updated survey of the competitive environment.

2.5.2 Diagnosis of the Current State of the Competition

The task for analysis in diagnosing the state of the competition is to examine both the current state and, equally important, current trends in the competition, and to make an evaluation in terms of U.S. preferences: What is it about the current state and the associated trends that the United States is satisfied with? What problems and opportunities does it face, both those related to the USSR and those related to third players? What changes does it want to make in the future state of the competition? This diagnosis should look across all subareas of the competition, as well at the state of the competition in each subarea, and should examine third party influences and challenges, as well as matters related to the United States and Soviet Union.

In addition to making an evaluation of problems and opportunities, the diagnosis should also identify relations or correlations among problems and opportunities in the current state of the competition and among desirable changes in the state of the competition, all in order to help set or update U.S. competitive goals.

An analytic evaluation of the current state of the competition and the associated trends should focus on the three dimensions of the military competition discussed in chapter 3 of volume I:

- The U.S.-Soviet military balance, including likely war outcomes in future contingencies.
- The competitive positions of the United States and Soviet Union, in terms of strengths and weaknesses, current competitive advantages held by each side, who holds the competitive initiative in various areas, and opportunities for competitive leverage by each side.
- The U.S. ability to deter attacks, reassure allies, and resolve crises without resort to war.

The cost to fix problems or seize opportunities need not be considered in the diagnosis of the current state of the competition. The function of analysis at this stage is to identify problems and opportunities; choices about what the United States can afford should be made in the next step in the analysis sequence, when goals are set. However, to aid in setting goals, the diagnostic analysis should rank or assign values to desirable changes in the state of the competition.

2.5.3 Setting Competitive Goals

The approach to setting competitive goals depicted in Figure 4 is one of the iterative testing and refinement. An initial set of goals is formulated, then refined or altered based

on analysis, and the process is iterated until a satisfactory set of goals is obtained. An equally acceptable procedure would be to formulate alternative goals; refine them iteratively, based on analysis; and finally select a subset of the alternatives for implementation. Analysis of U.S. competitive goals will also provide insights into strategies to achieve these goals, so there are obvious connections between the analysis of goals discussed here and the analysis of strategies discussed below. The desirability of feedback and iteration between the setting of competitive goals and the selection of strategies is evident.

A first-order evaluation of candidate goals probably is sufficient at this stage. Further understanding of U.S. competitive goals will be gained through the process of evaluating strategies and monitoring their implementation. Information gained from this process should be used to evaluate and possibly modify existing goals in an iterative fashion.

Setting the proper goals is an extremely important part of competitive planning. Goals will -- or should -- drive strategies and competitive actions. Hence, support to goal selection is a vital function of analysis. However, analytic techniques to support selection of goals are neither well developed nor widely used. Three types of issues should be analyzed in the process of setting competition planning goals: Do candidate goals most effectively serve U.S. purposes within available resources? Do they concentrate available U.S. resources on the right subareas of the competition? Do they get the United States out of subareas where it should not be competing, or reduce U.S. efforts in subareas that should have lower priority?

To address these issues, analysis should carry out the following broad tasks:

- Project future states of the competition likely to be reached (considering Soviet and third party actions), if the United States achieves various candidate sets of goals.
- Evaluate these future states that are likely to result from various candidate goals, to determine which states the United States most prefers.
- Evaluate the costs and difficulties of achieving various candidate goals.
- Select a set of goals based on an assessment of which future states the United States prefers and the difficulty of achieving the goals that would lead to these future states.

Hence, a key task for analysis in setting goals is to evaluate the benefits to the United States of achieving candidate goals. The evaluation should consider the likely military balance that would result if the candidate goals were achieved, the resulting U.S. competitive position (including how the resulting position might foil Soviet or third party competitive actions), and the likely impact on deterrence, reassurance, and crisis resolution capabilities.

Considering the multipolar arena for the military competition, analysis should also test whether candidate goals are focused on the right nations. Certainly most U.S. competitive goals will continue to be associated with the competition with the Soviet Union, but it may be that some goals should deal with third parties who are current or prospective adversaries or who otherwise can influence the military competition (positively or negatively). For example, the United States should seek to maintain or enlist the support of allies and other key nations in the competition with the USSR, may want to support some countries in ways that divert Soviet resources away from the competition with the United States, and perhaps should seek to avoid, defer, or mitigate direct third

player challenges to the United States that would divert U.S. resources away from the competition with the Soviet Union.

Analysis should also address the ability of the United States to achieve candidate goals. There should be first-order, or order-of-magnitude, estimates of the costs to achieve candidate goals, considering plausible Soviet and third party actions. Since the rate of change of military or competitive advantages is as important as the absolute level of advantages, time estimates should also be made:

- The likely time required for the United States to achieve candidate goals, considering Soviet and third party actions.
- The likely time period during which the United States can sustain the benefits of achieving candidate goals, once they have been gained. Again, both Soviet and third party actions must be considered in making these estimates.

Since competition planning involves looking ahead for as much as several decades, the time dimension may impose unique demands on current analysis tools and techniques, which generally are designed for shorter planning periods.

Cost and time schedules are not the only factors affecting the U.S. ability to achieve candidate goals. Analysis should also evaluate the feasibility of accomplishing candidate goals in terms of U.S. domestic politics, allied or other third party politics, U.S. bureaucratic processes, and the ease or difficulty with which the Soviets or third parties can block or counter U.S. achievement of these goals.

Another type of analysis that can be useful in selecting goals is trade-off studies of the benefits resulting from investing in alternate goals. Such trade-off studies would evaluate the

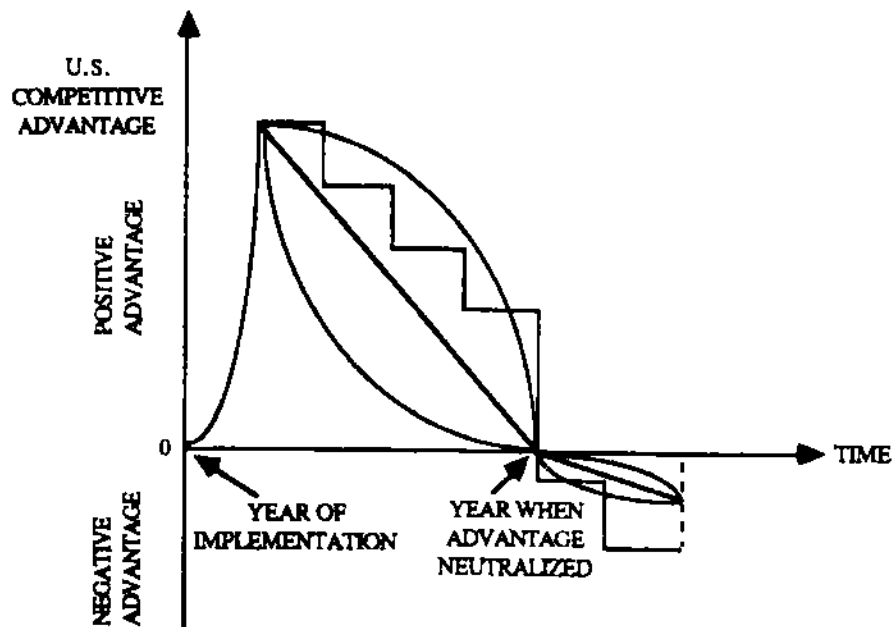
return on investment from alternate goals, assessed in terms of improvements in the military balance, in the U.S. competitive position, or in some combination thereof (assuming the alternative goals were equivalent in terms of deterrence, reassurance of allies, and crisis resolution capabilities).

The concept of trade-off studies for selection of goals opens some interesting possibilities. For example, U.S. security interests may require it to compete in some subareas even if the return on investment is poor. Nevertheless, given that the United States must compete in a subarea, trade-off studies among alternate goals for that subarea could be carried out to improve the return on investment, even if it remains poor relative to returns from committing the resources to other subareas of the competition.

Another trade-off that could be important for some subareas is that between sustaining or improving existing U.S. competitive advantages in certain subareas and investing to create new competitive advantages in other subareas. One contribution of analysis in this case would be to assess the rate at which existing competitive advantages would decay at various levels of U.S. investment, as illustrated by Figure 5.

A final set of considerations related to goal formulation is somewhat more perfunctory, but still makes demands on analysis. First, a candidate set of goals must be internally consistent; in particular, goals for subareas of the competition in layer 3 should be consistent with the high-level planning goals and strategy guidelines of layer 2. Second, goals should be useful guides to DoD planners for programming and budgeting purposes. They should meet such utility criteria as the following:

- Be specific enough to guide planners, without overconstraining the paths to achieving the goals.



Which curve best describes the decay of competitive advantage? What is the time constant or rate of this decay?

Figure 5. Illustrative decay of competitive advantage with time.

- Be clear and unambiguous.
- Be easily understood by planners, the Congress, the U.S. public, and U.S. allies.

2.5.4 Strategy Development

As with the setting of goals, strategy development and the associated analytic support is an iterative process. Once a set of goals has been selected, a number of alternative strategies for achieving these goals might be developed. Analysis would then test each strategy alternative and, based on the results, the set of strategy alternatives would be expanded, reduced, or revised,

and tested again. This analytic process would iterate until a single strategy to achieve the goals can be selected.

The essential task for analysis in this process of strategy development is to determine how best to move from the current state of the competition to a desired future state that is embodied in a set of goals, while remaining within available resources and within a desired time period. "Best" in this context refers to effectiveness in achieving the goals in the face of plausible Soviet and third player actions.

This means that analysis must be able to project plausible U.S. and Soviet sequences of moves and countermoves in terms of such parameters as research and development, weapon system characteristics, force levels, force deployments, operational concepts for force employment, arms control initiatives, public diplomacy and propaganda, and other instruments of the competition. Third player actions also need to be considered, as appropriate. Competitive move/countermove sequences should consider initiatives and responses by each side, and should develop estimated timelines for these moves and countermoves.

Analysis should then evaluate the effectiveness of each alternative strategy in achieving the desired goals in each of these move/countermove sequences. Effectiveness should be evaluated in terms of the resulting military balances and war outcomes in various contingencies; in terms of the resulting U.S. competitive position vis-a-vis the USSR or other adversaries; in terms of deterrence, reassurance, and crisis resolution capabilities; and in terms of the time required to achieve U.S. goals (if they ever are achieved) in each move/countermove sequence. When resource constraints are taken into account, any strategy will have negative effects on other programs or theaters that should be evaluated in such effectiveness analyses. For

example, during the Carter administration the maintenance of U.S. wartime force commitments to NATO by planning to "swing" naval and air forces from the Pacific to Europe resulted in unease among U.S. allies in Asia about the reliability of U.S. security guarantees.

The cost of each strategy alternative in each move/countermove sequence should also be estimated. The resulting cost-effectiveness evaluations of each strategy alternative in the face of plausible Soviet and third party actions (as represented by the move/countermove sequences) would then provide the basis for evaluating and refining the strategy alternatives, and eventually for selecting one of the alternatives for implementation.

As alternative strategies are refined in this analytic process, portfolio considerations should become more prominent. One of the results of evaluating strategies in a number of plausible move/countermove sequences should be the identification of risks that U.S. strategy should control or mitigate, possible opportunities that U.S. strategy should be prepared to exploit should they actually appear, and ways to improve the portfolio aspects of the alternative strategies. In this way, the analysis process should support incorporation of robustness, hedges, adaptivity, and other portfolio techniques into strategies.

2.5.5 Summary of Analysis Requirements

The foregoing discussion allows us to summarize the functions that analysis must be able to carry out in order to support competition planning. Nine major functions or analysis requirements emerge as a standard against which to evaluate current analysis capabilities in chapter 3:

- Identify changes in the competitive environment in order to validate or revise current planning assumptions.

- Diagnose the current state of the competition as an aid in setting U.S. competitive goals.
- Determine Soviet competitive goals and strategies.
- Determine the competitive goals and strategies of key third players.
- Determine how U.S. competitive goals, strategies, and actions are likely to affect Soviet weapons acquisition and operational concepts for force employment.
- Help set U.S. high-level competitive goals and U.S. goals in subareas of the competition.
- Identify plausible Soviet and third party player moves and countermoves.
- Evaluate alternative U.S. strategies for the military competition.
- Evaluate alternative U.S. portfolio management techniques in the context of specific strategy alternatives.

3. EVALUATION OF CURRENT ANALYSIS TOOLS

In this chapter we review nine classes of analysis tools and techniques in terms of their suitability for support to competition planning. The chapter begins with a preliminary discussion of what tools are included in our evaluation, then proceeds with the detailed evaluation of each major class of analysis tools. It concludes with a summary of the suitability of current analysis capabilities, and explains why the remainder of the report focuses on four types in more detail: military balance assessments, Soviet-style analyses, competition planning games, and military contingency analysis.

3.1 PRELIMINARIES

By analytic tools and techniques we mean methods of analysis broadly defined, including analysis concepts and systematic approaches or procedures, as well as algorithms and computer programs. We have not confined our inquiry to quantitative methods, but have included nonquantitative, but nevertheless systematic and rigorous, tools and techniques as well.

In reviewing the suitability of analysis tools for competition planning, we examined a wide range of tools in an effort not to overlook any possibly relevant capability. The results of our review are summarized in this chapter, organized into the following classes of analysis tools:

- Techniques for modeling and analysis of discrete military systems, military operations, and military support. While we conclude that such techniques as operations research and systems analysis and models of discrete weapons and operations have little applicability to competition planning, we find that modeling of combat operations, especially at the theaterwide campaign level, is quite important.

Therefore, a separate category of combat modeling is listed below.

- Strategic planning tools for businesses.
- The classical analysis tools of logic and expert judgment.
- Regional political-military analysis.
- Forecasting techniques.
- Military balance assessments.
- Analysis of Soviet threats and capabilities.
- Gaming techniques.
- Combat modeling.

Many of these tools and techniques currently are in use to support planning, programming, and budgeting and operational planning in the Department of Defense. However, the demands of the DoD planning, programming, and budgeting system and the JCS operational planning system are quite different from those of planning for the U.S.-Soviet military competition, as summarized in Table 1. PPBS and operational planning analysis typically focus on the near term, looking out at most five years, while competition planning must consider both the near term and the far term, over two decades or more. Moreover, PPBS and operational planning analysis generally is structured to support specific program or operational decisions; while change is certainly a key element in both the PPBS and operational plans, these changes typically are reactive in nature, generally caused by actions within the United States: responses to changes in availability of funds, variations in developmental progress, or changes in availability of forces. In contrast, competition planning is oriented toward formulation of goals and strategies, and should have a strong element of adaptivity explicitly designed into its plans, with changes in plans caused as often by the actions of the Soviet Union and third players as by U.S. actions. Another key difference is that PPBS

and operational planning rarely take the future environment into account, except episodically to consider allied reactions to U.S. planning initiatives. As described in chapter 1, consideration of the future environment should be a strong and systematic focus of competition planning and its supporting analysis.

Table 1. Characteristics of U.S. planning approaches.

<u>PPBS/OPERATIONAL PLANNING</u>	<u>COMPETITION PLANNING</u>
● Near-term focus	● Near-term and long-term focus
● Results in program operational decisions	● Results in formulation of goals and strategies
● Changes driven by resource availability or developmental progress	● Changes driven by both internal U.S. actions and actions of USSR and third players
● Episodic consideration allied views	● Strong, systematic of focus on competitive environment

We used two kinds of criteria for evaluating current analysis tools. One set of criteria consists of the those that also are applicable to tools for support to the PPBS and operational planning: rigor, transparency, ease of application commensurate with the importance of the problem being analyzed, and the ability readily to foster communication among contending bureaucratic parties in the planning process. The second set of criteria is uniquely associated with competition planning and derives from the analytic requirements summarized in chapter 2 and the characteristics of competition planning shown in Table 1. These criteria for analysis tools include the ability to examine both the near term and the far term over two decades or more;

sensitivity to changes in the competitive environment; sensitivity to Soviet and third player goals, strategies, and actions; and an orientation to key factors in the state of the competition, especially military balances, contingency outcomes, and the competitive positions of the two sides.

Since analysis tools and capabilities currently in use within the Department of Defense generally are tailored to support the planning, programming, and budgeting system and operational planning, we do not find these for the most part directly applicable to competition planning; nor do we find analysis tools and techniques used for business planning or university research directly applicable. Several of these tools have, however, the potential to support competition planning. More importantly, four tools currently in use within parts of the Department of Defense are notable exceptions to our general conclusion. Net assessments, Soviet-style analyses, planning games, and contingency analyses can contribute directly and importantly to competition planning, but even they need improvements for this purpose.

3.2 MODELING AND ANALYSIS OF MILITARY SYSTEMS, OPERATIONS, AND SUPPORT

The primary tools included in this class are operations research, systems analysis, and engineering trade-off analysis methods and models. These essentially are optimization techniques and models of system performance. As such, these tools are used extensively by DoD organizations and contractors to support weapon system acquisition and the planning, programming, and budgeting system. Their use is increasing for operational planning support to the Joint Chiefs of Staff, unified and specified commands, and the services for development of weapon system operational concepts, campaign concepts for operations plans, and other operational planning decisions such as force allocations and force deployments.

Clearly, these tools have a large role in the selection of implementing actions in layer 4 of the competition planning approach outlined above. This is the layer in which competition planning strategies are translated into PPBS and operational actions, and the role of operations research, systems analysis, and engineering trade-off analyses would lie principally on the PPBS and operational planning side of the interface with competition planning, where their use is relatively well understood.

These tools would provide little direct support to what is the heart of competition planning in layers 1, 2, and 3, although they may contribute to some of the tools and techniques discussed below, such as Soviet-style analysis and contingency analysis. The methods of operations research, systems analysis, and engineering trade-offs are not applicable to layers 1, 2, and 3, where the problems are fuzzy and not well-defined, the processes involved in the U.S.-Soviet competition are not well-understood, the range of possible adversary and third player actions is too wide to be captured in a tractable list of alternatives, and the unfolding of the unique and complex course of the competition is not amenable to the use of quantitative models or even stochastic analysis. In contrast, the methods of operations research, systems analysis, and engineering trade-offs are applicable to problems where goals are well-defined, quantitative objective functions or measures of effectiveness are feasible, the range of alternative actions by opposing sides can be explicitly and exhaustively defined, and the processes linking model inputs to outputs are well defined or can be confidently represented by probability distributions.

Game theory might seem to have applications to the U.S.-Soviet competition, but this turns out not to be the case for reasons similar to those just recited. Game theoretic analysis

techniques can be helpful for problems of competitive behavior that are better defined than those of the military competition, problems where the players have clear objective functions and payoffs that can be quantified, where there is a relatively small set of alternative moves for each player, and where the preferences of players for outcomes are well defined. Moreover, while some advances are being made on multiactor utility functions, most game theoretic techniques assume each player performs as a single rational actor.

Some of the basic concepts of game theory -- as contrasted with detailed analysis techniques and algorithms -- can be of use in structuring approaches to competition planning. Examples are the concepts of states and a state space, nonzero-sum games, cooperative games, and mixed strategies. Indeed, our own work on the U.S.-Soviet competition, especially the notion of the state of the competition, has been influenced by some of these concepts.

A recently developed operations analysis technique may have more utility for supporting military competition planning. This method, developed by Decision Science Applications, Inc., is called value-driven modeling of competitive paths. It is an adaptive, two-sided interactive, optimizing approach to understanding the evolution of military competition.

Another kind of tool for analysis of military systems, operations, and support is human resource modeling. Such models are used for the analysis of issues related to military manpower requirements; personnel recruiting, retention, and promotion; personnel assignment; and training. These models and the associated data bases and analysts potentially are useful for evaluating the feasibility of alternative competitive goals and strategies in light of demographic trends. Currently, however,

human resource models and data bases are structured to support analysis of U.S. military manpower issues, but not those of U.S. allies, the Soviet Union, or other countries.

Modeling of human behavior is another kind of tool for analyzing military systems, operations, and support that might on the surface appear to have value for projecting plausible Soviet or third player initiatives or responses in the military competition. As with game theory, however, these techniques currently have little to offer for competition planning, although artificial intelligence may contribute usefully to contingency analysis.

Modeling of human behavior includes two types of tools: cognitive models and artificial intelligence. The first type focuses on modeling human cognitive mechanisms and on understanding why certain decisions are made in specific situations. Work in this area has concentrated on simple models of human behavior, initially assuming a completely rational basis for decision making and more recently seeking to include "non-rational" or extrarational factors. The state of this particular art is currently at much too elemental a level to be of help for competition planning.

Artificial intelligence is making substantial progress in robotics, expert systems, and computer speech recognition and man-machine voice communications. Current or projected expert system techniques are not adequate for the forecasting of Soviet or third party moves in the military competition, but have the potential to increase the speed, reduce the costs, and improve the transparency and replicability of other tools that are suited to competition planning, including Soviet-style analyses, competition games, and contingency analyses. The automated Red and Blue war planners that are part of the RAND Strategy Assessment System

(RSAS) provide an example of a promising expert system for support of contingency analyses. The most useful characteristic of expert systems methods for these purposes is the potential to automate certain aspects of gaming and game support, to aid planners in setting up and executing analyses of future military contingencies, and to help planners project Soviet moves and countermoves.

3.3 STRATEGIC PLANNING TOOLS FOR BUSINESSES

Like many of the analysis tools and methods reviewed in this chapter, strategic planning tools for businesses seem like they should have substantial utility for competition planning, but upon closer examination prove not to do so. Some broad strategic planning concepts such as portfolio management and competitive advantage are useful in developing general approaches to planning for the U.S.-Soviet military competition, but primarily by evoking analogies rather than by providing detailed analysis methods. More specific strategic planning tools, techniques, and models do not appear to have potential for analytic support to military competition planning.

The main reason for this finding is that business planning is what mathematicians or physicists would characterize as a "well-behaved" problem in comparison with planning for the military competition, and hence analysis methods that may work well in business planning usually cannot be transported to the much more complex area of military competition planning. For example, use of single actor, rational decision-maker organizational models can be defended for business planning, even though they represent an approximation that may be particularly dubious for large businesses. Such models clearly are not appropriate for military competition planning. Moreover, unlike the military competition, business planning has well-defined, quantifiable measures of effectiveness in terms of growth and profit, and the set of

possible actions for both business planners and their competitors is relatively small, bounded by both the nature of the markets in which they compete and by laws and regulatory agencies.

To illustrate this last point, a recent analysis identified six types of strategic actions that should be considered by businesses that have low profits and declining market shares: organizational decentralization; reorientation of marketing efforts; product-market differentiation in terms of price, quality, or customer segmentation; asset divestiture; improved productivity; and increased control through vertical integration.¹ It would be difficult to develop a similarly concise but specific list of candidate strategic actions to improve U.S. performance in the military competition.

Even within the relatively well-behaved realm of strategic planning for businesses, current analysis tools do not provide much direct support for setting goals and selecting strategies. These important but difficult problems of business planning are addressed to a considerable extent in the same way they currently are addressed in military competition planning: by instinct and common sense, rather than by detailed analysis.

Business planning tools can be divided into two types: planning principles of a rather general nature and detailed financial, production, and market analysis methods and models. Planning principles aid in broad understanding of strategic planning for businesses, but do not provide much help in selecting specific goals and strategies, as is also the case for military competition planning. Detailed financial, production, and market analysis can provide inputs to business strategic planning and are important for implementing strategic plans in a way that is analogous to operations research, systems analysis, and engineering trade-off studies for military competition planning.

Because our negative conclusions about the utility of business planning tools for military competition planning are counterintuitive, we review these tools in some detail. This review is organized as follows (the first three topics fall into the category of planning principles; the remainder are detailed methods and models):

- Principles of strategic planning.
- Case studies.
- Characterizations of the strategic environment.
- Capital budgeting for project evaluation.
- Portfolio management.
- Operations research methods for business planning.
- Computer simulations.
- Business games.

3.3.1 Principles of Strategic Planning

There is a growing body of literature that sets forth general principles of strategic planning, as articulated by successful entrepreneurs and corporate planners. One of the better examples of this genre is The Mind of the Strategist by Kenichi Ohmae, which more than most books of this kind seeks systematically to inform the reader about the principles of strategic planning.² But even Ohmae's book consists of general principles interleaved with many examples. The principles are so broad that one needs excellent intuition or supporting analysis of the kind not discussed in the book in order to know where, when, and how to apply them. The examples do not help, because they are so specific that it is difficult to generalize from them. Reading such material is like trying to learn calculus through a few broad

principles and many unrelated sample problems, without the intermediate material on application methods that comprises the bulk of textbooks on calculus.

Some of the literature on strategic planning principles suggests steps or approaches that are relevant to military competition planning, and many of these have in fact been incorporated into our analysis and recommendations. For example, Ohmae sets forth five steps for successful long-range business decisions: clear definition of the business domain; extrapolation of the forces at work in the business environment on the basis of cause and effect; concentration of resources on a few critical strategic options; pacing the company's strategy according to its resources; and reviewing the business environment periodically to ensure that the basic assumptions underlying strategic choices are still valid.³ There are obvious parallels with the layered approach to competition planning described in chapter 1. As another example, it has been observed that Japanese firms try to shift the business competition to arenas where they have advantages against Western companies that have larger markets and greater experience in technology, production, and marketing than do the Japanese.⁴ This observation is perhaps of some help in understanding that Mikhail Gorbachev is pursuing a similar strategy in the military competition.

But for the most part the literature on strategic planning principles is too anecdotal to aid in developing systematic analysis techniques to support planning for the military competition. In fact, this literature illustrates two problems in extrapolating from actual experience to general methods for formulating successful goals and strategies, be it in the business world or national security.

One problem is that randomness -- or luck -- generally plays some role in success and failure, and its significance may be difficult to assess. A second problem is that strategic planners may be successful simply because they happened to adopt planning principles that were valid for the context in which they were operating, not because they knowingly chose these principles based on a thorough understanding of the competitive environment. The obvious test is whether a strategic planner can repeat his success in different contexts. If success can be repeated, the planner probably has the ability to diagnose the competitive environment and choose the specific strategic planning principles that are valid in varying contexts.

Thus, perhaps the most important lesson for the military competition to be learned from an examination of the business planning literature is that truly successful strategic planners have a valid "theory" of the competitive environment. Such a theory provides a guide as to how strategies that are not now being pursued might succeed and how the pursuit of different strategies by competitors would interact with the planner's candidate strategies. This principle is at the heart of the layered planning approach in chapter 1 and the analysis sequence in chapter 2.

3.3.2 Case Studies

The case-study approach to planning has the same fundamental problem as do statements of strategic planning principles: strategies that succeeded are presumed to have been good strategies and strategies that failed are presumed to have been bad. No analysis is presented to distinguish sound planning theory or criteria from good or bad luck. While case studies may alert planners to particular types of hazards and the impacts of fallacious planning assumptions, they do not, per se, generate a theory that one can use for strategic planning.

In the absence of a theory of the environment, the question What is generalizable? cannot be answered. Ex post assessments do not provide reliable guides about whether the strategies used were wise ex ante. To evaluate strategies on an ex ante basis, one must be able to characterize their context, recognize all of the relevant variables, and recognize those factors that might have turned out differently than they did in the case under examination.

Put another way, it is up to users of case studies to decide which ones are relevant to their own situations and which are not. Thus, the problem of understanding the nature of the environment within which one is attempting to develop strategic plans remains the crucial step. Once the nature of the environment is stipulated, then one can decide which cases are relevant, which lessons apply, and which are misleading.

In a typical strategic planning case study compendium, Casebook in Policy and Planning, some of the cases illustrate contexts that are explicitly designated as developing businesses, maturing industries, mature industries, and declining businesses.⁵ While each of the specific cases discusses environmental factors that define the context of the example, one is left to decide which apparent cause and effect relationships can be generalized and which cannot. As an application of the historical approach generally, the case study approach shares the tendency to presume that what would otherwise have happened is obvious, when in fact it rarely is.

Thus, if case studies are used to support military competition planning, care must be taken in their development to analyze cause and effect relationships in light of the specific competitive environment in which the cases occur.

3.3.3 Characterizations of the Strategic Environment

There are some attempts to move toward a theory of strategic planning for the business context in which alternative strategies are examined against explicit characterizations of the business environment. A prominent example is the book by Michael Porter entitled Competitive Strategy and its successors.⁶ Porter presents a virtual encyclopedia of the different dimensions of the strategic environment, including extended attention to competitive reactions. While Porter presents the basis for characterizing the strategic context, his examples are used more like case studies than tests of alternative theories. As in the case-study approach, the reader is left to determine which discussions apply to his own problem and which do not.

A recent article by Wernerfelt and Karnani, "Competitive Strategy Under Uncertainty," represents a more systematic attempt to relate strategy to the nature of the competitive environment.⁷ This article analyzes tradeoffs between (1) acting early or waiting and (2) focusing resources on one strategic option or on several, considering various factors in the business environment. While the lessons they draw are not directly applicable to the problem of national security strategy, analogous analyses could be valuable for military competition planning. But the utility of such analyses would increase in proportion to the precision with which the strategic context is defined. Thus, a basic need for both business planning and military competition planning is the ability to characterize relevant aspects of the competitive environment in some detail and to understand the likely behavior and choices of one's competitors, as is embodied in the planning approach described above.

3.3.4 Capital Budgeting for Project Evaluation

The general problem addressed by capital budgeting analysis for project evaluation is whether a firm should proceed with an investment such as a new plant or an R&D project. The standard approach is to use a discounted cash flow model. All cash flows into and out of the firm associated with the project are estimated and the relevant discount rate is specified. The model then computes the net present value of the project or the implicit rate of return associated with investment in the project. This provides planners with a way to rank alternative projects.

Use of discounted cash flow models represents a significant advance in business planning methods, but it does not solve the hard part of the problem: estimating the underlying cash flows associated with alternative projects. Methods of accounting for uncertainty by imputing probability distributions to the cash flows are becoming increasingly feasible, but in an environment that includes strong competitors and possibly drastic innovations assignments of probability distributions based on past experience are not reliable.

Another limitation of discounted cash flow models is that the essential nature of the project being evaluated is assumed not to change over time. An interesting variation of this class of models has been developed in which branch points such as cancellation of the project or variations in timing of the project can be examined.⁸

While discounted cash flow models are of value in implementing strategic plans for business, they offer little assistance for solving the key problems involved in formulating these plans. For this reason they have little to offer in the area of military competition planning.

3.3.5 Portfolio Management

The essential concept of portfolio management carries over to the national security arena: one should have a collection of assets whose individual performances will tend to balance out, so that the likelihood of the overall portfolio doing badly is low. Unfortunately, the extensive theory and methods for determining efficient portfolios that are available in the literature of finance depend critically on the existence of markets within which assets are valued. In that context, it is the distribution of assets relative to the market as a whole that determines value. There has been some recent work on valuing assets within incomplete markets that may provide some insights into the defense planning problem. The difficulty is that the natural analogy for defense investments seems to be evaluation with no markets, or "totally incomplete markets," for which no finance theory is available. Thus, the concept is appealing, but needs to be reworked for the defense context. We discuss portfolio management concepts for the military competition in chapters 1 and 2.

3.3.6 Operations Research Methods

Three general kinds of operations research methods are used in business planning: optimization of some performance variables within a single firm, evaluation of strategic options in a given competitive environment, and sensitivity analyses to determine which parameters are most important for strategic planning.

Performance optimization within a single firm uses a variety of techniques that assume precise knowledge of conditions bearing on the problem. For example, an oil company might develop a precise model of production inputs and outputs, conditional only

on overall market activity. One could justifiably use a linear program or a convex programming algorithm to determine the least-cost production scheme. In this context, confidence about the data and the assumptions relating to the competitive environment generally is warranted.

The second type of operations research use is evaluation of strategic options, examining the impact of various contingencies. To continue the above example, suppose an oil company is concerned about the behavior of a major supplier country and is asking questions about how feasible alternative adjustments to different moves by that country would be. In this context, the information is highly speculative, including the responses by competitor firms as well as by other countries. But operations research tools can still be useful as they allow one to specify a set of explicit assumptions and examine the range of feasible possibilities given those assumptions. In this case a sophisticated user can do parametric analyses with appropriate operations research models and gain substantial understanding of the nature of the strategic landscape and the advantages and disadvantages of different strategic approaches. It is particularly important, however, that the user understand the significance of factors that cannot explicitly be introduced into the analysis, such as perceptions, human reliability, or crisis mentalities. Their absence in models creates a misleading sense of predictability as well as a heavy bias toward the influence of tangible variables as opposed to the intangible. The use of contingency analyses discussed below seeks to provide this capability to evaluate strategic options in military competition planning, drawing on military combat models; the use of planning games and Soviet-style analyses (also discussed below) is intended to help the military competition planner take the intangibles into account.

The third type of operations research application in business planning is what might be called inverse sensitivity analysis. Here, instead of the classical paradigm of specifying constraints and an objective function, then searching for the optimal solution, the analysis seeks to identify parameters that do not matter in the problem under examination. In most business planning and military planning problems, there are too many parameters for systematic sensitivity analyses. The initial task is to eliminate most parameters, identifying for further analysis those that are truly important. Operations research models can help perform this function for business planners. We discuss below a similar role for contingency analyses in helping to determine the most important variables in describing states of the military competition.

3.3.7 Simulations

Dramatic advances in personal computers and simulation software have revolutionized the ability of individuals to construct and manipulate simulations of business operations. One can now describe a "system" on a personal computer by specifying variables, relations among the variables (including feedback loops), time lags in the influence of one variable on others, and so forth. This network of variables and their relations can be displayed on the user's screen, facilitating examination of how changes in one variable affects the others. Basically, current software allows one to construct a complex model in a short period of time, to perform sensitivity analyses and graphically display relationships, and to understand the structure of the model within a brief period of experimentation.

This technology is being used by some businesses for strategic planning in the form of "microworlds": computer simulations based on specific planning scenarios. These

simulations allow managers to vary the assumptions of their strategic planners, provide feedback about how changes in these assumptions affect the manager's scope for action, and indicate how their actions will affect growth or profits. One recent application of microworld simulation techniques was exploration of alternative scenarios about the world petroleum market.⁹ Another was a simulation of the U.S. government budget, to allow policy makers and congressmen to understand better the constraints on reducing the federal budget deficit.

The areas to which business simulations have been successfully applied are relatively simple compared with the U.S.-Soviet military competition. A simulation of the military competition that allowed analysts to assess the impact of changes in certain variables on the state of the competition clearly would be useful. We are, however, skeptical about the ability of computer simulations to capture all important complexities of the military competition. As discussed below, however, simulations have considerable potential as a tool for the kind of military combat analyses (or contingency analyses) that we judge to be a central part of competition planning.

Our skepticism results from the complexity of the competitive environment, the rich sets of choices available to each side in the military competition, and the highly imperfect understanding of the relations among these variables. Complexity, the multitude of choices, and the lack of a good theory for relating competition variables leads to substantial uncertainty about adversary goals, strategies, and future actions; about how the multipolar environment will affect the U.S.-Soviet competition; and about domestic conditions in the United States that could affect the competition. This uncertainty implies the need for U.S. competition strategies that can adapt readily to new information and for analysis methods that draw extensively on the ability of

the human mind to analyze complex patterns of behavior and to synthesize information.

Compounding the inherent difficulties of adequately modeling complex and dynamic environments with computer simulations is the fact that, for competition planning, simulations would be used by the large Pentagon bureaucracy, not by single analysts acting independently. A large bureaucracy finds it difficult to use simulations as an exploratory vehicle, tending rather to reject simulation models that have not been officially "blessed" and to assume that the authorized simulations adequately reflect all the important variables. Thus, even though contemporary simulation software facilitates analysis of the structure of a system, the slow-moving and highly structured nature of debate within a large bureaucracy and the associated need for explicit statements of assumptions mean that it is unlikely that military competition planning could exploit the power of this modern software.

We propose the use of military balance assessments, adversary move/countermove games and analyses, and military contingency analyses as the best approach to understanding the structure of the U.S.-Soviet military competition, rather than an approach that in some fundamental way is based on computer simulations. It may be that over time balance assessments, games, and contingency analyses will lead to sufficient understanding of the overall structure of the military competition to permit greater use of modern computer simulation tools, but the state of the art of competition planning is far from this condition today. Even with substantial progress in understanding the competitive environment and adversary interactions in the military competition, the role for computer simulations probably will be much more to archive and manipulate knowledge arrived at through other means, than to carry out research directly to advance the state of knowledge about the structure of the competition. Whatever the

role that simulations turn out to have in competition planning, the ability now found in some business simulations (and beginning to appear in combat simulations) to assemble and change the structure of a system rapidly and cheaply will be essential.

3.3.8 Business Games

Business games involve teams of people facing some business problem in a simulated or game environment that is designed to highlight adversarial or competitive relations, as well as opportunities for cooperative behavior. Such games are used by companies and business schools for four purposes:

- Education and training in management skills, strategic planning, and investment decisions or in company policies and procedures.
- Evaluation of potential organizational changes in cases where the internal group dynamics that could be set in motion by the changes may be important.
- Evaluation of potential investments in cases where moves and countermoves among competitors are important.
- Strategic planning, especially to understand the nature and consequences of changes in the competitive environment.

Business games were popular in the 1960s and 1970s, and may have declined in usage during the 1980s; in any event, their use is not growing dramatically.

The idea of using games to assist in projecting and evaluating the consequences of adversary moves and countermoves has clear applicability to the U.S.-Soviet long-term military competition, and is incorporated into our planning approach. Moreover, games may be of value in understanding the consequences of changes in the future security environment. The specific

techniques used in business games are, however, fairly standard and do not provide improved ways to use games for military competition planning. Indeed, the Department of Defense appears to be leading the state of the art of applying games to strategic planning, with such innovations as the RAND Strategy Assessment System and path games.

3.3.9 Summary

In our survey of business planning tools and analysis methods we found some broad analogies that are helpful in understanding planning approaches to the military competition and have drawn on these analogies in developing the planning concepts and methods described in this report. The major analogies from business planning that we found useful are the following:

- The need to understand the strategic environment in which competition is taking place.
- The use of detailed models to help determine what variables are important in the strategic environment and to help select specific strategies in light of trends in these variables.
- The use of gaming to help understand what the plausible range of adversary actions might be and possibly to aid in understanding the consequences of changes in the strategic environment.
- Portfolio management.

We also found that the details of these concepts need to be reworked extensively for military competition planning. Thus, we found no business planning tools or methods that can be transferred fairly directly to planning for the U.S.-Soviet long-term military competition.

3.4 CLASSICAL ANALYSIS TOOLS: LOGIC AND JUDGMENT

Logic and expert judgment have been combined in a tradition of analytic essays that goes back to the early Greek philosophers, epitomized in the writings of Plato. The analytic essay is still a powerful tool and is used in such varied forums as international security journals and Pentagon staff papers. Contemporary examples of the application of logic and expert judgment in essay form to problems of strategy include the work of Albert Wohlstetter, the report on Discriminate Deterrence by the Commission on Integrated Long-Term Strategy, and the reports by the Commission's Future Security Environment Working Group. The papers of DoD Competitive Task Forces also are in this vein.

The essential methodology of the analytic essay involves the application of inductive and deductive logic to facts and judgments, often guided by expert insights and intuition, and the synthesis of the results into a coherent set of conclusions. Such essays draw variously on historical data; scientific, technological, engineering, and military information; and political, economic, demographic, and social data and projections. Some also draw upon the results of quantitative analyses. The best of analytic essays go beyond induction and deduction to formulate new perspectives on security issues, define new problems for consideration, synthesize conclusions, and propound policies.

The analytic essay is a classic means for packaging the results of more detailed analyses in order to influence policy and strategy, to persuade others to implement preferred approaches, and to resolve bureaucratic disputes on security issues. It has a clear place in competition planning, including the following:

- Identifying important trends in the competitive environment.
- Characterizing the state of the military competition.

- Formulating and resolving issues about U.S. goals and strategies in the military competition.
- Achieving consensus on U.S. goals and strategies and promulgating policy guidance to implement U.S. strategies.

The best -- or most useful -- analytic essays for competition planning have certain hallmarks. One is transparency: the explicit statement of assumptions so the reader can easily understand what factors primarily determine the conclusions. Another is a kind of reproducibility in which the reasoning that leads from assumptions and input data to conclusions is set forth clearly for critical review by others. Not only is this sound scholarship, it also fosters closure of bureaucratic debates. Finally, the best analytic essays often meld together both quantitative and nonquantitative analysis.

The analytic essay is an important tool for competition planning, but its classical techniques are well understood, even if the vast majority of such essays do not reach the highest standards of this form. Therefore, we will not pursue this topic further.

A few words about expert judgment are, however, in order. There are a number of systematic techniques for extracting and utilizing the judgment of experts, but they should be applied with caution because these techniques (e.g., the Delphi method) are often used uncritically and for purposes that are not suitable.

Expert judgment techniques should be used primarily to develop inputs for analysis, not as a substitute for the analytic process. They should be drawn upon sparingly, focused as narrowly as possible on relatively uncomplicated questions, backed by explicit statements of the experts about why they reached certain

judgments, subjected to critical review and debate, and tested against data and analysis wherever possible. The areas of competition planning where expert judgment probably can most usefully be applied are the following:

- Understanding what trends in the competitive environment are most important.
- Developing a range of plausible future moves or countermoves by adversaries or third players.
- Formulation of candidate U.S. goals and strategies for analysis.

3.5 REGIONAL POLITICAL-MILITARY ANALYSIS

A form of the analytic essay in which logic and expert judgment are combined with summaries of pertinent country data and political forecasting is regional political-military analysis. Examples abound in political, regional, and international security journals, in the State Department, and in the Office of the Secretary of Defense. Most regional analyses have a near-term, descriptive, tactical focus, and are only peripherally useful for competition planning. Occasional articles or papers take a longer-term perspective; these are potentially more valuable for our purposes.

Regional political-military analyses that are directed specifically at competition planning issues can make a number of contributions, including the following:

- Aid in understanding the competitive environment.
- Help to make U.S. competition planning assumptions about the behavior of other countries explicit.
- Help to offset the U.S. tendency to attribute U.S.-style outlooks on the competition to other countries and thus to facilitate improved understanding of the

regional constraints and opportunities associated with U.S., Soviet, and third player moves and countermoves.

- Assist in explaining U.S. goals and strategies to allies and other key regional actors, and in implementing U.S. strategies that have regional components.

3.6 FORECASTING TECHNIQUES

Forecasting is the extrapolation of current trends into the future, using some form of systematic analysis (often quantitative) combined with judgment. Several kinds of forecasting potentially are relevant to military competition planning: political, economic, demographic, technological, military, and cost. Political forecasting is discussed briefly above, in connection with regional political-military analyses.

Economic trends are usually projected forward in terms of gross national product (GNP) or, when combined with demographic projections, in terms of per capita GNP. They aid understanding about the future resources that various countries can allocate to the military sector. One economic forecasting technique has been developed by Decision Science Applications, Inc. specifically for military competition planning. This is path costing, a method for determining the economic implications of two strategies competing over time, using a deterministic path simulation technique.

Demographic projections may include, in addition to population growth, the fraction of populations in various age groups or ethnic groups and comparisons of urban and rural population trends. Demographic forecasting is an aid to understanding future political and social conditions in various countries and can provide inputs to economic and military projections.

Technological forecasting typically involves projecting the state of various technologies such as jet engine thrust, laser pointing accuracy, computer weights and volumes, or communications rates. Technological forecasting may also be more broadly cast, seeking to identify emerging technologies with military applications and their impact both on the characteristics of weapon systems and on the nature of warfare. Soviet military technology forecasts have this broad character; the Commission on Integrated Long-Term Strategy also undertook such broad forecasts of military technology.¹⁰ Related to military technology forecasting is the more traditional kinds of projections carried out by the intelligence community: order of battle and weapon system characteristics such as accuracy, range, or payload.

While not normally considered forecasting, the projection of the costs of future weapons falls into this category of analysis, with the same benefits and uncertainties that are associated with other kinds of forecasting. This is particularly true for projections of the costs of weapon systems that would use technology that is significantly more advanced than today's, that could involve new designs, or that have not yet entered development. Such systems (e.g., the Strategic Defense System, advanced stealthy aircraft or ships, or smart cruise missiles) may figure prominently in strategies for the competition, and their costs must be considered in devising these strategies. The vaguely defined character of these weapons and the associated technology introduces additional cost uncertainties on top of those normally encountered for weapon systems that are about to enter development or production.

Another application of forecasting that could aid in formulating strategies that realistically take costs into account is the projection of future DoD budgets, given assumptions about the size of the future force and the rate at which existing

military capital stocks are to be replaced.¹¹ Such budget projections can help to identify problems in maintaining the current competitive position or to indicate the amount of discretionary investment funds available for new competitive initiatives.

Forecasting has a number of applications in competition planning, notably in characterizing the competitive environment, projecting adversary moves or countermoves, setting U.S. goals, and selecting strategies.

- Economic, demographic, technological, and military forecasting are major tools for characterizing the future competitive environment, as exemplified by the analysis of the Future Security Environment Working Group in support of the Commission on Integrated Long-Term Strategy.¹²
- Economic, demographic, technological, and military forecasting can make some contributions to understanding the constraints and opportunities associated with future U.S., Soviet, and third player actions and thus help to project moves and countermoves, to set U.S. goals in the competition, and to formulate U.S. strategies. Much of this contribution would come through application of forecasting in periodic updates of the survey of the competitive environment, although it may be useful to carry out additional forecasts to analyze candidate goals and strategies.
- Cost forecasting should be carried out for candidate U.S. goals and strategies as a check on their economic feasibility.

The limitations of forecasting techniques should be kept clearly in view when using these tools for competition planning. Forecasting is of necessity a continuous extrapolation from today's trends; it does not deal adequately with the discontinuities that sometimes will occur. Moreover, it is easy to be misled by the apparent precision of quantitative forecasts and overlook the often

considerable uncertainties associated with economic, demographic, technological, military, and cost projections that go beyond a few years into the future. Unfortunately, it is exactly these long-term forecasts that are most useful for competition planning.

More variables affecting the cost of future U.S. weapon systems are under the control of the Department of Defense than is the case for future economic, demographic, technological, and military trends. This observation raises the question whether it is possible to improve the accuracy of U.S. weapon system cost forecasts in ways that are not feasible for other types of forecasting. The problems are substantial. Parameters such as power, frequency, shaft horsepower, and speed are good predictors of future costs. But these performance parameters often are not known for advanced systems that may be deployed ten to twenty years into the future or they represent such leaps in the state of the art that current data bases for cost-estimating relationships are not applicable.

The SDI program is giving some attention to improved methods for cost forecasting. Today, most cost estimates for space-based systems and other leading-edge technology weapon systems are based on system weight, which is not a very accurate method. One approach to improving cost forecasting is to draw on technology forecasting methods to develop cost-estimating relationships based on advanced performance parameters, rather than on weight. Another approach is to devise analytic, R&D, and production techniques that improve the ability of the Department of Defense to maintain weapon systems within cost goals, even at the sacrifice of some performance.

Either approach to improved cost forecasting -- more accurate projection of the costs to achieve certain performance goals or affordability techniques that give confidence of achieving

adequate mission performance capabilities within fixed cost goals -- would prove valuable for competition planning, to help ensure that U.S. goals and strategies are consistent with the resources likely to be available to the Department of Defense in the future.

Forecasting will never be an exact art, especially for the kind of long-term forecasts that appear most useful for competition planning. The main use of forecasting in the military competition is to gain an improved understanding of the competitive environment, of the constraints and opportunities that may affect the goals and strategies of the United States, the Soviet Union, and third players, and of the uncertainties associated with all of this. In fact, use of forecasting techniques in competition planning probably should dwell extensively on exploring uncertainties through sensitivity analyses and bounding projections, to aid in developing hedges, adaptive strategies, or other portfolio management actions.

3.7 MILITARY BALANCE ASSESSMENTS

Net assessments of military balances are analyses of trends and asymmetries in the capabilities of opposing military forces in specific regions such as Europe or the Far East. They generally are carried out in order to understand the consequences of shortfalls in U.S. or allied military forces and the opportunities provided by shortfalls in Soviet or allied capabilities, and thus contribute to setting priorities for improvements in forces, support, or doctrine. Net assessments are carried out primarily by the Director of Net Assessment in the Office of the Secretary of Defense; by the Joint Staff; and to a limited extent by congressional staffs and the services.

Closely related are net technical assessments, which are analyses of trends and asymmetries in the capabilities of opposing

forces in specific mission areas such as fire support or submarine warfare, with an emphasis on technology. Net technical assessments are conducted by the office of the under secretary of defense for acquisition and sometimes by the services.

In their most elemental form, net assessments (and net technical assessments) merely compare trends in the order of battle of U.S. and Soviet forces, with perhaps some rudimentary analysis of these trends and the more obvious force asymmetries. Many net assessments still have that character. Over time, however, some net assessments, especially those carried out by OSD (Net Assessment), have made a concerted effort also to analyze trends and asymmetries in weapon system characteristics such as range, payload, and accuracy; force deployments in peacetime; readiness; sustainability; training; passive and active defenses; command and control; and concepts and operational plans for force employment. Military balance assessments also are making efforts to take the force capabilities of U.S. and Soviet allies into account. Using methodology advances pioneered by OSD (Net Assessment), the best of today's balance analyses seek to understand Soviet views of military balances and to use combat analyses to determine which specific trends and asymmetries have the most powerful influence on the outcomes of possible wars. While net assessments have always sought insight into likely war outcomes, the best of those being produced today focus a variety of analytic tools on war outcomes as a basic measure of military balances.

OSD (Net Assessment) makes periodic assessments of the military balances in strategic nuclear forces; various regional military balances, including Europe, the Middle East/Southwest Asia, and East Asia and the Pacific; and functional assessments such as the maritime balance and power projection capabilities. This office also has carried out comparisons of U.S. and Soviet military investment trends that aid in understanding various force

balances. These assessments are developed in detail for use by the secretary of defense and his senior officials; brief unclassified summaries have appeared in recent posture statements of the secretary of defense and in the 1988 edition of Soviet Military Power. Similar net assessment topics are covered by the Joint Staff in their annual statement on the military posture.

While some balance assessments consider only current forces,¹³ most examine pertinent data from the past and present, sometimes with projections into the near future. Embedding the current balance of forces in trends over time facilitates understanding of the ease or difficulty of changing the trends and provides an improved context for evaluating the impact on the balance of changes in weapons, force levels, or operational concepts.

Net assessments are used publicly to argue for proposed DoD budgets and force improvement measures. Internal to the Department of Defense, net assessments are used to a limited extent to help determine which force improvement measures will have the greatest positive effect on military balances. Net technical assessments are used to help guide DoD investments in technology.

Net assessments have strong potential as an analytic tool for competition planning, particularly to evaluate the current state of the military competition. Balance assessments can also contribute to identifying which changes in the competitive environment are most important (by evaluating the impact of such changes on military balances), to determining Soviet goals and strategies in the competition (by highlighting Soviet problems in current military balances), and to setting U.S. goals in the competition (by analyzing U.S. problems in current balances).

The concept of the state of the competition is discussed in volume I, with an emphasis on three dimensions: the military balance, the competitive positions of the two sides, and the state of relevant elements in the competitive environment such as deterrence, reassurance of allies, and crisis resolution abilities. Obviously, net assessments contribute directly and importantly to evaluations of military balances in various subareas of the competition. These assessments are the best means available for evaluating the U.S. ability to fight effectively in future wars, which is a key dimension of the state of the peacetime military competition. Moreover, since assessment of trends and asymmetries in factors relevant to the ability of each side to compete in peacetime is an important part of determining each side's competitive position, techniques for analyzing military balances have the potential for adaptation to analysis of this second dimension of the state of the competition as well. Through their ability to evaluate the implications of military balance trends and asymmetries for more U.S. traditional political- military objectives such as deterrence, net assessments can also contribute to understanding the third dimension of the state of the competition.

As discussed below in chapter 3.10 and in chapter 6, contingency analysis -- or analysis of military combat in specific scenarios -- constitutes a class of analysis tools separate from military balance assessments. But the most advanced concepts for net assessments (and net technical assessments) draw extensively on contingency analysis to identify important force engagements in a campaign for more detailed analysis and to identify those trends and asymmetries that strongly affect war outcomes in order to focus balance assessments on these factors. Thus, contingency analysis should aid in applying balance assessments for evaluating the state of the competition and for other competition planning purposes. As discussed below, however, contingency analysis also has direct

functions in competition planning separate from net assessment applications, notably as a primary tool for evaluating alternative U.S. goals and strategies.

A number of improvements in military balance assessments methods are needed before balance assessments can fully realize their potential to support competition planning. These improvements are treated in more detail in chapter 4. In brief, they are as follows:

- Extension of existing balance assessments to more regions (e.g., outer space) and to a greater diversity of combat scenarios in the multipolar competitive environment.
- Development of methods for applying military balance concepts to assessment of the U.S. and Soviet competitive positions.
- Development of succinct summaries of military balance assessments for use in brief descriptions of the state of the competition.
- Improved military balance assessment techniques, especially for focusing more strongly on war outcomes, for identifying the most important factors in complex balances, for easily analyzing a wide range of combat scenarios, and for synthesizing these analyses into a coherent assessment.
- Improved means for determining Soviet and third player views of military balances and for integrating these into coherent assessments.

3.8 ANALYSIS OF SOVIET THREATS AND CAPABILITIES

Analysis of current and future Soviet threats and behavior in the peacetime competition contributes primarily to the following areas of U.S. competition planning:

- Determination of Soviet competition goals and strategies.

- Assessment of the likely impact of U.S. competition goals, strategies, and actions on Soviet weapon acquisition and operational concepts for force employment
- Projection of future Soviet behavior in the military competition, particularly the identification of a plausible range of future Soviet initiatives and responses as an aid to evaluating candidate U.S. goals and strategies.

Analysis of Soviet military capabilities and peacetime behavior also contributes indirectly to other aspects of U.S. competition planning, such as identifying and evaluating changes in the competitive environment and evaluating the current state of the competition.

It is both natural and bureaucratically necessary for the Department of Defense to look to the intelligence community for the required analysis of the USSR in support of competition planning. However, the capabilities and resource allocation priorities of the intelligence community do not align closely with DoD competition analysis needs. In peacetime, a large percentage of the community's collection, processing, and analysis resources are devoted to determining the current Soviet order of battle and projecting it into the future; to estimating current and future characteristics of Soviet weapon systems; and to determining the location and readiness of Soviet forces. While these products about current and near-future Soviet forces are essential for evaluating the state of the competition using net assessment techniques, they do not contribute to other parts of competition planning and analysis.

The intelligence community is responsible for estimating the possible effects of Soviet capabilities and actions on the ability of the United States to achieve its goals. Though there

is much debate about the desirability of focusing on intentions rather than on capabilities, it is generally concluded that the intelligence community is mostly responsible for providing estimates of capabilities and not for estimating intentions. Only the latter really requires an understanding of the Soviet rationale for various courses of action. It is this rationale that is the focus of Soviet-style analysis. In Soviet-style analysis, the questions are why or when might the Soviets act. Analysis of capabilities addresses only "Could they?"

The intelligence community also gathers information and performs analyses in areas that may more directly support DoD competition planning, notably work on the Soviet economy and politics within both the USSR and the Soviet empire. But this work does not have high priority for resources, sometimes has been controversial and even wrong, and in some cases such as Soviet political trends falls into a bureaucratic gray area that inhibits imaginative research by the intelligence community.

The way in which the intelligence community potentially could most strongly contribute to competition planning is by drawing on Soviet military planning methods and information to estimate Soviet competition goals and strategies and to project a range of future Soviet competition moves and countermoves. The Soviet military planning process is, however, shrouded in secrecy and is based on a set of premises that differ significantly from those underlying U.S. military planning. Further, competition planning analysis has a time horizon of ten to twenty years or more and must consider a range of possible Soviet options that current Soviet military planning may not now be addressing, including Soviet responses to candidate U.S. actions that have not yet been adopted by the United States and that may never be. Therefore, replication or emulation of the Soviet military planning process

is needed much more than is any intelligence that may be available on current Soviet plans.

Replicating the Soviet military planning process is not an area in which the intelligence community traditionally has been strong. Moreover, the community generally feels restricted bureaucratically in developing alternative future Soviet actions for analysis by the Department of Defense, especially Soviet actions that are intended as responses to future U.S. moves that are under evaluation by the Defense Department.

To support competition planning, a focused effort is needed to incorporate explicit representation of the Soviet perspective on possible responses or initiatives. It has been demonstrated that mirror-image analysis of Soviet perspectives can lead to serious errors. Thus, a Soviet-style analysis of Soviet goals, strategies, and actions in the long-term military competition is needed, one that applies reasoning and analysis tools in ways that approximate Soviet analysis as closely as possible, based on an understanding of Soviet organizations, Soviet decision making, Soviet analytic techniques, and Soviet practices. This is not a mode of analysis in which the intelligence community is comfortable operating. The intelligence community, together with OSD (Net Assessment) has, however, fostered research on Soviet-style analysis methods for use by other organizations.

Thus, DoD competition planning should draw upon support from the intelligence community, but should also draw on Soviet-style analyses performed outside the community, especially to address longer-term planning issues. The essential steps in a Soviet-style analysis to support competition planning are as follows:

- Develop an estimate of the Soviet view of the threat.
- Identify possible Soviet responses to this threat, reasoning as the Soviets probably would. Four types of decisions that could be considered by the USSR should be examined:
 - Decisions about Soviet military doctrine, military objectives, and victory criteria.
 - Decisions on development of new weapon systems.
 - Decisions about priorities for basic research.
 - Decisions with respect to the operational art and tactics with which Soviet forces would be employed.
- Evaluate this set of Soviet response options, using Soviet criteria and methods.

This type of Soviet-style analysis can contribute in several ways to competition planning, as follows (see chapter 5.2 for a more detailed discussion):

- Identifying subareas in which the Soviet Union may choose to concentrate its competitive efforts in the future.
- Understanding Soviet perceptions of U.S. actions and options.
- Anticipating Soviet responses to U.S. strategies and actions and Soviet competitive initiatives.
- Identifying ways in which the United States can make effective Soviet initiatives and responses more difficult.

While substantial progress has been made in developing Soviet-style analysis methods in recent years, not many analysts have the required training and experience and the techniques of Soviet-style analysis have not been institutionalized within the Department of Defense. Three improvements are needed in order to provide better analysis of Soviet capabilities in support of competition planning and to move more strongly toward

institutionalizing Soviet-style analysis. More people need training and analytic experience along lines that give them a broad understanding of how Soviet decision-makers think, plan, and decide; more efficient ways to use these individuals need to be established in the Department of Defense; and analysts or strategists with little background in Soviet studies need to acquire greater skills in generating hypotheses for Soviet-style analysis and in working with the Soviet-style analysts. Approaches to these problems are discussed in more detail in chapter 5.5.

3.9 POLITICAL-MILITARY GAMING

Politico-military games are simulations of selected aspects of the current or future world that focus on national security issues. What distinguishes games from other forms of simulation is the use of human players in the simulation in ways that capture adversarial or cooperative relationships. Thus, games normally are composed of two or more teams with interests that are opposed or at least are not totally aligned. Important features of the real-world environment are simulated in the games. A control team steers the scenario, decides the outcomes of team interactions, represents politico-military influences outside of the teams, and records game results. Some form of analytic support often is provided to the players or controllers.

The design of specific politico-military games is dictated by the purposes of the games, which may be for training or education, for entertainment, or for analysis. Games used for analysis usually have one of three broad objectives: to explore a new politico-military environment, in order to determine what may be important about that environment; to learn how to think about an ill-defined problem; or to test solutions to a problem.

Another way to classify games is according to whether they simulate combat situations (war games), crises and confrontations that could lead to war (crisis games), or peacetime political-military planning or competition (planning games). War games use the opposing teams to direct the use of their respective forces in a military campaign, with analytic support to decide the outcomes of force engagements. This support may be rudimentary (e. g., the judgment of experts on the control team, perhaps augmented by random-number devices for determining outcomes) or may be quite elaborate, with computer models of engagements and other combat processes. One form of the war game, the RAND Strategy Assessment System, is highly automated, including the use of artificial intelligence software to replace the U.S. or the Soviet teams.

Some recent developments involve combinations of human players and such extensive computer support that they are hybrids at the interface between politico-military gaming and combat modeling. One example of this kind of hybrid is interactive computer simulations, in which human operators intervene from time to time to change the orders under which computer-simulated forces are operating. Another example is the Simnet system, in which human operators are placed in tank or helicopter mock-ups with high-fidelity physical simulation of the combat environment. A distributed computer network allows these mock-ups to perform combat functions and simulates tactical engagements with high fidelity. Because they have the potential to support competition planning in ways similar to more traditional combat models, interactive computer simulations and Simnet are discussed in chapter 3.10 below.

Crisis games generally involve traditional politico-military gaming techniques, as do planning games. One interesting form of planning game, which has potential for competition planning

applications, is the path game. This form explores a move/counter-move path from the present into the future, simulating the decision-making processes of the various sides and the impact of these decisions over a long period of time.

During the 1950s and into the 1960s, politico-military gaming had a certain ascendancy in the Pentagon and in research institutes like RAND. Gaming was a less prominent tool in military planning during the 1970s, but came back into greater use during the 1980s. Noteworthy gaming applications in the 1980s included war games to study alternative military campaign concepts for force employment, path games to support SDI and nuclear and chemical force acquisition decisions, and recent games conducted by OSD (Net Assessment) to explore the implications of the survey of the future security environment conducted in support of the Commission on Integrated Long-Term Strategy.

Gaming has major strengths, but also major weaknesses; both dictate how it should be used as a tool of analysis. The key strengths of gaming lie in the integral role of human players in the game process: the use of people to model complex human processes such as the interaction of adversaries, varying national styles of decision making and command, national perceptions, and doctrinal predilections adapted to specific game situations. The role of humans in games and the relative scenario-independence of computer support for many types of games allow more rapid adaptation of games to new scenarios or problems than is the case for many other types of analysis tools, especially large combat models. Moreover, with the right game structure, players can themselves serve as analysts by, for example, synthesizing new alternatives for analysis or deriving analytic results from the game play.

The integral role of human players in games also is responsible for the major weaknesses of games as analytic tools. Games are not reliable predictors of competition, crisis, or combat outcomes, though they can indicate general trends, problems, or opportunities that result from a given set of initial game conditions and the goals and strategies of the contending parties. Moreover, games tend to be manpower intensive and hence costly and time-consuming to set up and operate, although progress may be possible in reducing the resources needed for games, as discussed in chapter 6.

This brief review of the strengths and weaknesses of gaming suggests that the primary application of games to competition planning should be in the form of peacetime planning games, with contingency analysis (rather than gaming) being the primary means for evaluating goals and strategies in potential combat conditions. Gaming and contingency analysis have naturally complementary roles in setting U.S. competition goals, evaluating alternative U.S. strategies, and analyzing candidate portfolio management approaches, as depicted in Figure 6:

- Gaming can serve as a kind of coarse filter to identify the most promising candidate U.S. goals and strategies in the context of U.S. and Soviet moves and countermoves over time. It serves this purpose by helping to determine the future state of the military competition likely to result from each candidate set of U.S. goals and strategies.
- Contingency analysis can serve as a more refined tool for testing the candidate goals and strategies that emerge from the filter of the gaming analysis. Contingency analysis (discussed in more detail in chapters 3.10 and 6) is the evaluation of military effectiveness and likely war outcomes when U.S. and Soviet forces associated with a future state of the competition fight one another in various contingency scenarios. Combat models are a key part of contingency analysis.

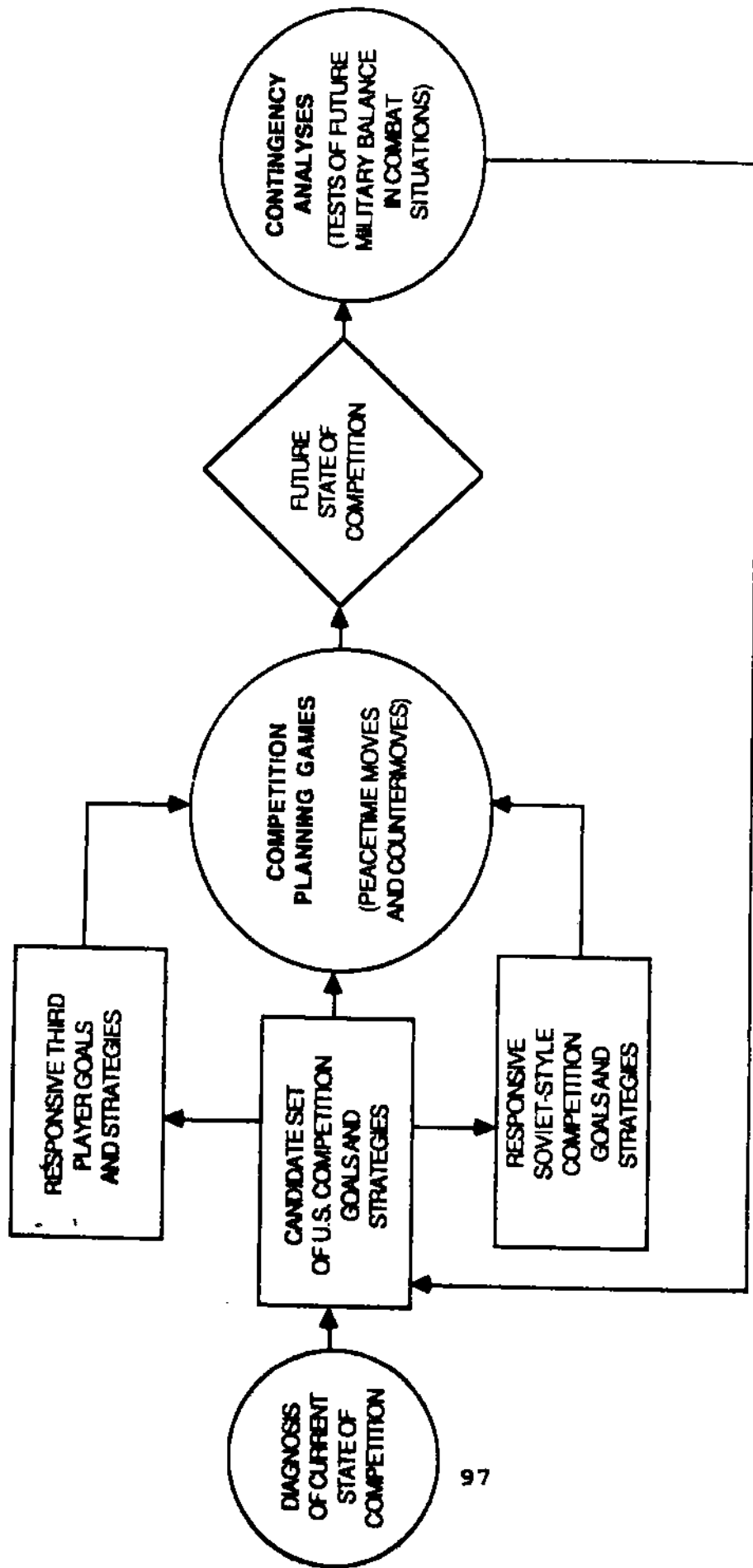


Figure 6. Roles of gaming and contingency analysis in competition planning.

Thus, planning games appear to have considerable potential for analytic support to competition planning by subjecting candidate U.S. goals and strategies to the effects of Soviet and third player moves and countermoves. As depicted in Figure 7 (a schematic representation of the space of current and future states of the military competition), while a U.S. strategy may be intended to achieve a certain future state (shown with a dashed line), when U.S. strategy interacts with the strategies of the Soviets and third players in a sequence of moves and countermoves over time, the result may be a quite different state (shown with a solid line), one much less desirable for the United States. Competition planning games can help evaluate alternative U.S. goals and strategies in this move/countermove context by indicating which future states of the competition are likely to result and by identifying portfolio management actions that will contribute to achieving the most desirable future states.

More specifically, competition planning games should have the following purposes in the analysis of candidate U.S. goals, strategies, and portfolio management approaches:

- Serve as a test bed for alternative U.S. competition goals and strategies by simulating peacetime moves and countermoves in which the Soviet-style adversary is seeking to block or undercut U.S. initiatives and to make competitive gains thorough its own initiatives.
- Evaluate the sensitivity of alternative U.S. goals and strategies to third player goals, strategies, and actions.
- Explore the uncertainties associated with future moves and countermoves in order to identify U.S. problems and opportunities to be addressed by portfolio management actions.
- Identify key military contingencies for more detailed combat analysis and determine the future military balance likely to result from a move/countermove sequence, as an input to these contingency analyses.

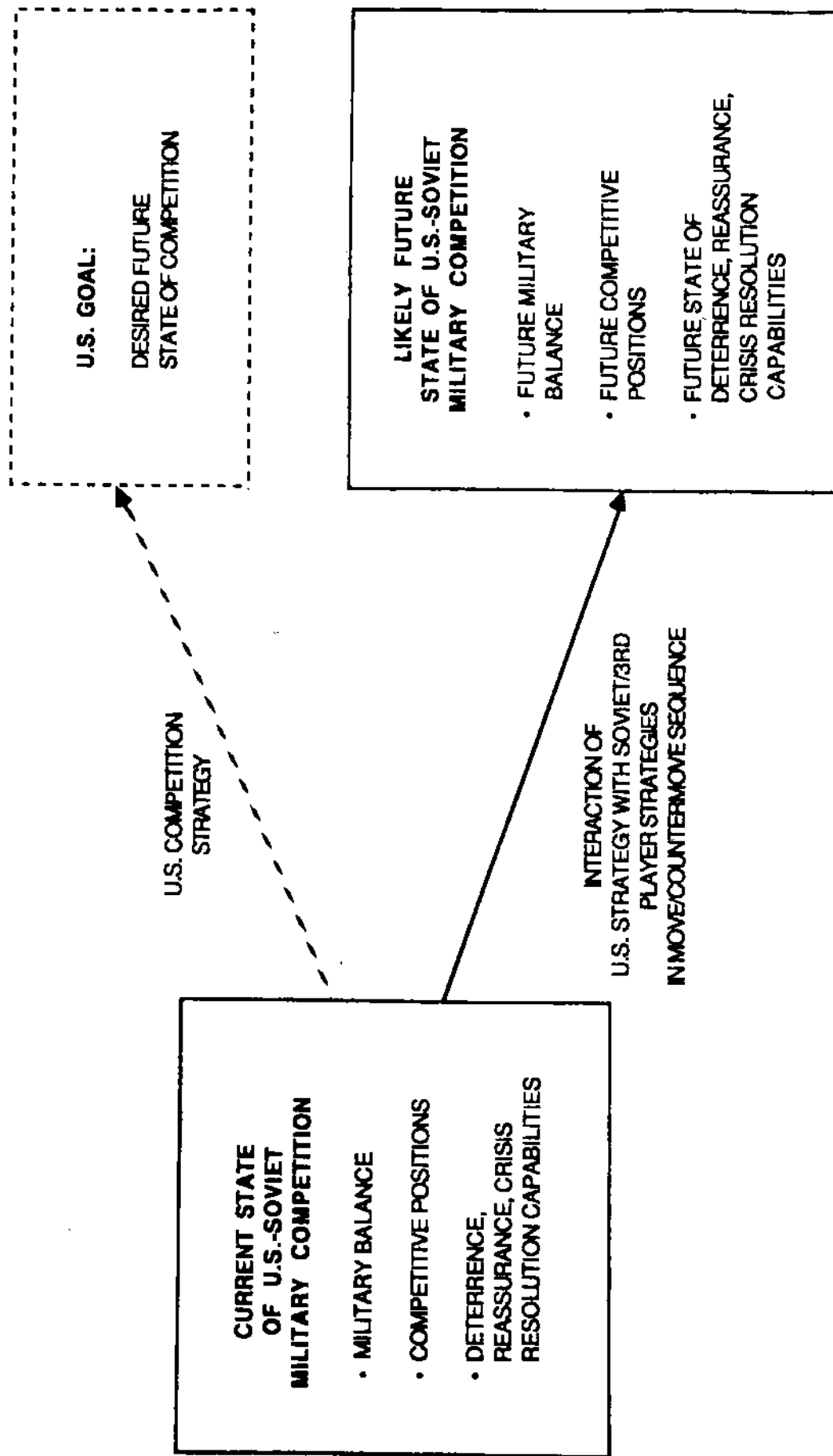


Figure 7. State space schematic representing movement from current to future state of the competition.

Planning games also have a number of secondary roles in competition planning. Through the kind of move/countermove games outlined above, they can test the reasonableness of estimates of Soviet and third player goals and strategies developed by other means. They can help evaluate the consequences of changes in the competitive environment. Moreover, planning games can contribute to diagnosing the current state of the competition by identifying strengths and weaknesses in the current U.S. and Soviet competitive positions, in terms of how these positions limit or enhance each side's competitive efforts in a series of moves and countermoves into the future.

It is possible that games also can be a means for capturing and archiving knowledge about the U.S.-Soviet military competition that is gained over time. For example, the results of move/countermove games, interesting U.S., Soviet, and third player strategies and portfolio management techniques, and important sensitivity tests can gradually be incorporated into the structure of competition planning games. Some of these results, plus contingency scenarios that planning games show to be important, might also be incorporated into the Red and Blue agents and the scenario generator of the RAND Strategy Assessment System.

Improvements in current planning game techniques are needed before gaming can realize its full potential as an analytic tool for competition planning. These improvements include the following, which are discussed in greater detail in chapter 6:

- Devising ways to move players realistically into future security conditions, in the sense of causing players to emulate credibly the actions of decision makers in conditions of ten to twenty years or more into the future.
- Reducing the cost, manpower, and set-up times for useful, credible analytic games.

- Converting move/countermove games into estimates of future states of the competition.
- Increasing the number of variations on U.S. and Soviet goals and strategies that can be examined in a fixed number of games (i.e., improving game productivity).
- Developing practical, efficient ways to capture and archive in games the results of past competition analyses.

3.10 COMBAT MODELING

Combat models are simplified representations of military combat in which the kinds and degrees of detail are determined by the specific analytic purposes for which the models are designed. Our discussion focuses on quantitative models of combat, which still encompass a wide range, including simple mathematical models, computer simulations, interactive campaign models, and the combined computer and physical simulations of the Simnet system. We survey these classes of combat models below, summarize their strengths and weaknesses for competition planning, recommend specific roles for models in competition planning, and identify improvements that are needed in combat models used for this purpose.

Our discussion of combat models is organized by type of model, but it is well also to have the range of applications of combat models in mind, because these applications, many of which have little direct relevance to competition planning, heavily influence the design of specific combat models. Major model applications include the following:¹⁴

- Battle planning: the preparation of concepts, doctrine, and plans for wartime operations, based on friendly and enemy orders of battle, the existing strategic or tactical environment, and specific missions or objectives.
- Wartime operations: the conduct of war, which is distinguished from battle planning by knowledge of the

availability of friendly and enemy forces, the objectives for friendly and enemy forces, and actual performance capabilities of weapons.

- Weapon system procurement: the design of weapon systems or selection from among competing weapons.
- Force sizing: decisions about how many weapon systems, delivery platforms, and force units to procure, operate, and support in the future.
- Logistics planning: the structuring, sizing, and operation of military logistics support.
- National policy analysis: policy analyses (e.g., arms control or broad national strategy) that are influenced by or influence military combat capabilities.

Mathematical models of combat had their origins in the period after World War I, pioneered by Lanchester and Richardson. They are combat representations in the form of mathematical equations; analysts often use computers to perform calculations using these equations, but the essence of this class of models is mathematical formulas, not the step-by-step simulation of combat processes. Such mathematical models generally are relatively simple in form and are intended to reflect only the most important quantifiable variables in a combat situation.

While mathematical models sometimes are used for initial scoping of more detailed simulation models, their most widespread and effective use has been to help improve military operations in wartime. This was the focus of operations research in its beginnings during World War II, and there were similar applications in later U.S. wars. Essentially, a simple mathematical model is applied to combat data in order to optimize the allocation of forces or to improve the tactics for employing forces. The selection of the right measures of effectiveness is as important as the development of the model for this kind of application. Examples include allied bombing and convoy tactics in World War

II, ASW search models, and the Lanchester models of force attrition.

Computer simulations are representations in computer programs of the detailed steps over time in the movement, engagement, and support of combat forces. Forces may be represented at levels of aggregation that vary from battalion-size maneuver units to individual artillery pieces; the scope of operations represented in these simulations can vary from one-on-one weapon versus weapon engagements, to few-on-few tactical engagements, up to theater-level campaigns. Human decisions are represented by preprogrammed decision rules; randomness is represented by probabilistic tables or decision rules and random-number generators. Computer simulations tend to be large and expensive; to require substantial amounts of data; and to be tailored to specific types of forces, scenarios, and combat doctrine and tactics. Examples include air defense penetration models, armor/anti-armor target vulnerability models, models of air, ground, or naval engagements, strategic exchange or strategic defense models, and some logistics models. They are used primarily for battle planning, force sizing, and weapon system procurement analyses.

Interactive campaign models operate on a computer system, but differ from computer simulations in two ways: they aggregate combat functions at the campaign or theater level and they allow easy analyst interaction with the computer model to provide command decisions and to alter model inputs or assumptions.

More specifically, interactive campaign models are designed to incorporate varying doctrine or force employment concepts for the opposing forces and to facilitate sensitivity analyses in which the analyst plays an active part during the on-line operation of the model. The model architecture is a

