

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

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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 this 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.				
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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 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 -3	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	$t_F = (t_C + 459.67)/1.8$	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)
kiloton	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)
knap	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 (lbf avoirdupois)	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 (lbm avoirdupois)	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

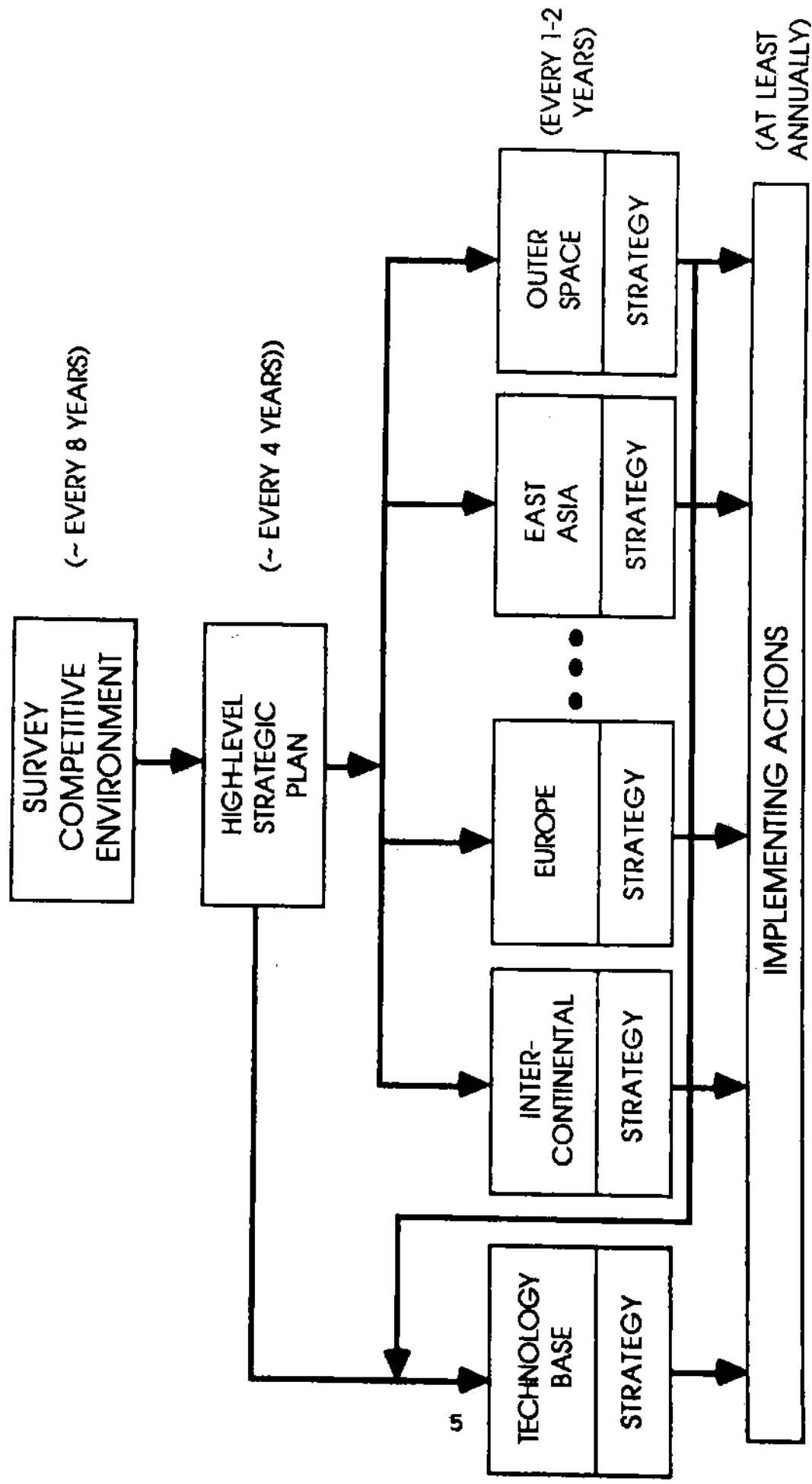


Figure 1. Generic functions in competition planning.

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).

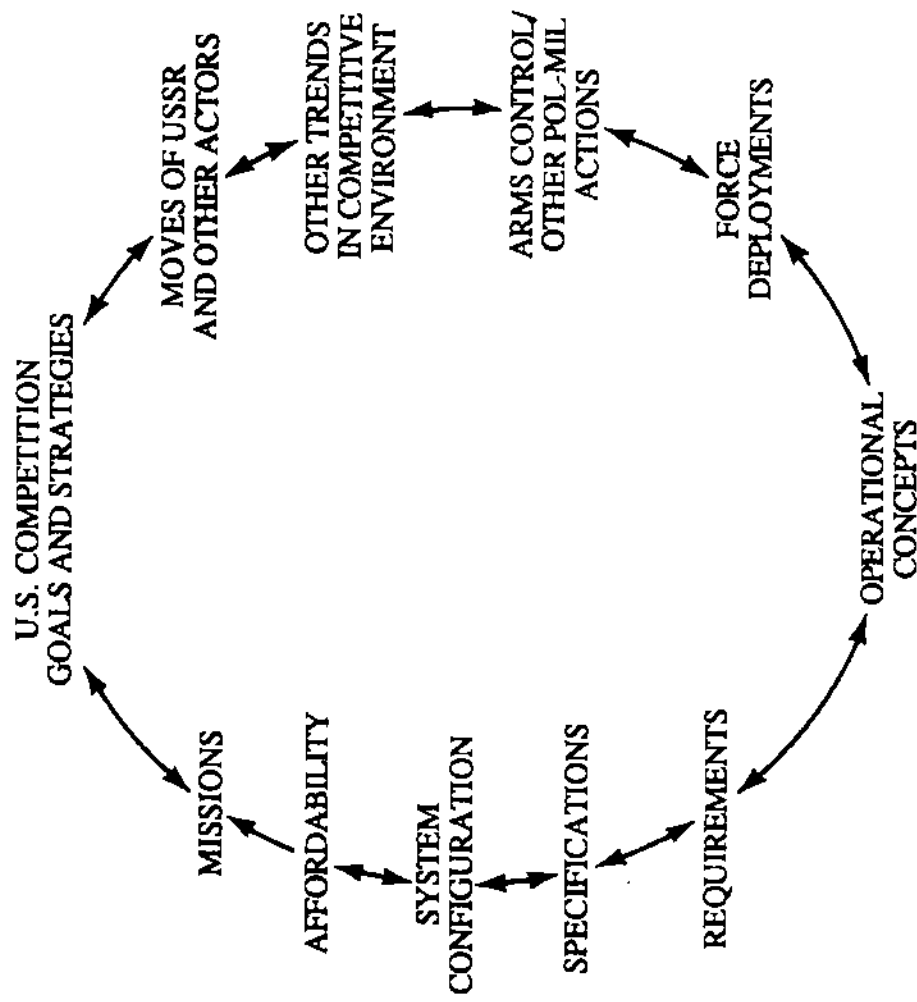


Figure 3. Emerging architectural approach.

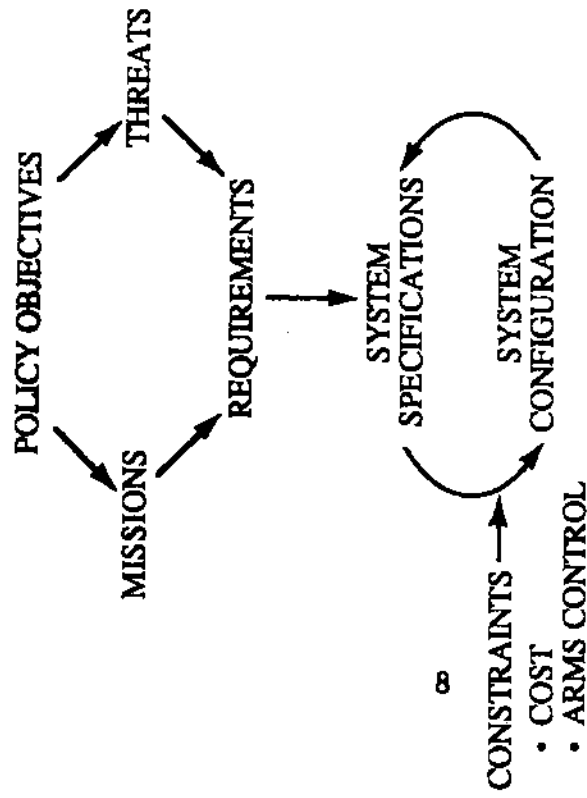


Figure 2. Traditional requirements approach.

- 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

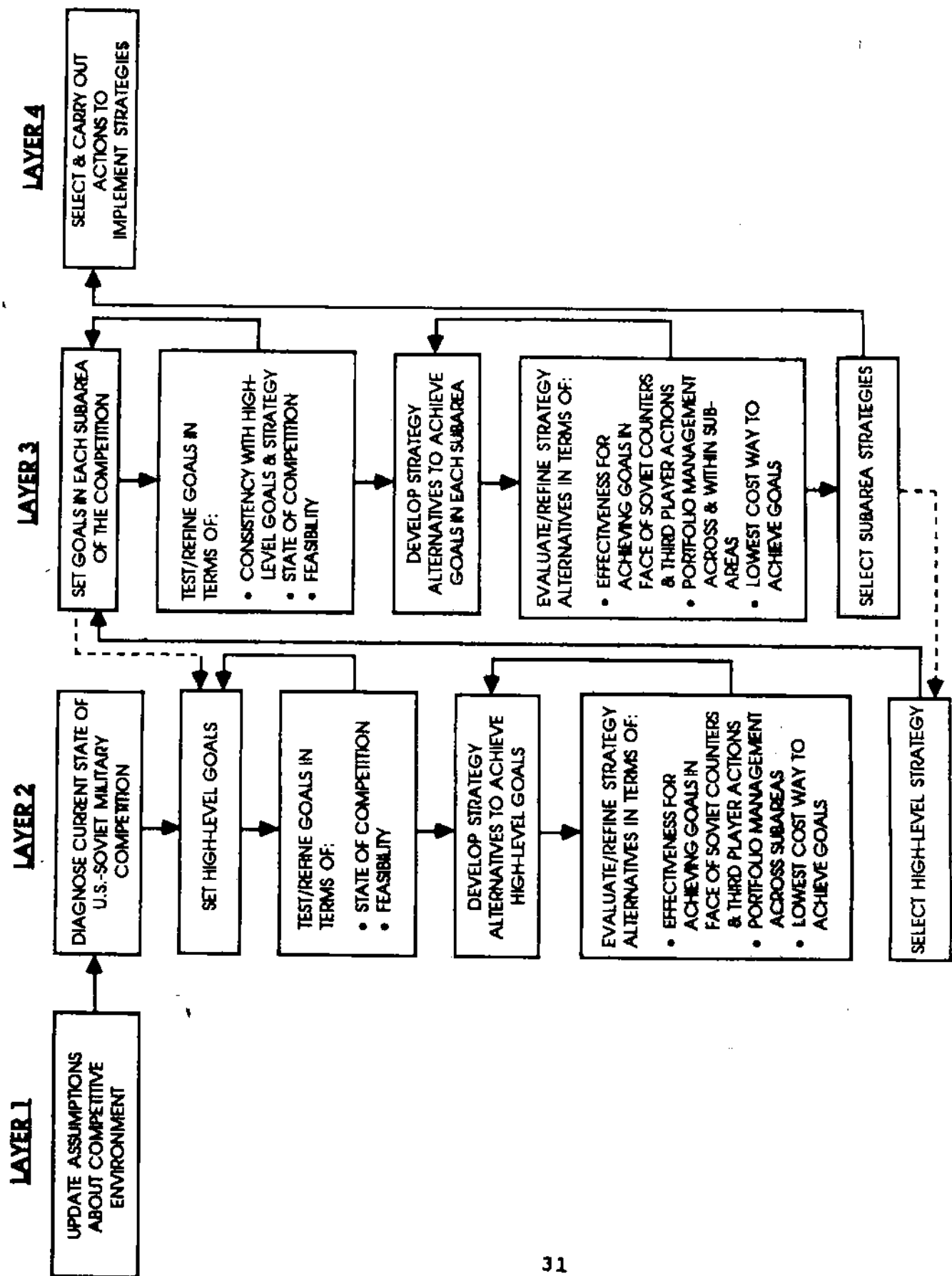


Figure 4. Analysis sequence for competition planning.

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

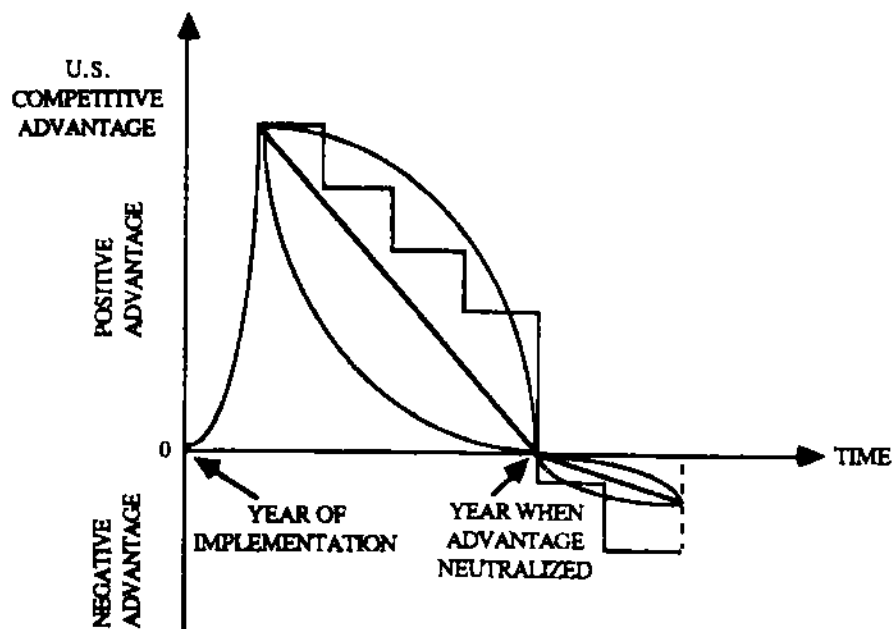
return on investment from alternate goals, assessed in terms of improvements in the military balance, in the U.S. competitive position, or in some combination thereof (assuming the alternative goals were equivalent in terms of deterrence, reassurance of allies, and crisis resolution capabilities).

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.

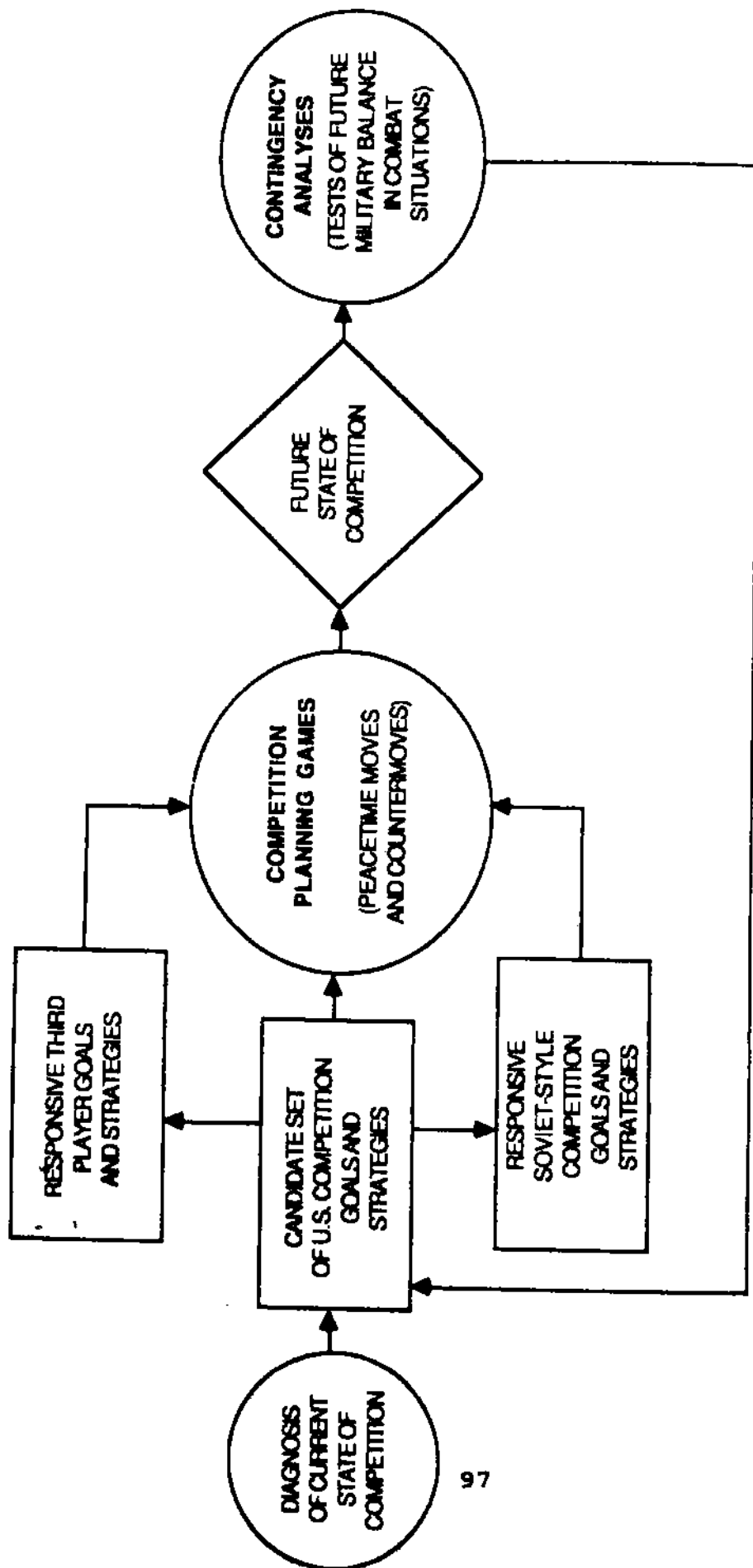


Figure 6. Roles of gaming and contingency analysis in competition planning.

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.

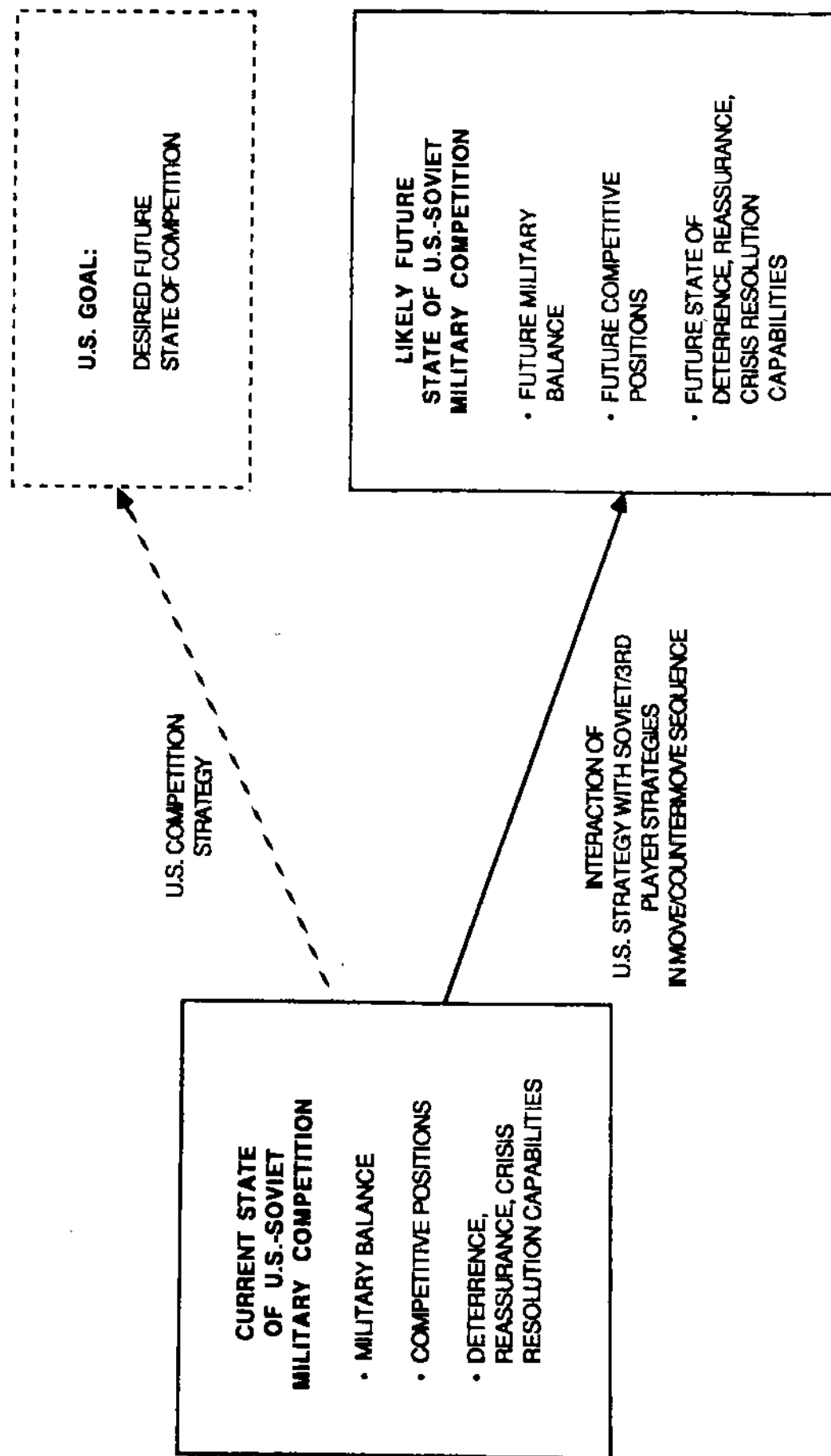


Figure 7. State space schematic representing movement from current to future state of the competition.

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 counter moves 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

relatively simple framework for adapting the model to new forces and combat situations, the model's routines tend to be simple mathematical algorithms rather than detailed simulations, and the model provides user-friendly display interfaces with the analyst. Campaign models of this type move forces at the user's direction, cause force engagements to occur, evaluate engagement outcomes, reflect the resulting attrition in subsequent campaign operations, and measure the progress of the campaign toward each side's combat goals. Since these campaign models are based on algorithms, movement rates, and probabilities of engagement and kill, their data requirements are more modest than those of computer simulations, but much of the data must be derived from more detailed combat modeling and analysis.

The RAND Strategy Assessment System is an example of an interactive campaign model. This system is an automated war game in which on-line human interaction with the computer model is provided primarily by heuristic rule-based agents or computer routines that emulate the decisions of the commanders of the opposing sides. In this case, analysts interact with the models through the heuristic rules incorporated into the Blue and Red command agents. The RAND Strategy Assessment System also includes analytic war plans to automatically work through the command decisions needed in specific campaigns and algorithmic modeling of both the force operations to carry out these plans and the resulting force engagements.

Another example of an interactive campaign model is the Maritime model developed by Science Applications International Corporation under contract to the Defense Nuclear Agency. Maritime was developed to support determination of theater nuclear weapon requirements related to naval warfare. All major conventional naval force operations are, however, also modeled, since one of the purposes of developing this model was to reflect adequately the

contributions of conventional forces before, during, and after the use of nuclear weapons. Hence, Maritime is a two-sided model of conventional-nuclear naval campaigns, and includes fleet air defense, antisubmarine warfare, submarine warfare, surface operations, strikes on targets ashore, and use of land-based aircraft to attack forces at sea. The user sets up the initial conditions of the campaign; moves forces; causes engagements to occur, if desired (engagements also will occur automatically if the user does not intervene); and adapts subsequent campaign operations to the results of force engagements. This model allows the user to save the current state of the campaign at any point in order to conduct scenario branching analyses in which alternative campaign courses are examined from that point on. Interactive campaign models are a relatively new development, so their applications are still emerging. Currently, this class of combat models is being used primarily to support force sizing analyses and weapon system procurement decisions, although these models have the potential also to support battle planning and net assessments.

Simnet currently is a training system, but it has strong potential for analytic support to long-range planning, and therefore is discussed here. Simnet currently simulates the combat operations of tanks and helicopters, linking together a possibly large number of these vehicles in the same game environment, even though the individual vehicle simulators may be geographically distributed throughout the United States or even worldwide. A combination of physical simulators and computer-generated displays provides a high-fidelity representation of the combat environment perceived by the crews in each vehicle, including visual, sound, combat communications, and sensor environments. These vehicles are netted into a common system by packet-switching data communications among the computers driving each vehicle's environment, allowing individual vehicles to maneuver, engage one another, suffer breakdowns, or be killed or damaged in this common environment.

Individual operators man these simulators at their home bases for small unit training and for simulated exercises with other units located elsewhere.

Simnet has the potential for analytic applications, especially for the testing of new weapon concepts, weapon systems, or doctrine in realistic, two-sided combat situations. By combining the best features of computer modeling and free-play exercises for analysis purposes, Simnet has the ability to evaluate weapons or concepts in a realistic combat environment in which both sides adapt their tactics to the new weapons or concepts, but at considerably less expense than free-play exercises. Moreover, the Simnet computer environment easily allows data to be recorded for later analysis, permits variables to be controlled for analysis purposes, and facilitates repeated tests for statistical validity.

Simnet can be a key tool for analysis of any combat problem in which the actions of human operators of weapon systems or commanders are of major importance for combat outcomes. Examples of such situations are armor/anti-armor engagements, manned aircraft penetrating air defenses, and submarine warfare. In each of these examples, human performance has a strong influence on the course, pace, and outcome of the campaign through such things as tactics, the interpretation of sensor outputs, and the potential for electronic, acoustic, or visual decoying or confusion.

The man-machine-computer system of Simnet has four essential characteristics that give it the potential to be an analysis tool:

- The highly detailed free-play interaction of small tactical units in battle.
- The strong role of human players in this system and the ability of the system to capture realistically the

interactions between humans and the weapon systems under study.

- The high-fidelity game world environment in which the players perform.
- The ability to capture much of what Clausewitz termed the "fog of war," including human errors, communications losses, and the way that the loss of a few critical tactical units can affect the dynamics of the battle. Obviously, the fear of injury or death cannot be reflected in Simnet or any other mock-combat simulation, but the physical and battlefield environment of Simnet can realistically reflect command style, small unit training and cohesion, and the "adrenalin" effects of combat actions.

Thus, properly structured, Simnet can move players forward into future combat environments and simulate the combat interactions of future tactical units realistically. Doctrine and tactics for use of future weapon systems can evolve naturally in Simnet, because -- unless artificially constrained -- the Red and Blue players will, under the pressure of the combat dynamics, adapt their actions to the new conditions created by these new weapons concepts. Obsolete doctrine quickly will become apparent in the Simnet combat environment. In this sense, Simnet is a self-adapting doctrinal system.

The strength of Simnet lies in its ability to model the engagement of small tactical units (e.g., tanks, helicopters, manned aircraft, SAM launchers, ships, or submarines) in many-on-many situations. Whether Simnet can be scaled up to the campaign level or theater level and still retain its benefits is an issue that needs to be researched.

Simnet currently exists as a training prototype developed by the Defense Advanced Research Projects Agency, and even in this form considerable work needs to be done in order to simulate realistically all relevant aspects of the tactical combat

environment. How to proceed is well understood; what is needed is adequate funding to improve the fidelity of the combat environment of the present Simnet system. To move beyond a high-fidelity training system to provide Simnet with the capability to analyze the performance of future weapons or weapons concepts in a realistic two-sided combat environment will require a considerable investment, but such a capability would have clear benefits for the DoD acquisition process generally, as well as for competition planning in particular.

This brief survey of combat models allows us now to summarize the strengths and weaknesses of this class of analytic tools. Combat models are most useful for the analysis of combat situations in which adequate data and understanding of the forces and doctrines of the opposing sides are available, so that the model can capture the important physical and dynamic relationships of the combat situation being analyzed. Models can be particularly helpful in these cases if they can generate multiple runs to facilitate sensitivity analyses without undue costs and in a time period that can support decisions.

Combat models are less helpful -- and can be misleading -- when applied to situations in which the types of forces, the balance of forces, the doctrines of the opposing sides, or other aspects of the combat situation such as the terrain are quite different from the combat conditions for which the models were designed. Highly detailed computer simulations are especially difficult (and, therefore, costly) to adapt to new combat situations because of the way the original design conditions are imbedded in this class of model. Simpler mathematical models and the emerging class of interactive combat models are in principle easier to adapt to new situations, provided their designs are not strongly tailored to one theater (e.g., Central Europe), one force balance regime (e.g., the current structure and balance of

conventional forces in Central Europe), or one set of campaign concepts (e.g., Soviet breakthrough doctrine or U.S. airland battle doctrine). In concept, Simnet can be adapted to new situations, but how adaptable it would be in practice depends on the software developed for a specific Simnet application. With proper design, including adaptivity considerations, Simnet should be able to support combat analyses of future force balances.

Competition planning requires assessment of alternative future force balances as part of the evaluation of future states of the competition that could result from a set of U.S. goals and strategies in the military competition. Combat models have a natural role in this evaluation by providing a capability to evaluate future force balances in contingency analyses -- the pitting of these opposing future against one another in war scenarios, using the combat outcomes in these scenarios as a means to help measure U.S. preferences for alternative future states of the competition.

The difficulty is that combat models designed for today's force balance regime may not be useful, and could be misleading, when applied to quite different military balance regimes in the future. Simnet has the potential to analyze new force balance regimes in the future, especially at the level of few-on-few or many-on-many tactical engagements. Simnet will, however, require an extensive development program before it is able to carry out tactical engagement analyses for future force balances.

Interactive combat models of the sort exemplified by the Maritime model described above have the potential for analysis of new force balances at the campaign level, supported by more detailed weapon-on-weapon and tactical engagement simulation models. Determination of the likely kinds of future force engagements and the doctrines associated with new weapon systems

will, however, need to be made outside of the interactive combat model using such tools as gaming and Soviet-style analyses.

Despite these limitations, combat models have a role in the contingency analysis test bed for competition planning described in chapter 6. This test bed would consist of a set of war scenarios for use in evaluating future force balances and a set of combat models for use in assessing the combat capabilities of these opposing future forces in the set of war scenarios. Inputs to this contingency analysis test bed would be provided by using military balance assessments, Soviet-style analyses, and competition planning games to translate a set of U.S. competition goals and strategies into a range of likely future military force balances, with the range depending on Soviet initiatives and responses and third player actions. War outcomes in this contingency analysis test bed would be an important measure of U.S. preferences for alternative future states of the competition and, therefore, one means of evaluating alternative U.S. competition goals and strategies.

The idea is not to predict the results of selecting a set of competition goals and strategies; this would be naive, given the complexity of future U.S., Soviet, and third player interactions. Rather, the idea is to determine a range of future force balances that bounds the likely results of selecting a particular set of goals and strategies and to test this range of future force balances in contingency analyses as a means of evaluating alternative goals, strategies, and portfolio management techniques.

Military contingency analysis of this sort would, therefore, primarily support the selection of U.S. competition goals, the evaluation of alternative strategies to achieve these goals, and the evaluation of portfolio management alternatives.

As a secondary or derivative function, military contingency analysis would support the diagnosis of the current state of the competition by assessing the combat capabilities of current U.S. and Soviet forces in various war scenarios.

For this purpose, the most useful type of combat models appears to be interactive campaign models in which humans interact directly with the computer. Whether the RAND Strategy Assessment System can be made sufficiently adaptable to be a key tool for the military contingency analysis test bed is not clear. Interactive campaign models of either type (the RSAS type, in which humans interact with the computer through heuristic programs, or the Maritime type, in which humans interact directly with the computer) will need to be supported by more detailed computer simulations of weapon-on-weapon engagements or few-on-few tactical engagements. Simnet potentially has a key role in a contingency analysis test bed for competition planning, if its development for this purpose can be funded.

Nevertheless, these combat modelling tools are not currently ideally suited for a contingency analysis test bed; research on a number of improvements is needed. Most obvious is the research needed to transform the analysis potential of the current Simnet prototype into reality. Less obvious but probably more important is research to reduce the time and costs associated with contingency analyses. The analysis of the combat effectiveness of alternative future forces can take years and many millions of dollars to accomplish, as illustrated by the succession of ICBM modernization studies in the 1980s and the equally complex studies of alternative ways to modernize the air-breathing leg of the strategic Triad carried out in the 1970s. How to reduce the time and costs required for such contingency-oriented analyses is a major problem. One line of inquiry relates to improved means for archiving and drawing upon the results of past studies. Another

is to find better ways to focus the analysis on the right issues at an early stage. A third approach is to determine the degree of detail needed in contingency analyses for competition planning purposes, so that analyses at a suitably aggregated level of approximation can be used.

At least two other problems need research. One is the limited ability of most combat models to adapt easily to analysis of a range of quite different force balance regimes that we discuss above. Another is how best to generalize from the detailed analysis of a variety of war scenarios to determine U.S. preferences among alternative future force balances.

3.11 SUMMARY OF SUITABILITY OF CURRENT ANALYSIS TOOLS FOR COMPETITION PLANNING

Analysis tools for competition planning should contribute to the following sequence of analyses, which is described in greater detail in chapter 2.1 (see especially Figure 4):

- 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 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.

Of the analytic tools surveyed in this chapter, four appear to have the greatest potential to support this analysis process: military balance assessments, Soviet-style planning analyses, competition planning games, and military contingency analysis. Table 2 summarizes the primary and secondary contributions of these four tools to the competition planning analysis functions identified in chapter 2 (see especially chapter 2.5.5 for discussion of these analysis functions).

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 analysis 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

Table 2. Contributions of major analysis tools to analysis functions of competition planning.

ANALYTIC FUNCTIONS	ANALYSIS TOOLS			
	MILITARY BALANCE ASSESSMENTS	SOVIET-STYLE PLANNING ANALYSES	COMPETITION PLANNING GAMES	MILITARY CONTINGENCY ANALYSES
• IDENTIFY/EVALUATE CHANGES IN COMPETITIVE ENVIRONMENT	S	S	S	
• DIAGNOSE CURRENT STATE OF COMPETITION	P	S	S	S
• DETERMINE SOVIET GOALS & STRATEGIES	S	P	S	
• DETERMINE THIRD PLAYER GOALS & STRATEGIES			S	
• DETERMINE IMPACT OF U.S. ACTIONS ON SOVIET WEAPONS ACQUISITION & DOCTRINE		P		
• SET GOALS FOR THE MILITARY COMPETITION	S		P	P
• IDENTIFY LIKELY SOVIET & THIRD PLAYER MOVES/COUNTERMOVES		P		
• EVALUATE ALTERNATIVE STRATEGIES FOR THE MILITARY COMPETITION			P	P
• EVALUATE PORTFOLIO MANAGEMENT ALTERNATIVES			P	P

P = PRIMARY CONTRIBUTION
S = SECONDARY CONTRIBUTION

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.

We have not identified analysis tools that can provide the primary capability to carry out every analysis function shown in Table 2. While the four major tools can make secondary contributions to identifying and evaluating changes in the competitive environment and determining third player goals and strategies, research is needed to improve support for these functions.

Other tools discussed in this chapter can contribute to these two functions, as well as to the other analytic functions listed in Table 2, as follows:

- 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.
- 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 can also contribute to an 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 more traditional DoD planning systems that is embodied in layer 4 of the competition planning approach described in chapter 1.

Tools used to support strategic planning in commercial firms provide important analogies upon which to model military competition planning concepts and methods, although the details need considerable reworking to apply to military competition planning. The primary business planning concepts that we have drawn upon for this report include the following:

- The need to understand the strategic environment within which competition is taking place (what we have termed the competitive environment).
- 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.

Many of the applications of analysis tools summarized in the foregoing bulletized paragraphs should be part of the intellectual background of literate, sophisticated analysts and long-range national security planners. In our judgment, specially commissioned analyses using these "lesser tools" of competition planning should be the exception rather than the rule. The essence of competition planning analysis is evaluation of the current military balance, projection of a range of plausible future military balances likely to result from a given set of U.S. goals and strategies, and evaluation of the resulting possible states of the balance in terms of war outcomes in a variety of scenarios. For this reason, we recommend that analysis to support DoD competition planning be centered on four primary tools: military balance assessments, Soviet-style planning analyses, competition planning games, and military contingency analysis.

It is conceivable that clever individuals will find additional competition planning applications for some of the other analysis tools surveyed in this chapter. Based on our survey, however, the Department of Defense should not invest substantial resources to adapt these lesser tools to competition planning. The greatest marginal returns for competition planning are most likely to come from investments to adapt and improve the four primary analytic tools for competition planning identified above. These tools and their needed improvements are discussed in more detail in the next four chapters.

ENDNOTES TO CHAPTER 3

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4. MILITARY BALANCE ASSESSMENTS

Military balance assessments analyze trends and asymmetries in opposing force postures in a subarea of the competition, focusing particularly on the implications of these trends and asymmetries for war outcomes in various scenarios. As such, they can play a major analytic role in competition planning by helping to evaluate current and potential future states of the military competition. The analysis of military force balances also can contribute to understanding trends in the competitive environment and to other analytic functions in competition planning.

This section examines the role that military balance assessments can play in competition planning, expanding on the brief survey found in chapter 3.7 by addressing the following points:

- Description of what constitutes a military balance assessment.
- Specific ways that military balance assessments can support competition planning.
- Shortfalls in current balance assessment capabilities to support competition planning, and research needed to overcome these shortfalls.

4.1 WHAT CONSTITUTES A MILITARY BALANCE ASSESSMENT?

Net assessments of military force balances have been carried out in various forms since the end of World War II. Largely consisting of numerical force comparisons through the 1960s, the process of net assessment became more sophisticated in the 1970s with the establishment of a net assessment directorate in the Office of the Secretary of Defense. More recently, the

Joint Staff and congressional staffs also have been preparing net assessments.

Net assessment is an evolving intellectual discipline, and analytic techniques for net assessment vary widely. The more useful net assessments seek to go beyond order-of-battle comparisons to include qualitative characteristics of weapon systems, defensive as well as offensive forces, doctrine and concepts for force employment, and the effects of less tangible but nevertheless important factors such as training, readiness, command and control, the organization of forces, and the coalition aspects of warfare. The concept of analyzing trends and asymmetries in opposing forces, force capabilities, and combat effectiveness has emerged over time as a distinctive characteristic of net assessments.

The most useful net assessments for competition planning purposes consist of four essential elements: analysis of trends and asymmetries, use of war scenarios, a strong focus on combat engagements and war outcomes, and the development of implications of the assessments for the Department of Defense. To carry out a military balance assessment, one must array and analyze past, current, and projected future trends and asymmetries in opposing force capabilities that most importantly affect war outcomes. The analysis should consider an adequate range of war scenarios involving varying assumptions about whether all allies on the two sides fight, what the war aims of each side are, how each side might employ its available forces, and the amount of force mobilization and readiness increases on each side before major engagements take place. Modeling and analysis in these scenarios should be directed particularly at understanding the likely course and pace of campaigns in the war, the likely war outcomes, and what forces, force posture characteristics, or other factors most strongly determine war outcomes. Finally, a net assessment should

synthesize these analyses and develop implications for the peacetime U.S.-Soviet military competition, for deterrence, and for the U.S. ability to resolve crises peacefully, to influence regional wars in which it is not directly involved, and to defend its own and allied interests in wars with the USSR or other adversaries.

This brief characterization makes clear that a net assessment can be a complicated undertaking. For this reason, rather than trying to assess the worldwide U.S.-Soviet military balance, net assessments are made of balances in subareas of the competition such as intercontinental nuclear forces, Europe, East Asia, or outer space. OSD (Net Assessment) also makes assessments of the U.S.-Soviet maritime and power projection balances. These assessments serve as diagnostic tools for DoD leaders, to highlight problems or opportunities that should be addressed by DoD weapon system acquisition planning, by JCS operational planning, or by U.S. diplomatic or arms control actions. Given this focus for current net assessments, it is an obvious step to extend this analytic discipline to include support for competition planning, especially to help diagnose the state of the U.S.-Soviet military competition in various subareas.

Two kinds of analysis are central to the conduct of military balance assessments: the analysis of force posture trends and asymmetries and the analysis of combat engagements.

The proper arraying of past, present, and projected future data related to the force postures of the opposing sides in a military balance assessment will highlight important trends and asymmetries within and between the two sides. Analysis of these force posture trends and asymmetries can then lead to development of trends in war outcomes and in the relative contributions of air, ground, and naval forces to the balance. But a number of issues

arise in carrying out comparative assessments of force trends, notably what specific trends and asymmetries to array and analyze, how to draw general conclusions from what could be a large number of specific trends and asymmetries, and how to avoid excessive dependence on scenario details in a comparative assessment of trends and asymmetries.

The concept of critical engagements is key to resolving these issues. Critical engagements are those opposing force engagements in various war scenarios that most powerfully affect the course, pace, and outcomes of the these wars. Examination of the critical engagements for a set of war scenarios will indicate which specific trends and asymmetries strongly affect war outcomes and which should therefore be analyzed. The translation of force posture trends and asymmetries into trends in critical engagements (e.g., by using campaign models) provides a way to derive general conclusions from a set of particular trends and asymmetries. And the use of a set of critical engagements derived from a range of war scenarios provides a means to buffer the analysis of trends and asymmetries from the fine details of the scenarios.

While the analysis of trends and asymmetries is necessary for a net assessment, it is not sufficient. The opposing forces must be played against each other in war scenarios in order to consider adequately the effects of such factors as doctrine, training, defenses, and readiness. Hence, combat analyses are also essential for net assessments.

The concept of critical engagements in war scenarios also provides the key to organizing combat analyses in a military balance assessment. Since it is in the critical engagements -- the opposing force interactions that determine war outcomes -- that combat capabilities are put to the most stressing tests, combat analyses that support net assessments should be structured first

to identify which engagements are critical, then to carry out sensitivity analyses to help understand the relative contributions made by various types of opposing forces to war outcomes through the critical engagements.

To put these concepts into a more structured context and to provide a more detailed appreciation for how one carries out a net assessment, the following paragraphs describe a series of general steps that should be executed when performing a military balance assessment. Figure 8 depicts these steps; each step is numbered or lettered in both the figure and the narrative, to enable easy correlation between the two.

1. Develop a set of war scenarios and select one to be used in the analysis.

2. Determine the critical engagements for each scenario, using the following substeps:

- A. Describe the war aims of each major belligerent in the scenario.
- B. Develop a campaign plan for each side by first examining the strategic choices each side must make for employing its available forces over time in various geographic areas during the campaign in order to achieve its war aims. Then, based on an analysis of strategic choices and on information about actual or probable war plans, develop the campaign plans.
- C. Determine the initial war conditions on D day that have important bearing on the campaign outcomes, especially the degree of mobilization and readiness of each side, the location of each side's forces on D day, and the alignment and degree of participation in the war of peacetime allies and key third parties.
- D. Play the forces of each side in the scenario, using the campaign plans developed above and starting from the initial war conditions on D day. Theater-level campaign models or other contingency analysis tools have an important role in this step. Essentially,

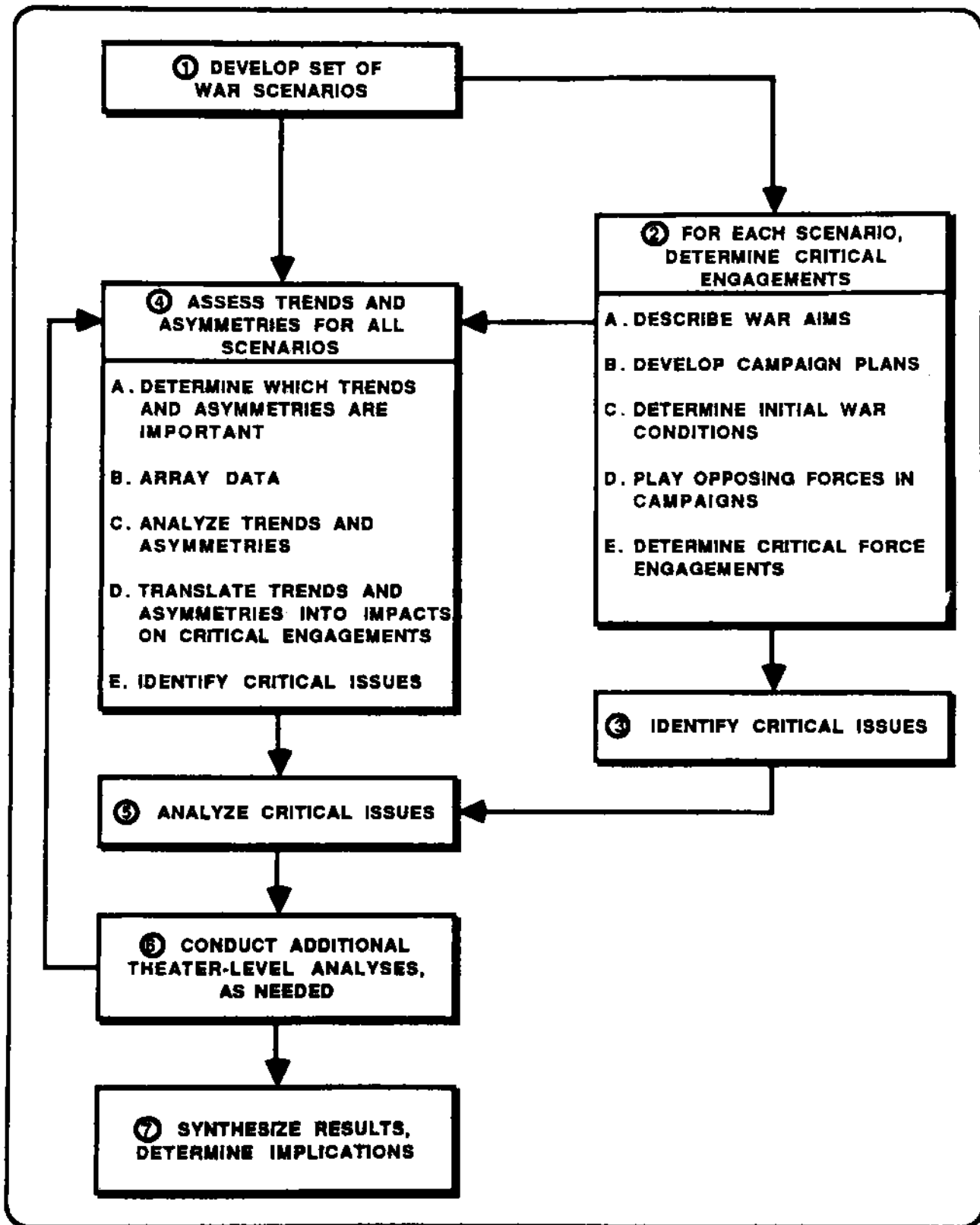


Figure 8. The concept of critical engagements has an important role in net assessment.

these models allow the analyst to examine opposing force interactions in the campaign and to conduct sensitivity analyses in order to accomplish the next step, which is to determine which force interactions or engagements most strongly affect the outcome of the war.

- E. Determine the set of critical engagements for the scenario, in terms of the impact on war outcomes. To illustrate this concept, examples of critical engagements in the East Asian/Pacific part of a global war scenario might be the air battle over Northeast Asia, the U.S. ASW campaign, and the Soviet counter-CI campaign. Criteria for criticality of engagements will need to be developed for the specific war aims of each side in each scenario, but generally force engagements will be deemed critical if they strongly affect the postwar balance of forces, the control of escalation, the territory held by each side at the end of the war, and postwar political alignments. Sensitivity analyses using combat analyses will be important for determining which engagements are critical, essentially by deleting certain engagements from a campaign and determining whether there is a significant change in the war outcome.

3. In the course of determining the critical engagements, a number of critical issues will be identified, associated, for example, with uncertainties arising out of steps 2A-2E. These issues should be compiled into a list for more detailed analysis in step 5.

4. The next step is to assess trends and asymmetries across the entire set of scenarios being used for the analysis. This step uses the scenarios developed in step 1 and the critical engagements identified in step 2; analyzes the associated past, present, and future force posture trends and asymmetries; and translates the force posture trends and asymmetries into trends in the critical engagements as a means of generalizing from the detailed trends and asymmetries. This analysis involves the following substeps:

- A. Determine which trends and asymmetries in forces, support, and C³I have major effects on the pace and results of each critical engagement. These are the force posture trends and asymmetries that are important across the set of scenarios. Which trends and asymmetries are important often will be obvious, but combat analyses may be needed in some cases.
- B. Array the data that are relevant to the important force posture trends and asymmetries identified in step 4.A.
- C. Analyze these data in order to understand the factors responsible for the force posture trends and asymmetries and to determine what the military implications are.
- D. Based on step 4.C, translate the force posture trends and asymmetries into trends in the critical engagements. For example, it will be important to understand the impact of the force posture trends on which engagements are critical as a function of historical time; on how the likely results of these engagements change as a function of historical time; on each side's operational concepts for force employment; and on how war outcomes vary over historical time in each scenario.
- E. Identify additional critical issues and associated uncertainties based on the assessment of trends and asymmetries. Combine these with the critical issues identified in step 3, as an input to the next step.

5. Analyze in greater detail the critical issues that define combat capabilities which emerge from the above analysis of critical engagements and trends and asymmetries. Weapon-on-weapon and tactical combat analyses will be important tools for this step.

6. Conduct additional theater-level analyses for past, present, or future forces, as appropriate.

7. Synthesize all of this analysis into an assessment of comparative warfighting capabilities and the contributions of ground, air, and naval combat power to the military balance.

Finally, determine the implications for the peacetime military competition, deterrence of attacks, reassurance of allies, crisis resolution capabilities, and war outcomes.

The net assessment steps outlined above may seem too complex or time-consuming for many problems, but these steps can be applied with varying level of detail for net assessment purposes or as a contribution to the diagnosis of the state of the U.S.-Soviet military competition in one or more subareas. The required level of detail depends on whether the assessment is an in-depth diagnosis or a brief update of past analyses. The foregoing steps can be used as a checklist to guide expert judgment, as a context into which a discrete analysis of some aspect of the balance can be set, or as a guide to a detailed set of balance analyses.

4.2 ROLE OF MILITARY BALANCE ASSESSMENTS IN COMPETITION PLANNING

The foregoing summary of what constitutes a net assessment indicates that balance assessments serve three purposes that are important for competition planning:

- Balance assessments 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 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 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.

Thus, military balance assessments are a natural analytic tool for diagnosing the current state of the U.S.-Soviet military competition.

We discuss the concept of the state of the competition in volume I, concluding that this concept has a central role in competition planning because, in order to formulate competition strategies, U.S. planners must know what the current state of the competition is, what the United States likes and does not like about the current state, and toward which future state or states it should try to move the competition. In chapter 2, therefore, we indicated that describing and diagnosing the current state of the competition is an essential part of the analytic support to competition planning.

This diagnosis should be applied to the three dimensions of the state of the military competition described in volume I: the U.S.-Soviet military balance, the competitive positions of the two sides, and the condition of more traditional U.S. political-military objectives such as deterrence, reassurance of allies, and the ability to resolve crises peacefully.

The importance of net assessments for diagnosing the first dimension of the state of the military competition -- the military balance in a given subarea of the competition -- is obvious. But net assessments can contribute to diagnoses of the second and third dimensions as well. The process of assessing a military balance will aid in understanding in detail the competitive advantages held by each side, the sources of these advantages, the ease or difficulty with which they might be overcome, and the extent to which one side or the other holds various forms of competitive initiative, all elements of the competitive positions of the two sides. Moreover, the final step

in the net assessment approach outlined above is to determine the implications of the military balance analyses for the traditional U.S. political-military planning concerns such as deterrence, reassurance, and crisis resolution capabilities. In this way, military balance assessments also can contribute to diagnosing the third dimension of the state of the competition.

Therefore, we recommend that military balance assessments be the primary analytic tool for diagnosing the current state of the U.S.-Soviet military competition. Specifically, net assessments for diagnostic purposes should be carried out periodically in each of the regional subareas of the competition; net technical assessments for major mission areas should be carried out periodically to diagnose the state of the competition in the technology subarea. Assessments perhaps every four years would be in order, or whenever a major review of U.S. competition goals is warranted. Such assessments are being carried out now as a part of the normal OSD and JCS planning activities, so their application to competition planning should not impose a major increase in the analytic workload. In order to support competition planning, however, current assessments should be more directly focused on evaluating the state of the competition, particularly with more attention to the second and third dimensions of the state.

Military balance assessments also have the potential to evaluate alternative future state of the competition, as an aid to setting U.S. competition goals. Given the uncertainties associated with projecting states of the competition a decade or more into the future and the amount of work required to carry out a full-blown balance assessment, we recommend that the evaluation of alternative future states of the competition be limited to the combat analysis portion of a balance assessment, focusing on critical force engagements. Combat analyses, or contingency analyses, involving the opposing forces likely to result from a sequence of U.S. and

Soviet moves and countermoves associated with a candidate set of U.S. competition goals and strategies can be a major analytic means for determining U.S. preferences for goals and strategies, as discussed in chapter 7. Nevertheless, net assessments of the current state of the U.S.-Soviet military competition can help to set U.S. competition goals by showing what aspects of the current balance the United States should try to maintain or enhance, and what aspects it should try to change in some fundamental way.

Moreover, the net assessment process also can contribute to determining Soviet competition goals and strategies, in support of U.S. planning. This contribution would naturally fall out of the analysis of trends and asymmetries and of Soviet strategic choices in various war scenarios that are part of a net assessment. Each side must make strategic choices about where and when to employ its available forces in order to achieve its war aims in a given scenario. These choices are constrained by the size and characteristics of that side's forces, the capabilities of the opposing forces, and perhaps by third player military capabilities, and should be examined in a net assessment. Such analyses of trends in Soviet strategic choices and of the problems or opportunities the Soviets currently face in making strategic choices about force employment in various scenarios can contribute to understanding what goals and strategies the Soviets may be pursuing in the peacetime competition.

Finally, military balance assessments can contribute to identifying changes in the competitive environment and determining their implications for the nature of the ongoing military competition. Examination of trends in critical engagements and war outcomes, the broader analysis of trends and asymmetries in military balances, the consideration of new types of war scenarios, and sensitivity analyses, particularly as they relate to allies and third players, as well as to political, economic, demographic, and

technological trends in the United States and the Soviet Union -- all of these net assessment analyses can aid in understanding how the competitive environment may be changing.

4.3 RESEARCH TOPICS

Military balance assessments are a natural and important analytic tool for diagnosing the state of the U.S.-Soviet military competition, but they are not perfectly suited for this application. A number of improvements are needed before balance assessments can fully realize their potential for analytic support to competition planning. Research approaches to these problems are discussed below, but none of these improvements is needed in order for military balance assessments to contribute immediately to competition planning. Net assessment is one of the more mature analytic tools for competition planning.

As indicated in chapter 3.7, improvements are needed in five areas:

- 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 balances.
- Techniques for improving military balance assessments.
- Ways to determine Soviet and third player views of military balances.

Probably the most important area for improvement is the extension of existing military balance assessments, since current assessments do not cover all key areas related to the U.S.-Soviet long-term military competition. Two types of extensions are

needed: to additional subareas of the competition and to a richer set of scenarios in existing balance assessments.

Several subareas of the U.S.-Soviet competition are not adequately covered by military balance assessments, making it difficult to diagnose accurately the state of the competition in these areas: outer space; the subarea of technology; and the low intensity conflict dimension of several competition subareas. Outer space currently is an active area of U.S.-Soviet military competition that is likely to grow in importance even if the U.S.-Soviet competition in Europe and in intercontinental forces diminishes. Military technology clearly will continue to be a key area of U.S.-Soviet competition, one in which the Soviet Union is seeking to make major gains through perestroika and acquisition of Western technology over the next two decades or more, while also trying to restrain selected U.S. applications of advanced technology through arms control. Low intensity conflict is emerging as an important area of military competition, partly because it is a means through which the USSR has tried and may continue to try to attack U.S. interests in the Third World and partly because it is a way in which third players increasingly may compete with the United States.

None of these subareas currently is addressed adequately by military balance assessments. The technology balance in various mission areas is addressed superficially in DoD reports and posture statements, but has not recently been subjected to the kind of in-depth net technical assessments that the Department of Defense carried out in the 1970s. This practice needs to be restored, both to support competition planning and to meet more immediate needs in OSD (Acquisition).

Within subareas of the competition that are covered in some depth by existing net assessments, military balance analyses

need to be extended to include a greater diversity of scenarios in order adequately to address trends in the competitive environment. Specifically, more work needs to be done in assessing the U.S.-Soviet balance of forces in "lesser wars" -- scenarios that are quite different from the canonical DoD planning scenarios of a large intercontinental nuclear exchange and a large conventional war in Central Europe. Some of these lesser wars should include limited Soviet attacks on U.S. interests in various areas around the Soviet periphery; others should include confrontations or wars with third players in which the United States or Soviet Union may or may not be directly involved, but which are influenced by or influence the U.S.-Soviet balance of forces.

Many of these extensions are straightforward, requiring only the commitment of resources to develop the necessary scenarios, data bases, and analyses. For example, additional resources are the primary key to enriching the scenarios examined by existing net assessments and will contribute to extending military balance assessments to new areas. But the latter also needs research to improve analytic techniques. Specifically, conceptual developments are needed as follows:

- For assessments of the military balance in outer space, ways must be found to relate military operations in space to the terrestrial air, ground, and naval campaigns that would be supported by space operations. Almost no development work has been done on such analytic techniques.
- For net technical assessments of the technology balance in various mission areas, analytic ways should be devised to assess potential U.S. or Soviet applications of advanced technologies in combat analyses.
- For assessments of the low intensity conflict dimension of military balances, ways must be developed to relate the political and economic aspects of low intensity conflict to the military aspect.

Accordingly, we make two recommendations about extending existing net assessments in order to improve support for competition planning. First, the Department of Defense should initiate pilot studies focused on improving the analytic techniques for assessing the military balance in outer space, on developing contingency-based net technical assessments of the technology balance in various mission areas, and on assessing the low intensity conflict dimension of military balances in appropriate regions. These pilot studies should also be designed to stimulate increased DoD interest in extending military balance assessments to these areas, particularly for the purpose of diagnosing the state of the U.S.-Soviet military competition.

Second, we recommend that the Department of Defense devote resources to developing scenarios, data bases, and analyses related to lesser war scenarios in areas covered by existing net assessments.

A second priority for improving the capabilities of military balance assessments to support competition planning is to develop explicit methods for using net assessment concepts and techniques to evaluate the competitive positions of the United States and the Soviet Union. Diagnosis of the current state of the U.S.-Soviet military competition requires, *inter alia*, an evaluation of the relative competitive positions of the two sides -- the extent to which each side has translated inherent strengths and weaknesses into actual advantages for pursuing the peacetime military competition. Understanding how well each side is currently postured to compete in various subareas is essential in order to formulate sound U.S. goals and strategies, both to exploit U.S. strengths and Soviet weaknesses and to determine if investments should be made to improve the U.S. ability to compete in particular subareas.

Being uniquely associated with competition planning, the notion of competitive position is new for the Department of Defense and therefore relatively undefined. We have suggested three indicators or measures to help evaluate the relative competitive positions of the sides: competitive advantage, competitive leverage, and competitive initiative.² More work is, however, needed on measures of competitive positions and work needs to be initiated on analytic methods to evaluate relative competitive positions.

With regard to the latter, we already have observed that the process of carrying out a net assessment of a military force balance will yield insights into the relative ease or difficulty with which either side can shift the balance in preferred directions. It seems reasonable, therefore, to suggest further that research be carried out to determine whether the concepts and methods of net assessments can provide tools for direct application to the evaluation of competitive positions. More work is needed to define in greater detail the concept of competitive position in the U.S.-Soviet military competition and to develop measures or indicators of the relative positions of the two sides. Beyond this, however, we also recommend that the concepts embodied in net assessment methodologies be examined for applicability to evaluating competitive positions. Specifically, we recommend exploring the following concepts:

- Development of analytic techniques to identify the major political, economic, technological, demographic, organizational, and military factors that affect the competitive positions of each side. Since a good competitive position is one that easily allows one side to achieve a desired future state of the military balance, it should be possible to translate advantages and disadvantages in the current military balance into an evaluation of competitive positions.

- The use of trends and asymmetries in key factors in the competitive positions of each side as an evaluation tool.

A third research area is the development of ways to summarize succinctly a military balance assessment, for use in brief descriptions of the state of the U.S.-Soviet military competition. While not the most pressing problem in competition planning, the ability to describe succinctly the current state of the competition or alternative future states would facilitate communication and debate about competition goals and strategies and perhaps improve the U.S. ability to select goals and strategies. The analogy is with mathematical notation, which provides a kind of shorthand for science, engineering, and operations research that both simplifies discussion and improves the research in these fields. While one cannot hope to reduce the complexities of the military competition to mathematical equations and while brief descriptors should not substitute for in-depth assessments, having an accepted and brief way of describing what is really important about the current or specific future states of the competition may be able to provide similar benefits. Since the military balance is one essential component of the state of the competition and since, as discussed above, military balance assessments contribute importantly to diagnosing the other components of the state of the competition, it may be that solving the problem of succinctly describing a military balance assessment will solve the larger problem of brief competition state descriptors.

Military balance assessments are complex and an effort to describe such assessments briefly runs the danger of oversimplification. Moreover, even summary descriptors of balances must reflect the many uncertainties associated with translating force posture trends into likely war outcomes. Nevertheless, the human mind and human language require generalizations as a way station to research progress and communication. And one

instinctively feels that the essence of a military balance can be captured in less than several hundred pages, even in less than several tens of pages.

We recommend research along four lines, the first of which is brief narrative descriptions. Recent annual reports by the secretary of defense contain summaries of regional balance assessments that vary from one to four pages; the 1988 edition of Soviet Military Power contains summary balance assessments of slightly greater length.³ The second approach to succinct balance descriptors is to use graphical displays of a few key trends, as is done in the 1988 edition of Soviet Military Power. A third approach is tabular in nature: to list the major military advantages and disadvantages (or strengths and weaknesses) each side has in the balance. The fourth approach would draw upon the strategic choice diagrams and war diagrams that Science Applications International Corporation developed as analysis tools in carrying out a net assessment of the East Asian/Pacific military balance, adapting these to summarizing the results of balance assessments.⁴ A strategic choice diagram is a decision tree that displays the major choices that a country must make in allocating its available forces in space and time to various missions so as to achieve its war aims in a given scenario. A war diagram is a PERT network that represents the key combat activities that take place as the forces of the two sides engage one another in a given war scenario.

Turning now to the fourth research area, the strong focus on war outcomes that we recommend for military balance assessments in support of competition planning results in the need to improve net assessment techniques along these lines. Research on the following topics would prove useful for competition planning, as well as for the general art of net assessment:

- Improved ways to relate trends and asymmetries in military force postures to war outcomes in a variety of scenarios.
- Improved ways to determine the most important factors in a complex military balance.
- Efficient and rapid means for exploring a large number of widely varying war scenarios in conducting balance assessments.
- Improved ways to synthesize the results of a large number of combat analyses and trends and asymmetries into a single coherent assessment.

As discussed in above, we recommend that the concept of critical engagements be used to make progress on all of the above problems. While this concept appears promising and has proven useful in work related to the above problems, more research is needed to develop detailed ways to apply the critical engagement concept and to explore other potential approaches to these problems. For example, the concept of a contingency analysis test bed discussed in chapter 7 appears promising for improving the speed and efficiency of combat analyses in a wide range of scenarios.

The final research area we address relative to military balance assessments is improved ways to determine Soviet and third player views of military balances and to integrate these views into coherent assessments and diagnoses of the state of the competition. This problem has two related parts. The first is improving the U.S. understanding of how Soviet planners assess military balances and diagnose the state of the competition, with particular emphasis on assessment techniques or views that differ significantly from those of U.S. planners. Such understanding would improve U.S. insights into Soviet competition goals and strategies by showing what problems or opportunities they see in current military balances. Progress is being made on this score, largely through

research sponsored by OSD (Net Assessment). Chapter 5 addresses this topic further.

Second, understanding how third players like China, Japan, or West Germany view military balances and diagnose the state of the U.S.-Soviet competition will become more important for U.S. competition planning. While such nations have not institutionalized net assessment analyses or their functional equivalent, they do have views about the condition of military balances. Unfortunately, almost no systematic work has been done in this area.

ENDNOTES TO CHAPTER 4

1. For a discussion of problems in evaluating the technology balance with combat analyses and an approach to solving these problems, see J. Grange and J. J. Martin, Net Technical Assessment Methodology, Final report prepared for the Office of Strategic Planning, OSD (Acquisition) (San Diego, Calif.: Science Applications International Corporation, March 10, 1989).
2. See chapter 3.3.3 in volume I.
3. Frank C. Carlucci, Secretary of Defense, Annual Report to the Congress: Fiscal Year 1990 (Washington: U.S. Department of Defense, January 17, 1989), pp. 13-31; Soviet Military Power: An Assessment of the Threat, 1988 (Washington: U.S. Department of Defense, April 1988), pp. 96-139.
4. The Asia-Pacific Nuclear Balance (U), draft technical report, (San Diego, Calif.: Science Applications International Corporation, June 1, 1988), Appendix B, SECRET-RD-NF-WN.

5. SOVIET-STYLE PLANNING ANALYSIS

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. Soviet-style analysis can support U.S. competition planning in a number of areas:

- Help to determine Soviet competition goals and strategies.
- Aid in assessment of the likely impact of U.S. competition goals, strategies, and actions on Soviet weapon acquisition and operational concepts for force employment.
- Help to project 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.

This section examines approaches and issues associated with using Soviet-style analysis to support U.S. competition planning, addressing the following topics:

- How the need for understanding Soviet competitive behavior has increased over time.
- Detailed discussion of the roles for Soviet-style analysis in U.S. competition planning.
- A description of five categories of U.S. expertise for Soviet-style analysis.
- Evaluation of current U.S. capabilities in these five categories.
- Recommendations for institutionalizing a Soviet-style analysis capability to support U.S. competition planning, as well as to provide other kinds of support to the Department of Defense.

5.1 RETROSPECTIVE ON THE MILITARY COMPETITION

The objective of improving the effectiveness of the United States in the long-term military competition with the Soviet Union naturally requires a good understanding of the nature of the competition and of the behavior of the principal competitor with the United States. In the initial phases of the military competition, which began in the aftermath of World War II, the differences in the strengths and in the specific competitive objectives of the two sides were sufficiently pronounced that it was possible to compete without having a fundamental understanding of Soviet competitive behavior. In the late 1950s and most of the 1960s the United States pursued a course aimed at developing military forces and policies that could deter any military actions the Soviets might initiate in support of their aggressive political objectives. The United States was in a position of military superiority and had sufficient resources to apply powerful leverage over the much weaker Soviet Union. Even Soviet bluff and conservative U.S. overestimates of Soviet military force developments did not cast much doubt on the ability of the United States to prevail in the military competition with the Soviet Union. Though a more detailed understanding of the actual situation within the Soviet Union might have allowed the United States to compete more efficiently, such information probably would not have materially affected overall U.S. priorities or strategy.

By the late 1960s, however, it was becoming apparent that the Soviet Union, albeit much weaker economically than the United States, could be a formidable rival to the United States in those specific military areas where it chose to excel. By the end of the 1970s, it had become clear to many in the U.S. national security establishment that the Soviet Union had established a military force structure and supporting military-industrial infrastructure that could match (or -- potentially -- exceed) the capabilities of

the United States in most major areas of the military competition. In fact, many feared that the United States had allowed the Soviet Union to develop some areas of distinct competitive advantage over the United States while this country was preoccupied with the war in Vietnam.

In the 1980s the United States began to redress some of the deficiencies in its operational capabilities and to modernize forces and upgrade operational planning to make them more suited for the threats that were emerging in the Soviet Union and the Warsaw Pact countries. At the same time, both superpowers apparently recognized that the competition for military power was becoming increasingly demanding as the sophistication of modern military forces grew. As a result, the competition in the development and modernization of military forces was seen as an important dimension of military capability by both sides. Increasingly, the focus of military planning in both the United States and the USSR has been on the peacetime development of military forces as much as on planning for the possible future employment of these forces. Both sides are now seeking to direct the competition in force development into areas that allow them to exploit their competitive advantages and to use their available resources to maintain a strong position relative to the other side.

As a result, the military competition between the United States and the USSR has become increasingly sophisticated. The management of this competition requires ever more complex interactions with economic policy, manpower utilization, diplomacy, foreign policy, and arms control. In order to direct the competition toward those areas in which the United States may hold advantages, it is now necessary to have a much more profound understanding of the strengths, weaknesses, and preferences of the USSR than has been needed in the past.

There are a number of different sources of information that can be used to understand Soviet strategy for the military competition, including intelligence on their military forces, synthesis of their comments on plans and directions in military force development, and assessment of the capacities of their military-industrial facilities. In order, however, to assess longer-range Soviet options or to understand why the Soviets have set their priorities as they have, it appears necessary to have the capability to do Soviet-style analysis: to emulate the process through which Soviet planners evaluate alternative courses of action, make decisions, and implement plans. It is only through such an approach that it is possible to anticipate changes in Soviet behavior or to understand the effect on Soviet plans and actions that might result from a U.S. decision or action. Though the traditional products of the intelligence community do an adequate job of describing the Soviet Union, Soviet-style analysis is needed to explain it (i.e., to understand the "why" as well as the "what").

5.2 ROLES FOR SOVIET-STYLE ANALYSIS IN U.S. COMPETITION PLANNING

5.2.1 Identifying Competition Areas Accorded High Priority by the USSR

The strong centralized control that is wielded by the leadership of the Soviet Union has resulted in a distribution of competences that seems paradoxical to the West: in some areas (e.g., traditional military technologies) the USSR is extremely capable, in others (e.g., electronics and information processing) they cannot compete with any of the industrialized nations. In general, the strengths of the USSR are a matter of Soviet choice. They consistently achieve impressive results in areas that are accorded high priority by the leadership, usually through dedicated, long-term programs that build a solid and redundant infrastructure. Though such programs often result in a substantial

competitive advantage for the Soviet Union, they come at a high cost -- the Soviets find it difficult to achieve any competence at all in the many areas to which they cannot accord high priority. This same phenomenon also can be observed in Soviet performance in international athletic competition, where their investment in infrastructure in selected areas makes them almost unbeatable. Thus, to a much greater extent than is true of the United States, the Soviet ability to compete in a specific area is almost entirely a function of the deliberate choices of the leadership. Of course, while the centralized planning system facilitates this "spotlighting" of selected areas of competition by the Soviet leadership, the gross inefficiencies of this system and the constraints on Soviet resources limit the number of areas that can receive priority treatment.

As a result, the very act of identifying Soviet weaknesses or U.S. strengths requires some ability to anticipate future Soviet priorities or, perhaps more practically, anticipate conditions that might cause the Soviets to change priorities in ways that could cause major shifts in their strengths relative to those of the United States. Thus, U.S. strategy for competition over the long term must consider the effects of possible shifts in Soviet priorities and anticipate ways that the Soviets could accommodate or try to eliminate pressures from U.S. competition actions.

Accordingly, the fundamental role for Soviet-style analysis in U.S. competition planning is to determine areas where the Soviets have elected to compete and, for understanding of future Soviet priorities, the criteria with which they evaluate the competition. In general, the Soviets will be strongest in those areas where they have made a deliberate decision to develop their strengths. Further, as a part of this analysis, it should be possible to identify areas in which the Soviets probably could be

strong competitors if they elected to shift their emphasis. Finally, for those areas in which the Soviets have failed to build the requisite infrastructure to be able to compete effectively, it should be possible to estimate the length of time that would be needed by the Soviets to develop competitive capabilities if they decided to rectify a previous weakness and to identify areas of the competition in which they might cut back in order to shift resources to these new areas. The purpose of this type of assessment is to describe the bounds on the durability of an apparent Soviet weakness or a U.S. strength.

5.2.2 Understanding Soviet Perceptions of U.S. Actions and Options.

The second major role for Soviet-style analysis of the long-term military competition is development of an understanding of the Soviet perception of U.S. actions and options. Because the Soviets assess U.S. actions and options in terms of the effects these could have on the Soviet Union, especially in circumstances that are unfavorable to the Soviet Union, they often perceive the potential consequences of these actions and options quite differently than does the United States.

The openness of the U.S. decision process is both a help and a hindrance to the Soviets in attempting to develop an estimate of the future conditions under which they might need to exercise military power. They are assisted by the U.S. process in that it is relatively easy to identify many (though not all) of the competition areas in which the United States is investing effort and resources. The fluidity of the U.S. R&D establishment and, indeed, of the U.S. economy in general makes it more difficult, however, for the Soviets to predict confidently future U.S. strengths or areas of emphasis. It is also difficult for the Soviets to predict which of the wealth of potential U.S. options

will be realized or the time scale on which they might be developed.

In addition to the differences in perception of potential capability that come from the inherent uncertainties that the Soviets must contend with as they attempt to predict the outcomes of the U.S. decision process, there also are differences in perception that arise from asymmetries in U.S. and Soviet views of the potential effects of a given U.S. action or capability. Thus, the Soviets may have to be concerned about the potential effects of a new U.S. system on a much broader spectrum of their own missions or assets than the United States could count on being able to threaten directly. For example, although the United States may know that its mission planning capabilities for long-range cruise missiles preclude their use against mobile targets, the Soviets apparently believe that these systems could be upgraded to allow retargeting of the missile in flight. In fact, the Soviets routinely discuss U.S. cruise missile systems as though an in-flight course correction from a satellite is well within current capabilities.

Finally, some U.S. capabilities are perceived differently by the USSR simply because the Soviets have selected different metrics for the evaluation of these capabilities than has the United States. For example, the relationship between the amount of time required to execute a combat action and the time that would probably be available for actual execution of that action is a basic Soviet measure of effectiveness for many different types of combat actions (e.g., the response time of the Soviet air defense system compared to the detection warning time). While the United States also is sensitive to such relationships, analysis of the "correspondence between required and available time" is probably more routinely a part of assessments in the USSR than in the United States. Thus, the Soviets will be sensitive to any U.S. system or

action that could have the effect of either increasing the Soviet response time or decreasing the warning time they receive. This sensitivity may cause the Soviets to perceive the effects of a U.S. action quite differently than the United States perceives them, even if there is no difference in perceptions of the specific characteristics of the system or action. As an example, the Soviet concern about the Pershing II missile and the resulting leverage that the decision to deploy this system afforded the United States in arms control negotiations probably exceeded by a significant measure the mission performance potential that the system provided to the United States.

The same types of asymmetries in perceptions apply perhaps even more strongly to R&D activities. Even with complete and accurate information, the Soviet view of the outcome of a long-term U.S. R&D program or of a shift in U.S. strategy may be quite different than the U.S. intention. These basic differences in perception may have a significant impact on Soviet strategies for the competition and on their views of the appropriate responses to U.S. actions. For example, although SDI research on new types of weaponry (e.g., hyperkinetic weapons and directed energy weapons) is seen by the United States as part of a program to develop the capabilities needed to defend against Soviet ballistic missiles, the Soviets appear to see U.S. success in these research programs as affecting general purpose force balances as well.

5.2.3 Anticipating Soviet Responses to U.S. Actions or Strategies

Understanding the Soviet view of U.S. actions can do much to provide a basis for anticipating Soviet responses, since their responses will be conditioned strongly by their view of the nature of the problems that their responses are intended to solve. An understanding of the structure of Soviet decision making also can

be useful in filtering a range of postulated Soviet responses for consistency with normal Soviet practice.

In order to anticipate the results of current or future Soviet response decisions, it is necessary to have some understanding of (1) the organizational responsibilities of the various Soviet decisionmaking entities, (2) the process through which they operate, and (3) the criteria or analytic procedures that are used to evaluate alternative options. Because the Soviet military makes its decisions through a highly structured, centralized decision process, there apparently is a greater degree of regularity in the Soviet process than is the case with the U.S. process. Although it is not possible to predict the specific outcomes of Soviet decisions with any degree of confidence, the steps they would take and the types of considerations they would address in the course of their analysis can probably be anticipated with some confidence. Because of the centralized nature of Soviet military planning, the Soviet decision-making hierarchy is defined in substantial detail, as are the procedures that are to be followed in making the decisions. Since the Soviet planning process does not provide many incentives for innovation, the most likely Soviet actions are those that are mandated by official charter. The fact that responses which require substantial resource commitments must be incorporated into the structure of the five-year economic plans adds a degree of continuity and predictability in the timing of Soviet decisions that makes assessing the likelihood of various Soviet responses feasible. None of this appears likely to change under the kind of economic and political restructuring introduced by Gorbachev to date.

Experience has shown that, although an understanding of the Soviet decision process cannot allow one to predict Soviet actions, it can be of significant value in understanding the amount of effort that would be required for the Soviets to implement

various responses. For example, those responses that might be routinely implemented through the normal decision process and that require only resources that are normally available for the specific functions in question should be considered likely. Alternatively, those responses that would require a radical departure from normal Soviet practice are less likely or might require significantly longer to implement; if implemented, Soviet planning practices are likely to provide early-warning indicators of these new types of responses.

5.3 CATEGORIES OF U.S. EXPERTISE FOR SOVIET-STYLE ANALYSIS

Current U.S. capabilities for Soviet-style analysis do not provide a large set of individuals or organizations with adequate training and resources to fulfill all of the requirements for Soviet-style analysis. In order to perform all of the requisite functions a substantial number of people are needed, each prepared to emulate a specific class of Soviet planners (e.g., planners for each of the Soviet military services, for the various general staff functions, for the Soviet military educational organizations, for the military-industrial ministries, and for the scientific research organizations and design bureaus that support the military). Because the development of such a knowledge base has not been given priority by the U.S. government or academic institutions, there is not a large pool of talent for performing Soviet-style analysis.

In fact, there currently is no U.S. capability that will allow high-fidelity Soviet-style analysis. Arguably, such a capability would require much closer access to the actual Soviet planning system than has been possible. Although some former Soviet citizens now resident in the West may have a degree of knowledge about the decision hierarchies and planning methods in some Soviet military organizations, their currency and the

suitability of their backgrounds are highly variable. Since Soviet-style analyses must be performed without benefit of all the resources that should ideally be applied to the task, one element of the definition of the methodology is the determination of the appropriate approximations to Soviet analysis needed for various aspects of U.S. competition planning.

Individuals who can perform Soviet-style analysis fall into several categories. In terms of the fidelity of their representation of Soviet behavior, these individuals can be characterized as being at one of five levels. The principal discriminators among the levels are the depth of understanding of the Soviet decision structure (including the specific decision-making responsibilities of various organizations and the methods that are used to substantiate the decision) and the depth of the "feel" for the Soviet rationale for these Soviet decision structures. The five levels are:

- Level 1: Being Soviet 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.

The requirements for being at each level, the types of analyses that people at each level are qualified to carry out, and the resources needed to support each level are discussed in the following paragraphs.

5.3.1 Level 1

The use of former Soviet citizens (defectors and emigres) clearly can achieve a much closer facsimile of the basic Soviet values and cultural influences than can any methodology that employs individuals who have lived only in a Western society. There are, however, a number of difficulties with using former Soviet citizens to perform Soviet-style analysis. Perhaps the most significant is finding former Soviet citizens in the West who have the required backgrounds to help with the specific problem under analysis. Though there are a large number of former Soviet citizens in the West, relatively few of them have had a substantial role in important Soviet military decisions. Further, those individuals who qualify by this criterion may not have sufficiently recent experience to be able to portray accurately the contemporary Soviet perspectives. Thus, although Soviet citizens may best be able to reflect the influence of Soviet culture on their decisions, those who are in the West may not have adequate backgrounds to understand the technical dimensions of the specific problems to be addressed.

A second difficulty associated with the use of former Soviet citizens to capture Soviet perspectives is that the individuals who are in the West and who could support DoD competition planning may have a different value structure than those Soviet citizens who have not decided to leave their country. Most emigres and possibly some defectors spent an extended period of time in a condition of less than full participation in Soviet life before they finally departed the USSR.

As a result, the use of former Soviet citizens often is plagued with inconsistencies and a pronounced lack of objective criteria for resolving the sources of the inconsistencies. It has

long been a problem that different defectors or emigres will provide different answers to the same questions. Absent other information, there is no basis for selecting the most nearly typical "Soviet" answer.

Additionally, the use of former Soviet citizens to support U.S. competition planning raises difficulties associated with security and could provide an avenue for the Soviets to attempt to influence U.S. actions and perceptions. For sensitive issues on which a Soviet perspective is needed, it may be difficult make a determination that a staff of former Soviet citizens should be provided with sufficient information for them to function effectively. There may be a large number of competition planning questions that require access to information that the U.S. government would be extremely reluctant to make available to former Soviet citizens.

A final difficulty with the use of former Soviet citizens is the lack of U.S. personnel with appropriate backgrounds to be able to communicate with former Soviet citizens. Both official English and official Russian, especially in the areas of technical military terms, are languages that are fully comprehended by only a small portion of the populations of the two nations. Thus, even former Soviet citizens with a good grasp of the English language may require extended instruction to be able to understand specific competition planning questions that would be asked of them. Even if they grasp the questions accurately, they may not be able to state the answers in terms that make their meaning and implications clear to the American users of this particular form of Soviet-style analysis.

For example, there are many instances in the record of U.S.-Soviet arms control negotiations where very specific statements by one of the sides were perceived by the other side as

vague generalizations because the technical meanings of the terms in the original language were not the same as in the translations. As a result, the process of using former Soviet citizens to support competition planning should include at least a small number of individuals (U.S. citizens or former Soviet citizens) who have a good understanding of the military terminology of both nations.

5.3.2 Level 2

The use of U.S. citizens who are well-schooled in the Soviet military decision process and who have a good understanding of the reasons why the Soviets do things the way they do is probably the best of the available alternatives for U.S. Soviet-style analysis. In order to have a faithful capability for Soviet-style analysis, however, it is necessary to obtain the services of individuals who have a deep understanding of the Soviet Union, both culturally and procedurally. To attain this level of competence, analysts need to:

- Understand the Russian language, in part because the sources of information that provide a basis for understanding the Soviet planning process are mostly in Russian, but also because translations can only approximate the actual Soviet discussions of procedures and issues.
- Be familiar with the proclivities that are deeply rooted in the Russian culture and, to the extent that the cultural traditions of the other republics may make a difference, those proclivities as well (though the military decision process is probably more strongly influenced by the Russian traditions than those of the other republics in the USSR).
- Understand the bureaucratic imperatives that derive from the philosophy of centralized economic planning.
- Have a thorough knowledge of Soviet military forces and the decision hierarchy through which these forces are developed and commanded.

- Understand the specific organizational responsibilities and procedures (including planning methods and algorithms) that comprise the Soviet military decision-making process.

In practice, there are few, if any, individuals who have broad knowledge of all these dimensions across the spectrum of Soviet military planning. There are, however, some individuals who have substantial expertise in specific areas of Soviet planning or who have the competence to emulate some classes of Soviet planners.

It seems to be a consensus of the most experienced Western analysts of Soviet military planning problems that at least five years of professional experience and an intense personal interest in understanding the Soviet Union are required in order to have enough competence to provide a consistent portrayal of likely Soviet behavior. Even with this level of expertise, most individuals have a strong basis for understanding and anticipating the behavior of only certain classes of Soviet decision makers.

Individuals with this level of skills usually are competent to identify and explain consistencies in Soviet behavior, including the reasons that Soviet preferences might differ from those of the West. They often have enough breadth of background to provide some ability also to recognize conditions that might lead to changes in Soviet behavior in the long-term military competition.

5.3.3 Level 3

The distinction between level 2 and level 3 is the degree of experience and the breadth of the knowledge base of the individual. Though a minimum of five years of dedicated professional experience appears necessary to achieve the competence required by level 2, a more limited knowledge of Soviet practices

and a rudimentary feel for the origins of their different behavior can be achieved by an individual with an intense personal interest in about three years. Since a normal tour of duty for military officers and many government civilians is two to four years, level 3 competence can be achieved in a single tour without an exceptional level of commitment on the part of the individual beyond a strong personal interest in attaining level 3 competence.

This level of expertise usually is focused on specific classes of Soviet decisions or decision makers or on specific Soviet attributes. Individuals at this level usually are able to describe Soviet behavior in an area such as naval forces, although they may not be able to provide a full explanation of the basis for Soviet behavior. Because their understanding of the Soviet perspective is incomplete, they generally will not have a great deal of skill in anticipating potential changes in Soviet behavior.

5.3.4 Level 4

There are many people who have some experience in reading Soviet military writings or observing Soviet behavior. Many of these analysts have observed Soviet forces or actions simply in order to catalog the actions that can be observed or in order to understand the extent to which Soviet forces or actions could interfere in some way with U.S. forces or objectives. Often such analyses do not address the Soviet rationale for their actions and do not require that the forces and the threat be viewed from a Soviet perspective. For example, many analysts in the intelligence community have a detailed understanding of the technologies embodied in Soviet weapon systems and of the physical performance capabilities of the systems, but have little understanding of the Soviet perspective on the military requirements for these systems. In general, these individuals have not made a personal commitment to the development of an understanding of the Soviet Union and may

not have an abiding interest in aspects of the national fabric of the USSR other than those elements that have been assigned to them as analysts.

Individuals at this level may have a good capability to describe Soviet actions, but they often attribute these actions to motives that would be more logical for U.S. decision makers (that is, they do mirror-image analysis). They generally are competent to produce consistent estimates of Soviet actions and force status in areas where there is an adequate amount of explicit evidence, especially if these areas are not changing very rapidly. In these areas, they also probably are able to identify possible changes, but have little basis for anticipating or explaining the changes. They usually have a weak understanding of the influence that is imposed on Soviet actions by the structure of the system in which Soviet planners operate.

5.3.5 Level 5

The lowest level of technical knowledge about the Soviet Union is possessed by those individuals who are involved in planning some aspect of U.S. national security policy, forces, or operations and who recognize that an understanding of the Soviet Union is essential to the correct performance of their own function. In general, these individuals do not have a detailed background in Soviet studies and do not have the time or the knowledge to do a substantial amount of personal research. They often, however, have a driving need to understand why the Soviets behave as they do, and may be especially intrigued by the apparent asymmetries they see between Soviet and Western actions.

These individuals have a good understanding of the implications for the United States of alternative Soviet courses of action, probably substantially better than individuals at any

of the other levels, but have little basis for assessing the likelihood that the Soviets will choose a specific alternative.

5.4 CURRENT CAPABILITIES FOR SOVIET-STYLE ANALYSIS

Current capabilities for Soviet-style analysis are embodied principally in those individuals who have elected to make Soviet-style analysis their careers (i.e., those who are at level 2 and, to some extent, those at level 3). There is no institutional system for inducing individuals to make this choice and the rewards for it are variable. There also is no standard process through which one can become a Soviet-style analyst. Even those with graduate degrees in Soviet studies actually have studied political science, international relations, or Soviet history (from a Western perspective), with emphasis on the effects that policies and actions of the Soviet Union have on the West. For example, a typical Soviet specialist will have formal training in Western international relations theory, with emphasis on the application of the theory to U.S.-Soviet relations, but with no knowledge of international relations theory as it exists in the Soviet Union other than that acquired as a matter of personal interest.

As a result, there is a small number of individuals (on the order of a few dozen, perhaps) in the United States who are at level 2 in terms of their ability to emulate and anticipate Soviet military decisions. The knowledge of many of these experts is eclectic and idiosyncratic, with no institutionalized mechanism for filling in gaps or resolving differences. Thus, the current state of the art in Soviet-style analysis rests far more heavily than it should on pitting "our Soviet expert" against "their Soviet expert." The fact that there are no clear career paths for those with an intense personal interest in studying and understanding Soviet perspectives and planning methods probably fosters idiosyncrasies in this particular discipline, since a career in

Soviet-style analysis is attractive only to those who are willing to sacrifice the security of a more conventional career in order to be afforded the freedom to pursue their personal scholarly interests.

Individuals at level 2 are, however, the key to adequate Soviet-style analysis in support of competition planning. It is only at this level that the depth of understanding of both the U.S. issues (which the level 1 former Soviet citizens generally lack) and the Soviet imperatives (which people at levels 4 and 5, and to some extent those at level 3, lack) is sufficient to enable assessment of the possibilities for change.

There are more people at other levels than at level 2. The number of former Soviet citizens is potentially quite large, although the number that is currently involved in Soviet-style analysis of military problems probably is about as large as the number of people at level 2. There are, however, not many who have served at high levels in the Soviet military planning process, especially with recent experience. There probably are on the order of a hundred analysts at level 3 and a few thousand at level 4. The number at level 5 is difficult to estimate, but could be quite large, since anyone who thinks seriously about the impact of Soviet decisions on U.S. options could be at this level. Recent trends in U.S. strategy have created an environment in which more analysts are asking such questions.

The current practice in Soviet-style analysis generally relies on the use of a variety of sources of information, mostly from the level 5 analysts, to generate a set of hypotheses with respect to future Soviet behavior in the competition. These hypotheses often are influenced by judgments about the effects that various Soviet options would have on the United States. These hypotheses then are submitted to Soviet specialists, especially

those at level 2, but also individuals at the other levels, for their evaluation of the plausibility of the specific assumed Soviet decisions. The evaluation of the hypotheses is supported by individual research, using the resources that are available to that individual since there are no standard and widely accessible data bases to support Soviet-style analysis.

Current capabilities for training cadres to perform Soviet-style analysis are weak. Some of the requisite skills are routinely taught in universities, but most are acquired only through individual effort, mostly by on-the-job training. The following tabulation indicates the U.S. state of the art in training for the various attributes required to be a level 2 analyst:

- Russian language: Many good curricula are available, though none focuses specifically on military terminology. While they do not concentrate on military terminology, the Defense Language Institute and the U.S. Army's Russian Institute generally are very effective in equipping individuals with basic Russian language skills.
- Soviet culture: This receives fairly good coverage in the Russian language programs, though there is little emphasis on specific cultural influences on military decision making.
- Soviet military forces: Military intelligence training generally covers the characteristics of weapon systems adequately, but coverage of military organizations and support functions is weaker.
- Soviet military science: Existing education and training courses provide poor coverage.
- Soviet military organizations and decision making: Training is limited to a few short courses, taught irregularly.
- Soviet military planning methods: Training is limited to a few short courses, taught irregularly.

In addition to the issues associated with doing good Soviet-style analysis, there also are issues related to communication of the results. Those individuals who have developed the deepest understanding of the Soviet Union tend to think in Soviet constructs and to adopt a Soviet perspective on military planning issues. As a result, they become almost as difficult for Westerners to understand as the Soviets themselves, albeit more accessible. The crux of the problem is one of language and therefore of the structure of thinking that is implied by the use of a specific language to describe the elements of a planning framework. U.S. specialists on Soviet military planning have developed a special form of the English language for use in describing Soviet constructs and concepts. This version of English, though it uses words that are seen in normal English usage, often assigns connotations to the words that are unknown outside the Soviet studies community (e.g., the phrase correlation of forces is not defined by any English dictionary entries for correlation). In order to communicate effectively without discourse entirely in Russian, Soviet specialists have adopted translation conventions, but these are not universally accepted and often are debated. While the use of such conventions is necessary for the specialists to communicate among themselves, the result has been the creation of a new English-language jargon that is used in Soviet-style analysis, with terms that often are interpreted incorrectly by the users of Soviet-style analysis. The fact that the English terms themselves are understood differently by different communities contributes to this problem. Because the level 5 analysts usually understand both the Soviet-style analysis terminology and the military terms of the users of Soviet-style analysis, their participation in Soviet-style analyses is important for development of a usable study.

The most productive applications of Soviet-style analysis for competition planning at the present time probably should

involve level 5 analysts who (1) think carefully about the aspects of Soviet behavior that are important in the context of a specific U.S. planning issue, (2) generate a set of hypotheses about Soviet actions, (3) work with a level 2 analyst to understand the circumstances that could lead to the hypothesized actions and to evaluate their likelihood (usually generating additional hypotheses in the process), and (4) translate the findings from the Soviet-style analysis into terms that are intelligible to the U.S. personnel involved in decisions about U.S. competition goals, strategies, and actions.

5.5 REQUIREMENTS FOR INSTITUTIONALIZING SOVIET-STYLE ANALYSIS

In order to move from an individualized capability for Soviet-style military analysis to an institutionalized one, there are three principal requirements:

- A larger number of individuals need to be at level 2.
- More efficient use of the level 2 individuals is needed.
- Greater skill in hypothesis generation and in working with level 2 people is needed at level 5.

The next few paragraphs provide some recommendations for fulfilling these requirements.

5.5.1 Creating More Level 2 Experts

Satisfying the requirement for more experts at level 2 is simple conceptually, but difficult bureaucratically. There is a substantial number of individuals who are interested in learning more about the Soviet Union. There are, however, few opportunities for them to devote the requisite time to this endeavor without substantial personal sacrifice. Creating programs that provide

incentives and awards for individuals to spend five years out of their professional careers in gaining the necessary knowledge base is, therefore, the most important step to take.

The five years can be more productively spent if educational programs and research resources are provided that allow each individual to build upon the knowledge of others in the profession. Thus, some form of training or improved use of research tools may make it possible to achieve the necessary level of expertise without the need for trainees or apprentices to duplicate completely the work that has been done by others in the past. Experience suggests that higher quality experiences during the five year apprenticeship can substantially enrich the ultimate capability of level 2 analysts, but it does not appear to have much effect in shortening the period of time needed for the development of level 2 skills.

While a substantial number of individuals might make the effort needed to develop level 2 competence if there were a practical way for them to devote the necessary time and they saw enhanced career prospects as the reward, the resulting cadre of experts would not necessarily have the full spectrum of skills and interests that are needed for competition planning. Thus, some mechanism for inspiring interest in individuals with widely-varying backgrounds should be developed. There is a need for Soviet-style analysts with formal education in engineering, in mathematics and computer science, in operations research, in economics, in psychology, in pedagogy, and in military art, as well as a need for the political scientists and historians who are the more traditional Soviet specialists.

Finally, it probably is not possible to build a team of Soviet experts simply by cataloging skills and appointing individuals to Soviet-style analysis billets. A certain kind of

personal style seems to be required, as well as proper training. People who do Soviet-style analysis must be able to recognize and study asymmetries in national perspective without judging the correctness of the various perspectives. Not everyone has the ability to comprehend and explain differences without feeling compelled to determine which perspective is right. A strongly multidisciplinary educational background is the only indicator of this skill that has proven to be at all reliable thus far. Individuals who have degrees in both social and physical sciences, for example, appear to have interests in the unbiased study of phenomena from different perspectives.

5.5.2 Using Level 2 Individuals More Efficiently

Current practices probably do not make the most efficient use of the limited number of level 2 experts that are available. Since it is only at this level that changes in Soviet competitive behavior are likely to be anticipated or the rationale for asymmetries explained, the small number of people with this level of expertise needs to be leveraged as much as possible. Current practices make this hard to do, since most level 2 individuals operate independently and are supported only with the research resources that they have amassed through their own individual efforts. The normal operating mode is to ask each individual to estimate the Soviet actions in a particular situation. In developing an answer to the question, each analyst must develop an estimate of the Soviet view of the situation, describe the Soviet perspective on the problems implied by the situation, formulate a set of candidate Soviet responses, and do a Soviet-style analysis of the options. Each of these steps can require a substantial amount of effort in order to look at the problem thoroughly, especially if the problem differs significantly from other problems the individual has examined.

Several steps could be taken to improve the utilization of level 2 expertise. First, common-access data bases could be developed that make relevant information more readily available to all Soviet-style analysts. This would enable analysts to make better use of the research that has been done by others. For example, data bases that describe the Soviet view of the threats they face from the military forces of other nations are first-order information in any Soviet-style analysis. Development of such data bases can be done by people with lesser skill levels, though the interpretation of the information and the development of the organizational structure of the data bases probably requires a good understanding of Soviet planning structures. Other data bases that could be valuable are (1) Soviet views of their military requirements, (2) Soviet views of their own forces (the Soviets are beginning to make such information available publicly), (3) Soviet arms control positions (even the positions that were not deemed worthy of response by the United States could provide valuable insights into the directions that Soviet force development might be taking), (4) Soviet developmental programs, (5) timelines of Soviet decisions leading to existing forces, and (6) the history, roles, and personnel of Soviet military organizations, especially the organizations associated with military force development, weapon system acquisition, and the higher-level military academies.

Most of this information is already available, but only in anecdotal form. Development and maintenance of a set of data bases would be a significant effort, but it could be done by staff with a spectrum of skill levels. In the steady state, there would probably be a requirement for a one-to-four person level of effort to maintain each data base. This data base development effort would also be a useful research task to aid in the development of a larger number of experts at level 2.

Second, the structures of Soviet models, algorithms, and decision aids are well known in some areas, but few have been implemented in the West in forms that allow rigorous Soviet-style quantitative analysis. Development of a rudimentary library of basic Soviet-style models could provide for more systematic examination of Soviet options. These models would necessarily be simple because the level of detail in the data bases that would support use of the models is limited.

Third, the time of level 2 individuals probably can be used better if people with lesser levels of expertise could do some of the preliminary thinking and hypothesis generation. For example, it is much easier to answer the question "How difficult would it be for the Soviets to adapt their scheme of echelonment in response to a U.S. conventional strike system with a range of 150km?" than it is to answer the question "How would the Soviets respond to a U.S. deep-strike system?" The use of individuals at all levels of expertise, but predominantly those at levels 1 and 5, to generate a set of hypotheses may make it possible to get level 2 insight into a much larger number of problems. Of course, the clear disadvantage is that the level 2 experts may not have the opportunity to think about additional hypotheses that might not be raised by any other source.

Finally, providing mechanisms for level 2 experts to share their research findings among themselves could add greater depth to the profession and reduce the diversity of individual opinion. There are few forums that allow direct interchange of information among these Soviet specialists except for unclassified academic conferences, many of which are not suited for addressing military competition planning issues.

5.5.3 Increasing the Skills at Level 5

Because Soviet-style analysis is most useful if it is embedded within the U.S. planning process rather than executed as an off-line adjunct, providing some basic training in Soviet perspectives and some simple tools for Soviet-style analysis to personnel in the U.S. competition planning process could allow them to perform a rough kind of Soviet-style analysis, at least to the extent of allowing them to take a more sophisticated approach to the generation of hypotheses about Soviet moves and countermoves.

Two elements are essential in order to allow "if-I-were-Soviet" analyses to be done in ways that are not strictly mirror-images of U.S. perspectives. First, training is needed to demonstrate that there are good reasons why Soviet moves and countermoves might differ from those the United States might make in similar circumstances. This can be accomplished rather simply, even though an understanding of the implications of the differences may not be so easily acquired. For example, the Soviet Operational Art course in the curriculum at the U.S. Army Command and General Staff College has produced a generation of army officers who have a grasp (though not a fundamental understanding) of some of the differences between U.S. and Soviet command and control. Many of these officers are adept at anticipating issues the Soviets will be sensitive to, even though these officers are not necessarily able to emulate the process the Soviets would use to resolve the issues. That is, they seem to be good at figuring out the questions the Soviets would ask, even if they cannot always determine the answers the Soviets would arrive at.

Second, preliminary experience suggests that there is merit in the development of simple reference tools that would allow competition planners to understand what Soviet behavior is normal and what is not. For problems in which little change in Soviet

behavior is likely, it is possible to develop checklists that can be used as a first-order filter on Soviet move or countermove options. This approach has been used with some success for analysis of Soviet arms control positions, of Soviet views of U.S. military technologies, and of Soviet responses to the Strategic Defense Initiative. For broader areas or for questions whose answers may require explanation, it may be necessary to develop handbooks or cross-references to intelligence documents in order to support the development of useful hypotheses.

Initial work in the use of such reference data bases on microcomputers for Soviet-style analysis appears to be promising. The principal caveats associated with such reference tools are (1) the range of applicability of the Soviet-style behavior rule must be specified, and (2) the rules must be updated periodically (probably under the guidance of level 2 analysts) to reflect changes in Soviet perspectives or Soviet practices. These tools should be designed to support the generation of hypotheses for further study by Soviet-style experts rather than to support more extensive Soviet-style analysis by those who are not experts in this art. The first generation of such tools is currently being developed to support U.S. Army decisions on nuclear force development and for use by Red teams in wargames. While the development is costly, it appears that recent generations of microcomputer software will accommodate this type of application fairly easily.

6. COMPETITION PLANNING GAMES

This chapter expands on chapter 3.9 by discussing in greater detail the roles of planning games, or path games, in U.S. planning for the military competition. It also describes improvements needed for gaming to realize its full potential for competition planning support and outlines approaches to making these improvements. During our research, we examined improvements in two specific areas associated with using path games for competition planning: moving players more realistically into future game situations and reducing the dollar and manpower costs of games. This chapter describes the results of our research.

As we use the term in this report, a competition planning game is a path game focused on the future course of the peacetime military competition in one or more subareas. Players would normally be organized into teams representing the United States, the Soviet Union, and appropriate third player nations, in order to reflect the adversarial and cooperative relationships in the military competition. While the primary purpose of a competition planning game is to evaluate a candidate set of U.S. competition goals and strategies, the other teams also would be given sets of goals (and strategies, unless one of the tasks for the Soviet and third player teams was to develop strategies to implement their goals). The teams would then play out a series of moves and countermoves over future time as they sought to achieve their goals and implement their strategies. The time period simulated in the game may itself be a product of the path game, although it would seem that these games should extend over two decades or more to be useful for competition planning.

The essential purpose of the game is to simulate the decision-making processes of the critical countries and the impact of these decisions on the state of the military competition over

an extended time, in order to help evaluate alternative U.S. goals and strategies. As such, not only should a competition planning game simulate the decision processes of teams with interests that are not totally aligned with one another, but it should also replicate important features of the expected future competitive environment, utilize the control team to steer team interactions in ways that help to evaluate the U.S. goals and strategies under examination, and provide a means for recording the relevant analytic outputs of the game.

6.1 ROLES FOR COMPETITION PLANNING GAMES

The competition planning function of the kind of move/countermove game described above is best understood by recapitulating the analytic paradigm into which gaming would fit. As depicted in Figure 6 above, this paradigm starts with a diagnosis of the current state of the U.S.-Soviet military competition, using military balance assessments as a key tool for analysis. Alternative U.S. goals and strategies are then formulated for improving the current state of the competition. Each alternative is evaluated by projecting the future state of the competition likely to result if the United States pursued this particular set of competition goals and strategies; move/countermove games and Soviet-style analyses are key tools for carrying out these projections. The future states likely to result from each candidate set of U.S. goals and strategies are then evaluated, with emphasis on how well the United States could protect its interests in future wars, given the military balance associated with each of the projected states of the competition; contingency analyses are the main tool at this stage of the analysis. The analytic process is iterated, rejecting some sets of goals and strategies and refining others, until a single preferred set of U.S. competition goals and strategies is arrived at.

As can be seen, path games or -- in this context -- competition planning games have a natural and important role in evaluating candidate U.S. goals and strategies by translating each candidate into the future state of the competition likely to result when Soviet and third player moves are considered.

Even if there were no opposition to U.S. goals and strategies, projecting the future state likely to result from them is complex and uncertain because of budget, technological, bureaucratic, and political uncertainties associated with future U.S. military programs. When the competitive initiatives and responses of a powerful adversary like the Soviet Union are considered, as it seeks to undercut U.S. initiatives and make competitive gains through its own initiatives, the state of the military competition likely to result if the United States pursues a given set of goals and strategies over a period of ten to twenty years or more is even more difficult to project. As suggested by the schematic in Figure 7 above, the resulting state of the competition could be quite different from the future state U.S. planners would hope to achieve. Moreover, the likely future state almost surely would be less preferred by the United States than the desired state, since presumably the future state that is the Soviet goal is less preferred by the United States than is the U.S. goal, and the actual future state will fall somewhere between the two in terms of U.S. preferences.

Thus, there is a significant risk that U.S. and Soviet moves and countermoves over an extended period will result in unintended consequences for the United States that it might prefer to avoid by pursuing a different set of competition goals and strategies. Accordingly, it is important that the evaluation of alternative goals and strategies include a projection of the end state likely to result over a period of two decades or more and the

states through which the competition is likely to pass as it moves toward the end state, to permit assessment of these resulting states for each alternative.

While important, making these projections is not easy. Gaming is not a predictor of the future, but it is more likely to reveal a plausible range of resulting future states, including unintended and undesirable consequences, than are other analytic tools such as logic, expert judgment, forecasting, and other techniques that do not involve gaming. This is because the adversarial relationship between game teams in a realistic simulation of the competitive environment is more likely to reveal the consequences of U.S. and Soviet competitive interactions than are other analysis tools. Specifically, the U.S. team in a competition planning game should pursue the set of goals and strategies under evaluation, while the Soviet team pursues its own goals and strategies, which would be partly -- but not entirely -- influenced by the U.S. set of goals and strategies. Soviet-style analysis should be used both off-line from the competition planning games and in direct support of these games, to help determine the goals, strategies, and actions of the Soviet team, as described in chapter 5.

Games to translate goals and strategies into likely states of the competition should be carried out for each major subarea of the competition, with a few games devoted to examining the interaction of goals and strategies across the subareas. It would be best to play a series of games for each subarea, to explore alternative states that might result from a given set of U.S. goals and strategies because of variations in Soviet goals and strategies or other future uncertainties in the competitive environment. This application of gaming is analogous to the use of wargaming to evaluate candidate campaign concepts for operational commands or path gaming to explore the unintended

Consequences of major weapon system acquisition programs such as SDI. In this case, however, the focus would be on U.S. goals and strategies in the U.S.-Soviet long-term military competition.

In addition to providing a means for systematically taking Soviet moves and countermoves into account in the competition, another important role for planning games is to take the goals, strategies, and actions of key third player nations into account. Given the multipolar nature of the competitive environment, it is essential that competition planning games include one or more teams to reflect the moves of those U.S. or Soviet allies that could strongly influence the extent to which either superpower is able to achieve its competition goals, or third player competitors such as Iraq or China. In particular, competition planning games should be designed in part to test the sensitivity of alternative U.S. goals and strategies to third player moves, in order to eliminate those candidate goals and strategies that are unduly sensitive to disruption by third player actions or to revise them to reduce that sensitivity.

Competition planning games also can contribute to evaluation of the portfolio management elements in candidate U.S. strategies. This can be done by using both the game scenario and the actions of the control team to focus the players in part on the uncertainties associated with future moves and countermoves. In this way, the judgments of the players can be used to help evaluate how well the portfolio management techniques that are part of the strategy being considered can overcome unanticipated problems or seize new opportunities arising out of these future uncertainties. At least four kinds of uncertainties should be examined in these games:

- Uncertainties associated with U.S. weapon and C³I programs, such as technology problems, cost overruns, schedule slips, and political opposition in the Congress.

- The nature, timing, and intensity of Soviet responses to U.S. competitive actions.
- New competitive initiatives by the Soviet Union. As discussed in volume I, the uncertainties associated with Soviet initiatives are different from those associated with Soviet responses and are more difficult to hedge against, because they are not directly keyed to specific U.S. initiatives.
- Political, economic, or military actions by third players that affect the U.S. or Soviet abilities to achieve their competition goals.

The final major role for competition planning games is to determine how the U.S.-Soviet military balance in the subarea under scrutiny is likely to evolve under the influence of U.S., Soviet, and third player moves and countermove. Game play should be organized to provide a sense of the plausible range of military balance states likely to result from a given set of U.S. goals and strategies, as an input to the contingency analyses that are discussed in chapter 7. A related output from competition planning games should be a plausible set of contingencies that the United States could face during the future period covered by the game play, as the competitive environment changes over time. This set of contingencies also would be an input to the contingency analyses.

Games also can make lesser contributions to competition planning. Move/countermove games designed to evaluate candidate U.S. goals and strategies also can test the plausibility of Soviet and third player goals, strategies, and actions that are postulated based on other analysis techniques. These same games can help validate or refine diagnoses of the current state of the military competition. A natural by-product of move/countermove games should be a better understanding of how the current military balance and competitive positions of the two sides limit or enhance their

efforts to achieve their competition goals, thus adding insights to diagnoses of the current state developed using military balance assessment techniques. Finally, path games also can be used to help determine the long-term implications of changes in the competitive environment by playing out various peacetime competition scenarios in the changed environment.

6.2 EXAMPLE OF A COMPETITION PLANNING GAME

To illustrate the foregoing roles for competition planning games, we outline a series of games that might be played to evaluate U.S. goals and strategies for the European subarea of the military competition. This outline necessarily is brief, since the specifics of the game structure would depend on more detailed development of candidate U.S. strategies than we undertake here, but this description should suffice for illustrative purposes.

Assume that the United States has three major (not necessarily fully consistent) goals in the military competition in Europe:

- To reduce substantially the confidence of Soviet leaders that they could win a conventional war.
- To reduce, if not eliminate, Soviet short-warning attack capabilities.
- To reduce U.S. defense budgets by withdrawing a considerable number of U.S. forces from Europe, and converting these forces from active to reserve units.

Further assume that two alternative strategies are under consideration by U.S. competition planners. Both strategies would seek to negotiate asymmetric force reductions in Europe, with special attention to withdrawing both U.S. and Soviet forces and to sharply reducing the Soviet ability to mount effective short-

warning attacks in Europe. Further, both strategies depend strongly on deep attack capabilities to deter future Soviet attacks in Europe or to defend against those attacks, especially until U.S. reserves could be mobilized and moved to Europe. The two strategies differ in the specific ways in which deep attack capabilities are to be implemented: one would use U.S. long-range bombers and conventional sea-launched cruise missiles (SLCMs) as the primary attack means, while the other would use tactical aircraft and tactical ballistic missiles deployed with West European forces and with those U.S. forces remaining in Europe after successful conclusion of Conventional Forces in Europe (CFE) negotiations.

The primary purpose of a series of competition planning games would be to evaluate these two strategies in a move/countermove context, especially to evaluate the ease with which each strategy could adapt to the emergence of one of several alternative Soviet futures, which might be broadly characterized as (1) perestroika succeeds and the Soviet military evolves toward a smaller, advanced technology force; (2) Gorbachev is unseated by a conservative backlash and the USSR reverts to being a militaristic state that is overtly hostile to the West; (3) the USSR is not able to make any fundamental improvement in its economy, and the country "muddles along" somewhat as it is today; and (4) separatism has reduced the Soviet state to its slavic or Great Russian core, with a strong military force and a xenophobic leadership. An equally important purpose of these games would be to evaluate the extent to which the success of each strategy depends on the support of a unified Germany. Lesser purposes include an evaluation of the U.S. competition goals outlined above, the projection of the military balance in Europe under the influence of moves and countermoves associated with each U.S. strategy, and the development of a set of contingencies in which the evolving military balance should be assessed.

A series of several two-to-three day competition planning games over several months might be organized along the following lines to achieve these purposes. The moves in each game would be separated by four or five years, would start in 1990, and would extend to 2010 or perhaps longer, depending on details of the game play. Each game would start from the current competitive environment, but each would follow different alternative futures after the first move, to encompass the alternative Soviet futures described in the previous paragraph, and perhaps two or more alternative futures for Germany.

Players would be organized into three teams for most games: a U.S. team, a Soviet team, and a European team. Individual players on the European team would be assigned at the minimum to play the roles of Germany, Britain, and France. For some games it may be useful to have a separate East European team or a separate German team to reflect more explicitly the independent views of these third players in the military competition. The Soviet team would be supported with both off-line and on-line Soviet-style analyses to help ensure that their moves and countermoves faithfully reflect Soviet planning and decision-making practices.

In each move, each team would allocate suitably constrained resources to deployed military forces, research and development, and weapons procurement. They would also plan political, diplomatic, and arms control actions. These moves would be directed toward accomplishing the goals of each team. In the case of the U.S. team, both the goals and the strategy would be provided to the team as part of the pregame instructions.

Soviet competition goals and at least the broad outlines of the Soviet competition strategy would be developed from intelligence materials and the use of Soviet-style analysis, and

provided to the Soviet team. The overall Soviet goal might be to maintain or enhance Soviet hegemony in Europe. In at least the early moves of the competition planning games outlined here, the Soviet strategy could be to achieve a breathing space in the competition, while seeking enhanced military superiority in Europe over the twenty years or more of game play through a combination of detente, arms control, upgrades in the Soviet technology base and production capabilities, and a general improvement in the state of the Soviet economy. The Soviet team would, however, be free to change this strategy in response to U.S. and European moves and as a function of the alternative Soviet future towards which the control team is moving the game.

Goals would be specified for the European team or for individual countries on this team and the European team would be expected to develop a strategy or strategies to pursue these goals. Generally, the European goals would involve some combination of improved relations with the USSR, preservation of European security interests, and reduced defense costs.

Between moves, the control team would update the state of the competition based on each team's plans, giving particular attention to updating the military balance in Europe and the competitive positions of the United States and the Soviet Union. The control team would also update the competitive environment, especially the political state of Europe and of U.S. and Soviet alliances; economic conditions in the United States, the Soviet Union, and Europe; and the status of military programs and deployed forces. All these updates would be provided to the teams as inputs for the next game move, although certain information about military programs may be withheld from some of the teams if they normally would not have access to this information.

The game moves naturally would focus on political-military conditions in Europe. Given, however, the importance of maritime operations and sea lines of communications in the U.S. strategy alternatives, game moves should also address naval forces. Similarly, since space-based C³I and surveillance systems could be important for NATO's deep attack capabilities and Soviet responses, military systems in space and the means whereby each side could degrade or destroy the other side's space systems would also be within the scope of the game moves.

Either the control team or a special analysis team would observe the game play and debrief players in order to derive analysis results from the series of games. This team would develop four specific analytic products:

- Evaluation and possibly refinement of the U.S. goals and the two candidate U.S. strategies described above.
- Evaluation and possibly refinement of the portfolio management techniques that would be part of a more detailed statement of each U.S. strategy or that might emerge from the game play.
- A trace of the range of European military balance states between 1990 and 2010 resulting from the series of games.
- Identification of military contingencies the United States might face in this series of games, as a function of the changing competitive environment.

6.3 RESEARCH TOPICS

Gaming is an important analytic tool for competition planning, and path game techniques are sufficiently well-developed to support competition planning today. In order, however, to realize the full potential of gaming as a competition planning

tool, research is needed on the following improvements in path gaming methods:

- Better ways to move players psychologically into the future conditions associated with game 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 discuss the nature of each of these research topics and why they are important, and outline some research approaches. In the case of the first two topics, moving players into the future and reducing the resources required for games, we summarize the results of preliminary SAIC research; for the other three issues, we briefly discuss candidate research approaches.

6.3.1 Moving Players into the Future

Move/countermove games for competition planning require that players emulate credibly the actions of U.S., Soviet, and third player strategists, planners, and decision makers ten to twenty years or more into the future. Experience with path games suggests that this is not easy. Game teams tend to act very much as they do in today's environment, even when the game play puts

these teams into competitive environments or game worlds that often are quite different from today's.

Thus, the problem addressed here is to develop methods to enable game players to understand and accept the political, social, cultural, economic, and military conditions of future worlds that may be generated by game play, so they can more credibly emulate the actions of their real-life counterparts in those future worlds.

Our research approach to this problem examined the methods used in other activities that required the psychological movement of people from their world today into a role in some other, quite different, world. Specifically, we examined five activities for methods that might be used in path games:

- Psychodrama and role theory.
- Rigid-rule board games like Monopoly or War in the Pacific.
- The game of Dungeons and Dragons, in which players assume new roles and personalities in fantasy situations.
- Training simulators and military field exercises, in which people perform in an environment that is physically simulated.
- Large-scale war games, such as the global war games at the Naval War College, in which players are moved into future conflict environments.

Methods from psychodrama and role theory provide cues to reinforce the player's feelings of being in a different environment, reinforcement among the players of specific features of the new environment, and sustaining of the sense of the new environment across breaks in the game play.

Several techniques can reinforce the player's sense of being in a different environment:

- Associate the movement of players into a future environment with a unique room that is a kind of time chamber by using this room for all briefings into new games moves and for the final debrief at the end of the game.
- Use a standard set of specific actions to mark the transition to a new environment in the future. For example, overnight breaks or lunch breaks might always precede a change in the period associated with a game move.
- Associate the movement to a new time period in the game with a standard set of physical devices, such as player badges for new game moves and a different color note paper in the game rooms for each move.

Similarly, a number of devices can be used to reinforce the specific nature of the competitive environment associated with new game move. For example, enhancing the realism of each player's role in the new environment can increase the realism of the environment itself. This can be done by providing players with game resumes that reflect each player's role, and updating these resumes for each game move with promotions, new jobs, publications, and the like. Players should be encouraged to be active in creating their new roles, adding to the readiness with which the player accepts the new role. Further, reinforcing each player's sense of his or her role during the first game move can improve the player's sense of realism associated with the environment of all games moves. Key individuals briefed into their roles before the game could, for example, then brief other team members into their game roles, acting as leaders who in some sense are already living in the game world. Similarly, specially briefed players on each team should consciously seek -- through their own role playing -- to draw the other players into their respective roles (role reciprocity).

Once players have gotten into the spirit of the environment of the game world, it is important to sustain their sense of the game world across breaks in game play. For example, players should be encouraged to stay in their roles during lunch breaks and in overnight breaks. They could do this by considering game issues from the perspectives of their individual roles and thinking about the game issues overnight.

Consideration of rigid-rule board games suggests two additional methods for moving path game players more realistically into future game worlds. The first, and perhaps most important, is to develop the path game analog to victory conditions in a rigid-rule war game in order to increase the interest and, therefore, sense of realism that the players have in the path game. Victory conditions can be established for path games even though they are peacetime planning games that do not result in wars. This can be done when designing the game by defining the major tensions between the teams that are to be simulated by game play and the goals of each team as they relate to these tensions. For example, if the primary tension is between the U.S. and Soviet teams, "victory" for one team could lie in preventing the other team from coercing it, in preventing armed conflict, or in achieving specific military advantages. On the other hand, if the primary tension in the game is to be between the U.S. and the European teams, "victory" could consist of maintaining alliance cohesion or domestic political consensus. The important thing is to define explicitly for the teams what constitutes victory and to have regular feedback to each team on their progress toward victory, both to stimulate and guide each team's play and to reinforce the sense that each team should have that it is a common entity, striving for common goals in these future game worlds.

A second technique derived from rigid-rule board games is to design path games so that the first game move takes place in the past. By initiating game play at a relevant historical point, players can perhaps more readily insert themselves psychologically into the game environment than if the game started in the future. Having established a feeling that the game is realistically imitating life, it will probably be easier to sustain the game-as-life feeling when the game moves into the future.

The popularity of the game Dungeons and Dragons stems in large measure from its ability to allow players full rein in using their imagination to create roles in a fantasy world that is radically different from ordinary life. Dungeons and Dragons offers several techniques that could be adapted to path gaming as means for more realistically moving players into future game environments:

- Let path game players assist in creating their game roles, in order to increase their sense of the realism of these roles and the associated environment. For example, players could be given some choices for the resumes of the roles they will play in the game and encouraged to expand on these choices to personalize further their game resumes.
- Provide prompt feedback to game players on the effects of their actions in the game in order to increase their sense of being real decision makers, to raise the emotional intensity of the game, and to draw them further into the game dynamics.
- Select players who have both gaming experience and strong interests in gaming in order to reduce the time and the psychological effort needed to move the players into the game world. At a minimum, each team should be led by one of these experienced, interested players.

Further lessons for path games can be gleaned from the area of training simulators and military field exercises. First,

the designers of a path game should determine which aspects of the competitive environment should be simulated in order to reinforce the player's sense that the game world is real. If the players actually have lived and worked in some version of the game environment, then the game should recreate appropriate parts of the environment so that it feels authentic to the players. If the players have not themselves lived in that environment, then the game need use only a rough approximation to the real-world setting.

Second, game play should be conducted so as to allow players to improve their ability to act out their game roles authentically, just as people in training simulators and field exercises learn by doing. For example, the control team should have a check list for monitoring team deliberations, so they can ensure that the teams address all the issues they are expected to cover. Further, the control team should have explicit criteria for judging the impact of team actions, as the basis for briefing player teams on the results of their actions.

Large-scale war games also provide some lessons for improving the realism of the competitive environments in path games. For example, the mix of players on each team can affect how well the team collectively moves into future game worlds. Examination of large-scale war games suggests it is important for this purpose to have a substantial number of players who have experience with the kind of game being played, perhaps as much as one-third who recently have played the same kind of game, one-third who have played in similar games, and no more than one-third who have no experience with path games.

Another lesson from large-scale war games is that the sense of a realistic game world can be lost if a team gets off track or is unable to make progress on the planning issues it is supposed to address. The design of a path game should provide

explicitly for control team intervention when needed in order to refocus the player teams. For example, the control team might organize a subgame on the sidelines to focus the teams on certain key questions. Or, if a player team is unable to focus its discussion on the key issues, the control team could give the players a nonauthoritative position on these issues which they can use as the basis for more focused discussion.

In summary, other kinds of games and role-playing activities provide a number of useful suggestions for moving players more effectively into future worlds in competition planning games. Among the more promising methods are the following:

- Psychodrama techniques to reinforce the sense of the players that they are in a different world, to reinforce specifics of that new game world, and to sustain the realism of the game world across breaks in game play.
- Development of explicit victory conditions for competition planning games.
- Use of a mix of players that has a high proportion of people with a demonstrated track record of effectively assuming their assigned roles in path games and who have the proven ability to lead other players into future game worlds.
- Consideration of the backgrounds of individual players when designing competition planning games, to ensure that the details of future game worlds are sufficiently authentic in light of the player's real-life experience that the players find it easy to accept these game worlds.
- Involvement of the players in creating the details of their game roles.
- Beginning competition planning games with a move set in the historical past.

6.3.2 Reducing the Resources Required for Competition Planning Games

A path-style competition planning game involves considerable pregame and postgame activities, as well as operation of the game itself. Resources in the form of people, funds, and time are involved in all three stages of a competition planning game. Pregame activities include design of the game, identification of players and the issuing of invitations, preparation of game materials, conduct of dry runs, and briefing the users of the game results on the game design. As indicated in Figure 9, which reflects SAIC's experience in staging path games for the European Conflict Analysis Project (ECAP), pregame activities can involve up to eight people, take up to eleven weeks, and cost as much as five man-months.

Resources required for actual game play depend on the number of players, controllers, and analysts involved and on the duration of the game. As indicated in Figure 9, on the order of forty people can be involved for three days, resulting in a cost of over four man-months, assuming only two-thirds of them must be paid with game funds.

Postgame activities include analysis, preparation of a final briefing, and conveying to the users the game results and planning conclusions. SAIC's ECAP path gaming experience suggests that this phase could involve eight people, take three weeks, and cost on the order of a man-month. The kind of competition planning games discussed here, where extensive analysis and a final report are needed, could require more resources than the ECAP games.

ACTIVITY	PREGAME		GAME	POSTGAME	TOTALS
	PREPARATION OF GAME DATA, PLAYER SELECTION, DRY RUNS		PLAY OF GAME	DEVELOPING GAME RESULTS/ LESSONS LEARNED	
	INITIAL GAME DESIGN				
● NUMBER OF PEOPLE	3 FOR 1.5 DAYS/WK 5 for HALF- DAY/WK	3 FOR 2.5 DAYS/WK 5 FOR HALF-DAY/WK	40 FOR 3 DAYS (2/3 PAID)	3 FOR 1.5 DAYS/ WK 5 FOR HALF-DAY/ WK	3 STAFF + 5 CONSULTANTS (+ PLAYERS)
● DURATION	3 WEEKS	8 WEEKS	3 DAYS	3 WEEKS	4 MONTHS
● LEVEL OF EFFORT	1 MAN- MONTH	4 MAN- MONTHS	4 MAN- MONTHS	1 MAN- MONTH	10 MAN- MONTHS
● COST OF PEOPLE (CONTRACTOR COSTS)	\$10 K	\$40 K	\$40 K	\$10 K	\$100 K

Figure 9. Why path games have cost so much.

If the objective was to involve a comparable number of experts at relatively low cost to identify plausible competition moves and countermoves and to determine the implications for candidate U.S. competition goals and strategies, other interactive techniques could be substituted for path games. For example, using the same resource estimation methods as we used in developing Figure 9 and assuming twenty experts are to be involved, preparation and review of a briefing or a point paper might involve twenty-two people, require a few days, and cost about one man-month. A report based on a single brainstorming meeting of twenty experts or a summary of individual interviews with these experts would require comparable resources (i.e., about one man-month).

But path games have unique attributes for competition planning support, as well as higher costs compared with other interactive analysis techniques. The most important attribute of path games is the adversarial relationship among the teams that is important for generating an imaginative set of moves and countermoves. This is absent from other analysis methods. Other unique path game attributes also are important for competition planning: the explicit play of institutional or bureaucratic perspectives, the potential to move game players into a common future game world that can be quite different from today's competitive environment, and the ability to keep players focused intensely on a specific set of issues for several days.

Thus, the challenge is to preserve the unique attributes of path games but to reduce their costs. Our work with path games and our cost-reduction analysis indicate that the amount of experience that game designers and analysts have with both path games and the topics on which these games are focused is the critical determinant of the resources needed for path gaming.

We examined a number of ways to reduce the manpower, time, and costs required to stage path games, evaluating them based on the experience of both SAIC and others with games. Some of these methods would reduce costs without reducing significantly the realism of the simulation of future competitive environments or without in other ways reducing the usefulness of path games for competition planning. Other methods cut costs, but sacrifice too much in path game effectiveness. Discussion of both kinds of resource-reduction methods is instructive.

We first discuss methods for reducing the required resources without a major reduction in the utility of path games for competition planning. Using these resource-reduction measures, we reestimated the resources needed for a path game as shown in Figure 10, reducing the number of people involved from thirty to twenty, reducing the total time required from four months to one month, and reducing the cost from ten man-months to three man-months, as compared with the ECAP game resources shown in Figure 9.

Pregame activities involve design of the game and preparations to implement the game design. Resources for game design can be reduced by selecting a game topic that supports an already on-going analysis of a substantive issue and using people who are already involved in this analysis to design the game, thus avoiding duplication of the analysis learning curve with a new set of game designers. To limit the collection of possibly extraneous data for game support, the game design should be centered on an explicitly-designated set of problems or interteam tensions that are to be examined. For example, a game designed to evaluate a candidate set of U.S. competition goals and strategies will probably cost less than one intended to explore the future competitive environment in Asia, because of the more focused nature of the former. Finally, use of a real-world model (e.g., the High-

ACTIVITY	PREGAME		GAME	POSTGAME	TOTALS
	INITIAL GAME DESIGN	PREPARATION OF GAME DATA, PLAYER SELECTION, DRY RUNS	PLAY OF GAME	DEVELOPING GAME RESULTS/ LESSONS LEARNED	
● NUMBER OF PEOPLE	2 FOR 3.5 DAYS/WK 4 FOR 2 HALF-DAYS/ WK	2 FOR 3.5 DAYS/WK 4 FOR 2 HALF- DAYS/WK	20 FOR 2 DAYS (HALF OF PLAYERS FREE)	2 FOR 3.5 DAYS/ WK 4 FOR 2 HALF- DAYS/WK	2 STAFF + 4 CONSULTANTS (+ PLAYERS)
● DURATION	1 WEEK	2 WEEKS	2 DAYS	1 WEEK	1 MONTH
● LEVEL OF EFFORT	1/2 MAN- MONTH	1 MAN- MONTH	1 MAN- MONTH	1/2 MAN- MONTH	3 MAN- MONTHS
● COST OF PEOPLE (CONTRACTOR COSTS)	\$5 K	\$10 K	\$10 K	\$5 K	\$30 K

Figure 10. Reducing the cost of path games while retaining their special attributes.

Level Group as a NATO body involved in nuclear force planning) to help answer questions about the game design can reduce design resources by focusing the game designers directly on the substantive issues under consideration.

Major improvements in game preparation efficiency also are possible, primarily by building on experience with related games and analyses:

- Use people for game preparation activities (data development, player selection, assembly of game materials, dry runs, conduct of user briefings) who understand path gaming, understand the substance of the issues under examination and the decision structures to be emulated by player teams, and familiar with the roles to be assumed by players.
- Develop standard templates or checklists for use by both the control team for deriving analytic results and the player teams in presenting conclusions and recommendations.
- Identify at an early stage people to whom postgame briefings will be given and the types of briefings to be presented. Develop checklists and other game materials that facilitate efficient preparation of these briefings.
- Use material prepared for previous competition planning games as models for game materials to support a new game.
- Select players who are experienced with role playing in path games, who understand the substantive issues to be examined in the game, and who will play in the game at no added cost to the competition planning staff.

Resources for the game itself can only be reduced by using fewer people, paying for only a subset of these people, and playing shorter games. In Figure 10, we assume that competition planning games generally will be part of a larger, ongoing analysis of U.S. competition goals and strategies and that economies can be

gained by building on this experience base (unlike the case of the ECAP games underlying the data in Figure 9). Further, we assume that half the players will come from government offices at no cost to the competition planning staff. Additional reduction in the time needed for game play can be gained by limiting the debriefs of player teams to issues of substance, eliminating the debriefs on game process that sometimes are conducted.

Finally, reduction in the resources required for postgame analysis can be achieved by involving the users of the game results in developing and critiquing these results, eliminating some of the analytic middlemen, so to speak. These results would be documented in a briefing, rather than in a technical report, further reducing cost and time.

The resources illustrated in Figures 9 and 10 probably bound the resources required for a competition planning game. Except when a series of games is conducted around minor variants of the same game, three man-months of effort in a period of one month is probably a lower bound on game resources, assuming that the game builds on the experience and results of a larger, ongoing competition planning analysis and that the game designers, analysts, and some of the players are members of an experienced cadre that supports competition planning with path games. The analysis of gaming resources summarized here indicates that it should be possible to conduct competition planning games at a cost of no more than ten man-months each, and generally substantially less.

We considered and rejected other methods for reducing the manpower, time, and costs for path games for competition planning. These other methods and the reasons for rejecting them are summarized as follows:

- Use a previous game design with little or no change for a new game (no two games are sufficiently alike to do this).
- Develop only the data and game materials needed for team briefings, wall charts, and a short game book for each team (the game would not simulate enough aspects of the competitive environment with sufficient authenticity).
- Restrict the dry run to a single move over half a day (excessive risk that the dry run would not simulate the competitive environment with sufficient authenticity to test the game design adequately).
- Use players who do not cost the government anything, but who do not have the required experience with path games or the competition planning issues under examination (excessive risk that the game would not simulate the competitive environment with sufficient authenticity and that team play would be of doubtful analytic value).
- Limit game play to one day (insufficient time to develop moves and countermoves over a two-decade or more game period).
- Require players to do their own administrative work such as recording a chronology of ideas or keeping logs (not the most productive use of the time of expert players).

By way of summary, we have discussed techniques that will reduce the manpower, time, and funding resources needed to conduct path games for competition planning, but which appear unlikely to reduce materially the realism of the simulations these games carry out. SAIC's work in designing and running path games indicates that the experience of game designers, players, controllers, and analysts with both path gaming and the substantive issues under examination is the largest single factor contributing to cost reduction without sacrifice of analytic effectiveness. This suggests that a special cadre of competition planning personnel should be established to design and run competition planning games. It also suggests that a series of games in support of competition

planning should be structured in such a way as to take advantage of learning-curve cost reductions through building on past gaming and analysis experiences related to the same general topic.

6.3.3 Other Research Topics

We close this chapter with a brief discussion of three additional research topics related to competition planning games.

The first is the issue of how to transform the results of one or more move/countermove games into estimates of the future state of the U.S.-Soviet military competition. As discussed above, an important output of games that evaluate a set of U.S. competition goals and strategies is the evolution of the state of the military competition over two decades or more as the United States pursues this set of goals and strategies in the context of moves or countermoves by the USSR and third players. Especially important is the evolution of the U.S.-Soviet military balance and the competitive positions of the two sides.

The evolution of the state of the military competition will not fall out of competition planning games as a natural product; effort is required by the control team or analysis team to derive this information from the games. The natural focus of move/countermove games or path games for competition planning will be on how well the U.S. strategy performs and the extent to which each side is able to achieve its goals. It is easier to assess the strengths and weaknesses of alternative goals and strategies based on competition planning games, and especially to weed out poor goals and strategies, than it is to understand what state is likely to result if the United States pursues a given set of goals and strategies.

There are two difficulties:

- The moves and countermoves of competition planning games are not likely to provide all the political, economic, technological, and military information needed to estimate new military balances and competitive positions resulting from game play. Assumptions or off-line analysis will be needed about relevant factors not explicitly gamed by the teams.
- A range of plausible future states of the competition will be associated with a given set of U.S. goals and strategies, because there is a range of plausible Soviet and third player moves and countermoves.

Derivation of a range of plausible future states is an important analytic function associated with competition planning games. Some candidate U.S. goals and strategies probably can be eliminated based on game play alone, without the need to project the resulting future states of the competition. It is unlikely, however, that merely observing the interplay of U.S., Soviet, and third player moves and countermoves will lead to a single, obviously superior, set of goals and strategies. Understanding the bounds on the unintended consequences of goal and strategy sets that are not eliminated early in the series of games will be a key evaluation criterion. Even if a single set of U.S. goals and strategies does emerge from the game moves and countermoves as superior, competition planners will want to know what unintended consequences could result, based on examination of the plausible range of future states of the competition associated with that goal and strategy set.

Thus, research is needed on specific techniques for converting the play of competition planning games into estimates of the future U.S.-Soviet military balance and competitive positions. One approach to explore is ways for the control team

or the analysis team to make quick mini-assessments of changes in the state of the competition resulting at each move of the game, starting from the detailed assessment of the current state that should be part of the competition planning process. The control or analysis team would have to supplement information derived from game moves with assumptions about or forecasts of the other relevant political, economic, technological, or military factors. This point-estimation procedure might be augmented with estimates of a range of plausible future states by conducting a series of games, each of which plays out one bound on the range of plausible Soviet or third party moves. Or a series of games could evaluate the same candidate set of U.S. goals and strategies, but with alternative assumptions about the future course of the Soviet economy (as outlined in chapter 6.2 above) or about other factors that affect the future state of the competition.

A second topic for research is how to increase the productivity of competition planning games by increasing the number of interesting variants on U.S. and Soviet goals and strategies that can be evaluated in a fixed number of games. It is possible, for example, to think of a "branch and bound" approach to evaluating candidate U.S. goal and strategy sets, in which whole sections of related goal and strategy sets in a "tree" of goal and strategy sets are eliminated based on a few games focused at the upper end of the tree. Another approach is that of "analytic representation," in which only a single representative goal and strategy set from a family of similar sets is gamed, as a coarse screening. If a family of goal and strategy sets passes the coarse screening in this way, then individual members of that family can be evaluated further in subsequent games. A third approach is to modify a candidate set of U.S. goals and strategies based on the results of game play, then evaluate the modified goal and strategy set by replaying only selected moves of the original game.

A final research topic is how to reflect the results of past competition analyses in future games in practical, efficient ways, so that the entire path gaming process in support of competition planning undergoes learning as the competition planning process itself becomes more sophisticated over time. The means for capturing and archiving in games the results of past competition analyses need not be particularly exotic; they probably have to do with scenario updates, ready access of the control, analysis, and player teams to files of past analytic results, improvements over time to the data bases from which game materials are prepared, and the like.

7. MILITARY CONTINGENCY ANALYSIS

Military contingency analysis uses combat models for a two-sided campaign analysis 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. This chapter describes the concept of contingency analysis and its role in competition planning, and discusses research needed to improve the contributions that contingency analysis can make to competition planning.

7.1 THE CONCEPT OF CONTINGENCY ANALYSIS

As depicted in Figure 6 above, analysis to support competition planning starts with a diagnosis of the current state of the U.S.-Soviet military competition, depending heavily on the use of military balance assessments. Based on this diagnosis, a number of alternative U.S. competition goals and strategies to achieve these goals are developed for evaluation. Each of the candidate goal and strategy sets is subjected to the moves and countermoves of the USSR and relevant third players in one or more competition planning games (Soviet-style planning analysis provides key inputs to these games). One important output from the competition planning games is a set of plausible future states of the military competition associated with each candidate goal and strategy set.

At this point, the key analytic step is to rank the states of the competition associated with each candidate goal and strategy set according to U.S. preferences among states. This ranking should be one major basis for evaluating the candidate goal and strategy sets and either selecting one for implementation or modifying some for further analysis. 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.

This recap of the analytic process resulting in selection of a set of U.S. goals and strategies makes clear that the role of military contingency analysis in competition planning is to test future military balances in combat situations and rank these balance states based on the results. Contingency analysis would be applied to military balances as they exist at the end of competition planning games, but it could also be applied to balances at intermediate game moves, if necessary. Perhaps more importantly, since the combat adequacy of a given set of U.S. or Soviet forces depends in part on the specific war scenario in which these forces fight, the military balances resulting from competition planning games should be subjected to combat analysis in a wide variety of future scenarios or contingencies. For most evaluations, theater-level campaign models would provide the appropriate level of detail for contingency analysis, although theater-level models may need to be augmented by weapon-on-weapon or tactical engagement models, as discussed below.

Given the major role of military balance assessments in the diagnosis of the current state of the U.S.-Soviet competition, contingency analysis can have a secondary role in supporting this diagnosis.

Many DoD offices have the combat models, data bases, and analytic skills to carry out contingency analysis, but this kind of analysis has a sufficiently large role in competition planning that it is worth considering establishing a contingency analysis test bed, either with its own staff and analysis tools or as a formal mechanism for organizing existing DoD combat analysis capabilities in support of competition planning.

7.1.1 Contingency Analysis Test Bed

A contingency analysis test bed is an established means for testing future military balances in combat analyses, hence the name "test bed." The essential components of such a test bed for purposes of competition planning consist of the following:

- 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 analysis.
- Experienced modelers and analysts.
- A master set of future contingencies or war scenarios for use, with suitable modifications, in specific contingency analysis. This master set of contingencies should, like the models, be coordinated within DoD to the extent necessary to ensure their bureaucratic acceptability.
- The ability to develop new operational concepts for the future U.S. and Soviet forces being modeled in the contingency analysis. Employment concepts for future Soviet forces should, of course, reflect Soviet operational style and planning patterns that are not likely to change over time.

One way to establish this contingency analysis test bed is to set up a separate staff, with its own models, data bases, and

analysis capabilities. This test bed might be part of a larger competition planning staff, if such a permanent staff were created. Alternatively, a contingency analysis test bed could be established by drawing on existing DoD organizations to provide the models and data and to carry out the required analysis. In this configuration, however, it would still be necessary for some designated competition planning organization to maintain a master set of contingencies, ensure that appropriate models and data are used for the analyses, develop tasking for specific contingency analyses, and act as an interface between the contingency analyses and other aspects of competition planning.

To illustrate one component of the contingency analysis test bed that may be less obvious than the others, Table 3 lists a sample of contingencies that might be used to support competition planning. This set was developed by considering classes of war scenarios that plausibly could occur during the next two to three decades and that are sufficiently different from one another that, taken together, they span the set of wartime conditions that should be used to test or evaluate future U.S.-Soviet military balances. Therefore, understanding of trends in the competitive environment heavily influenced development of this contingency set.

Most of the contingencies shown in Table 3 have U.S. and Soviet forces directly fighting one another. Some may not involve the United States or Soviet Union in actual combat operations, but the intelligence, logistics, or weapons transfer support of each superpower to the antagonists would be affected by the way in which the U.S. and Soviet force postures changed over time as a result of the military competition. Finally, some contingencies in the table involve the United States or the Soviet Union in wars with third players, reflecting the multipolar nature of the competitive environment.

**Table 3. Sample set of contingencies to be used
in contingency analyses.***

- Large U.S.-Soviet intercontinental nuclear exchanges
- Limited U.S. or Soviet use of strategic forces to support regional wars:
 - Europe
 - East Asia
 - Southwest Asia
- Regional U.S.-Soviet wars in one or more of the following areas, involving nonnuclear (including chemical) and possibly nuclear operations:
 - Major attack in Europe, including the flanks
 - Limited attacks in Central Europe or on one of NATO's flanks
 - East Asia
 - Southwest Asia
- U.S. assistance to the People's Republic of China in one or more of the following contingencies:
 - Sino-Soviet war
 - Sino-Indian war
 - Sino-Vietnam war
- U.S. assistance to countries attacked by the People's Republic of China
- War involving the United States and well-armed lesser powers (nonnuclear, chemical, and possibly nuclear operations):
 - South Korean-North Korean war
 - Persian Gulf war
 - Arab-Israeli war
 - Indian-Pakistani war
- U.S. military assistance or operations in Central America (possibly including Mexico):
 - Counterinsurgency operations
 - Support to insurgents
- U.S.-Soviet war in space associated with any of the above contingencies
- U.S. counterterrorist operations

* This is a menu of candidate contingencies. Only a select subset would be used for any particular contingency analysis.

The contingencies in Table 3 are not meant to be predictors of the future. Indeed, U.S. readiness to respond to a contingency is the best way to deter its outbreak. Nor are these contingencies meant to guide overall DoD force planning. They are, however, meant to be used singly or in appropriate combinations to test and rank future U.S.-Soviet military balances as an aid to competition planning.

In addition to having a master set of contingencies, as illustrated in Table 3, the contingency analysis test bed also should have a brief characterization of each contingency, if only as a checklist for review and appropriate modification when any of the contingencies are used for analysis. This characterization should include statements of who actually is fighting, the alignments of other key countries, and the initial conditions of the war (especially the amount of warning time and what other wars, if any, are taking place elsewhere).

Four types of models are needed for the contingency analysis test bed:

- Theater-level campaign models would normally be used as the primary type of contingency analysis model. As discussed in chapter 3.10, interactive campaign models appear to be best suited for this purpose, to provide the flexibility to adapt to new contingencies and new force balances.
- A library of weapon-on-weapon and few-on-few tactical engagement combat simulations would be needed to develop input parameters for the theater-level campaign models, based on the details of the force balances being investigated.
- Force generation models or simulations may be needed in order to take adequately into account the warning, mobilization, and reinforcement aspects of various contingencies.
- As discussed in chapter 4.10, the Simnet system has the potential, with adequate development, to test new

weapon concepts, new weapon systems, or new combat doctrine in realistic, two-sided combat situations.

7.1.2 Carrying Out a Contingency Analysis

Contingency analyses can consume a substantial amount of resources. How can they be used to support competition planning with relative ease, speed, and efficiency, at a level of detail appropriate for competition planning? In chapter 7.2 we discuss research approaches to reducing the time and costs associated with contingency analyses. Methods for the efficient focusing of contingency analyses on DoD planning problems are, however, available now; these are discussed here.

The key to efficient contingency analyses for purposes of evaluating military balances is to concentrate on analysis of the opposing force capabilities that are most relevant to war outcomes in various scenarios. The most relevant opposing force capabilities are those brought to bear in engagements that are critical for determining the outcomes of the contingencies under examination. Concentrating only on the critical engagements in these contingencies will eliminate unnecessary detail in the analysis and serve to organize the detail that is important.

Thus, we propose essentially three steps for carrying out a contingency analysis:

- First, identify the critical force engagements in each contingency, as discussed in chapter 4.1 (see especially Figure 8). This can be done by reviewing analyses and wargaming results, working through the campaign dynamics of the contingency with experts or by means of campaign analyses, and reviewing contingency representations in the form of war diagrams. This last is a technique developed by SAIC that is discussed in more detail below.

- Second, organize an analysis plan centered on these critical engagements. That is to say, determine which one-on-one, few-on-few, and theater-level campaign analyses of future opposing forces in each critical engagement are needed in order to determine the implications of the military balance under examination for war outcomes in various scenarios.
- Third, draw upon already completed analyses and initiate new campaign analyses as needed to support this analysis plan.

War diagrams can contribute to this analysis process. A war diagram is an analytic representation of the major combat activities in a war or a campaign plan (see Figures 11 and 12 for examples), showing the combat interactions of two sides as a war (or its visualization in a campaign plan) unfolds.

More specifically, a war diagram is a PERT network that represents time-driven combat processes such as pre-D day mobilization, air campaigns, or ASW operations, in which operations take place over a substantial period of time. Thus, a war diagram consists of nodes connected by arcs. Each node represents a milestone to be achieved by one side or the other (e.g., attack submarines moved from peacetime positions to wartime operating areas, four carrier battle groups marshaled, or the carrier battle force moved to within strike range of targets in Northeast Asia). An arc connecting two nodes in the war diagram represents the number of days expected to be needed to go from one milestone (or node) to the other. Parallel arcs represent combat activities that can proceed independently of one another, or simultaneously. Arcs that are connected in series represent combat activities that must be carried out sequentially.

If the war diagram is overlaid with the X-Y axes of a Cartesian coordinate system, with the X-axis representing time in days, the nodes in the diagram should be positioned relative to the

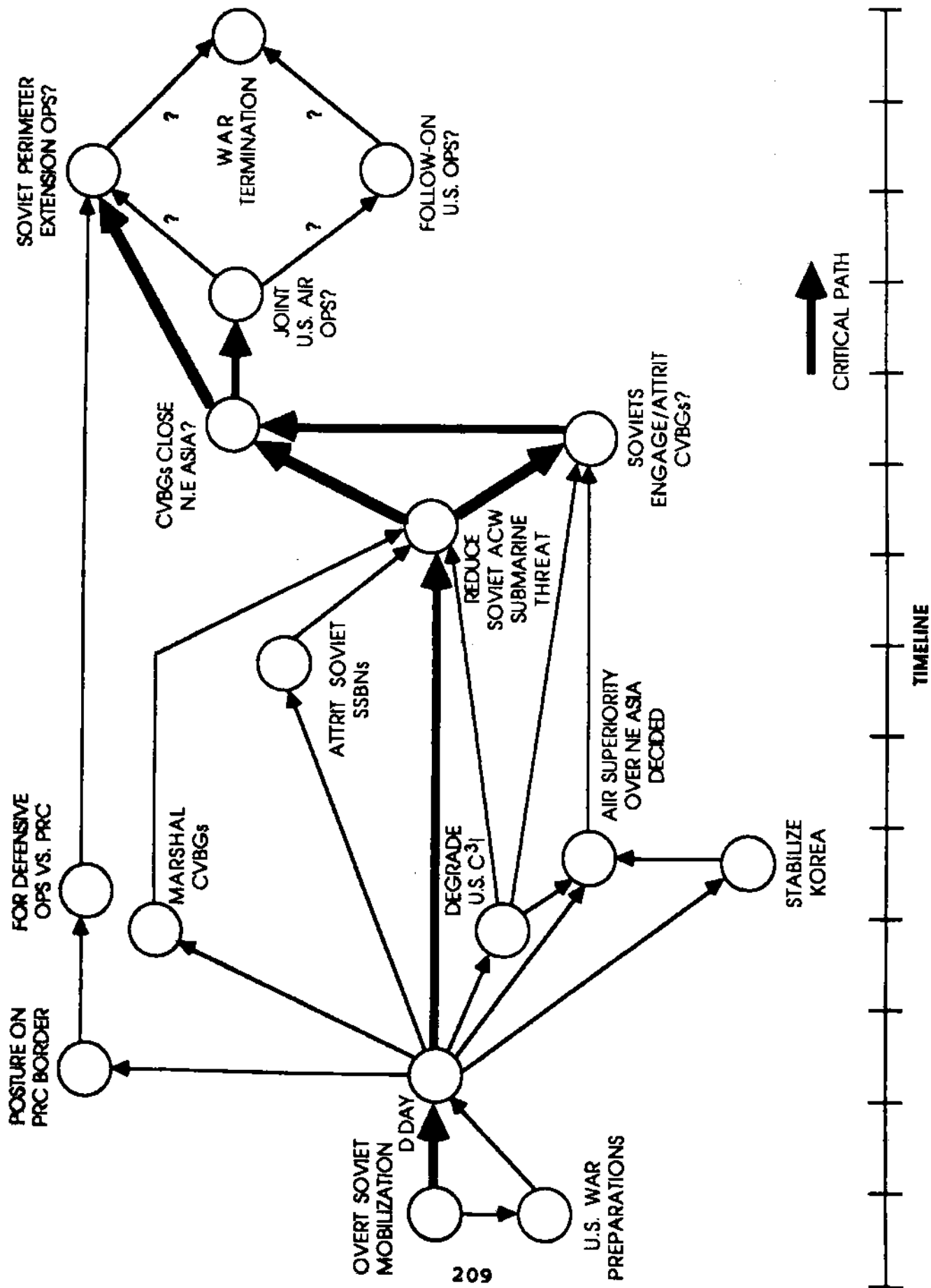


Figure 11. Expected course of the Asia-Pacific part of a global war (early 1980s).

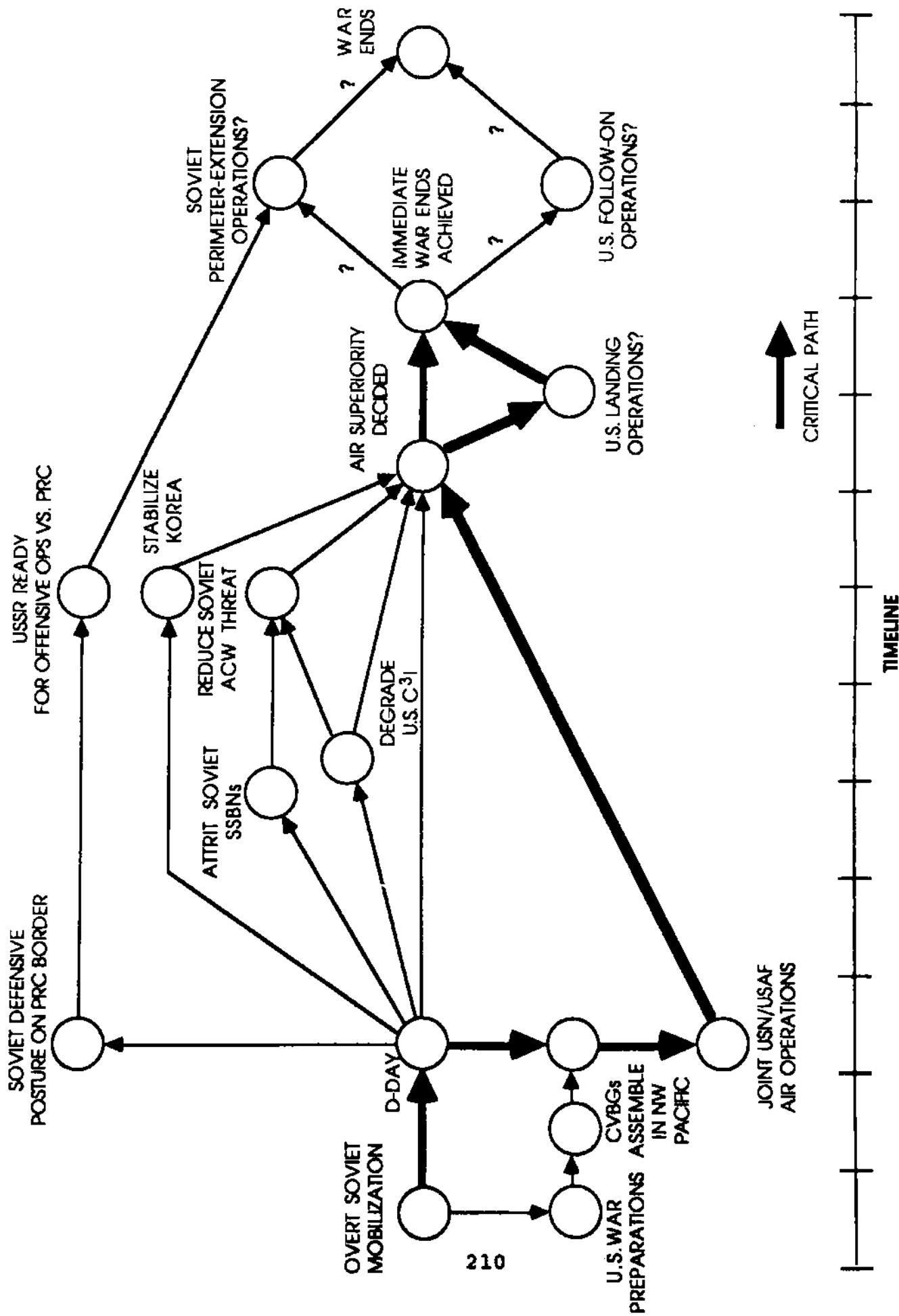


Figure 12. Expected course of the Asia-Pacific part of a global war (1988).

X-axis so as to show the time at which each milestone is expected to be reached (e.g., D-10, D+21). Alignment of the nodes with the Y-axis (which has no dimension) can be adjusted to facilitate uncluttered drawing of the arcs.

Constructing the war diagram as a PERT network allows one to use standard network analysis techniques to determine the critical path through the network (i.e., the subset of combat milestones that determine the time required to reach the end of the war) and the expected duration of the war or its distinct phases. Such techniques also can be used to perform sensitivity analyses to determine how the war diagram must change in order for some other subset of milestones to become the critical path.

War diagrams can be used to represent any of the following distinct entities:

- A Blue campaign plan showing Blue's image of how the war would be fought including planned Blue operations and operations Blue assumes that Red would conduct.
- A Red campaign plan showing Red's image of how the war would be fought, including planned Red operations and operations Red assumes that Blue would conduct.
- The expected course of a war, basing on campaign analyses that determine the major Blue and Red combat activities affecting the war's outcome, their interrelationships, the likely results of these activities, and the expected times required to reach key combat milestones.

War diagrams can contribute to several analytic objectives, including the following:

- Show the important relationships among the combat activities of each side and between the opposing combat activities, particularly as these relationships affect the course of the war and its outcome.

- Show how the relationships among combat activities change as a function of different initial war conditions or different strategic choices.
- Show how relationships among combat activities change as a function of changes over time in Blue and Red force posture trends and asymmetries.
- Through the above, serve as an analytic tool for determining which engagements or variables have strong effects on war outcomes (i.e., are critical engagements or variables).
- Contrast Blue and Red images of how a war would be fought and help determine the implications of asymmetries in these images.
- Display in summary fashion the results of campaign analyses.
- Aid in assessing force posture trends and asymmetries and in communicating these assessments to DoD officials.

More specifically, war diagrams can contribute to contingency analyses by displaying in summary form the results of existing campaign analyses, thus helping to identify critical engagements, to show their relationships, and to organize a contingency analysis plan. War diagrams can also help to interpret the results of theater-level campaign analyses and the supporting engagement analyses.

Figures 11 and 12 are examples of war diagrams showing the expected course of the Asia-Pacific part of a global U.S.-Soviet war; no units are shown on the timelines in order to keep the figures unclassified. Figure 11 shows the key operational milestones and their relationships assuming the U.S. commander-in-chief, Pacific (USCINCPAC) concept of operations that prevailed in the early 1980s, in which the carrier battle groups (CVBGs) would not move to within strike range of Soviet territory until ASW operations had reduced the Soviet submarine threat to a safe level.

Figure 12 assumes the USCINCPAC campaign concept of the late 1980s, which reflects the influence of the U.S. Navy's maritime strategy. In this case, the carrier battle groups could be in position to strike Soviet territory as early as D day.²

These war diagrams support the identification of the critical nonnuclear engagements: the Northeast Asia air campaign, the naval campaign, and the Soviet counter-C³I campaign (the figures assume no use of nuclear weapons; variants can be drawn for cases of in-theater nuclear exchanges). By comparing the two diagrams, one can also gain insights into how to organize analyses pertaining, for example, to the naval campaign. If it is assumed that USCINCPAC operates his carrier battle groups in accordance with the early 1980s concept, then U.S. ASW engagements with Soviet anticarrier submarines are of most interest. If the 1988 campaign concept is assumed, three types of naval engagements are important: Soviet Naval Aviation raids against fleet air defenses, Soviet submarines against CVBG local ASW and cruise missile defenses, and U.S. broad area ASW operations against Soviet submarines.

War diagrams can be useful even if extensive campaign analyses are not available from which to construct them. In this case, war diagrams add structure to the judgments of experts or to combinations of analysis and expert judgment. They can be used to support and direct debate among experts about contingencies and to identify the most important campaign analyses to perform if additional analysis resources are available.

7.2 RESEARCH TOPICS

The state of the art of combat modeling is generally well developed and mature for the analysis of the combat effectiveness of current and near-term forces. Current models and the associated data bases are less well-suited for evaluation of future military

balances in a wide variety of war scenarios. A contingency analysis test bed using today's models, data bases, and methods would be adequate to support competition planning because the state of the art of long-term planning for the military competition is itself in a relatively primitive state. But, as competition planning becomes more sophisticated, DoD capabilities for the kind of contingency analysis described here will have to improve.

At least four topics require research in order to improve the DoD ability to carry out contingency analysis in support of competition planning:

- 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 analysis, so it does 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.

7.2.1 Adaptivity of Combat Models

The military force balances of two or more decades into the future that will emerge from competition planning games are likely in many cases to be quite different from those of today. Moreover, the analyses described above will require evaluation of these force balances in a wider range of combat scenarios than generally are modeled today.

A problem in carrying out these evaluations is that most of today's combat models are structured to reflect today's military force balances and a few canonical planning scenarios. It is difficult to adapt these models to possibly drastically different future force mixes and balances or to a wider set of war scenarios. Further, the structure of most of these models is symmetric with regard to U.S. and Soviet force employment, making it difficult or impossible to model the employment of Soviet forces in ways that are consistent with Soviet strategy, operational art, and tactics. In particular, three characteristics of today's combat models and the supporting analysis base limit the adaptation of these models to new and different force balances and scenarios:

- Insufficient experience and base of analysis for modeling force mixes and force balance regimes that are quite different from those of today.
- The relatively inflexible structure of most combat models.
- The lack of campaign models for certain types of contingencies that are important for competition planning, primarily space warfare and low intensity conflict.

Making progress on these problems is important for both competition planning and for more traditional DoD planning activities. The future U.S.-Soviet military balance is a major component of the future state of the competition and U.S. selection of competition goals and strategies should be determined in part by U.S. preferences for the future military balances likely to result from candidate goals and strategies. Consequently, it is important that the evaluation of future military balances be based on methods that are comparable in sophistication to those increasingly being used to assess today's military balance -- namely, the use of combat analysis to assess the balance in terms

of its impact on war outcomes, rather than in terms of order of battle comparisons.

The Department of Defense would need to improve the adaptability of its combat models even if it were not carrying out long-range planning for the military competition. Several current trends -- arms control, technology, strong downward pressures on DoD budgets, and relaxed East-West tensions -- indicate that the future U.S.-Soviet force balance is quite likely to be different from today's and that U.S. forces must, in the future, be prepared to fight in quite different kinds of contingencies than have been considered in past force planning. More adaptable combat models are needed to help guide technology development, weapon system acquisition, force sizing and deployment decisions, and development of operational plans and doctrine in this changing security environment.³

Several research approaches to reducing the impediments to model adaptivity appear promising. Ways to reduce the inflexibility of the structure of most current models are reasonably well understood, but will require substantial time and funds to implement. For competition planning purposes, priority should be given to the development and use of highly adaptive theater-level campaign models as the primary vehicle for contingency analyses of the sort discussed in this section. For the near term, at least, this means placing heavy emphasis on models that have a very general campaign structure, with most details provided by the user through interactive man-machine interfaces. These theater-level campaign models should be structured so as to permit the employment of Soviet forces to be modeled in ways that are consistent with the fundamental precepts of Soviet planning. Further, new campaign models or comparable analysis concepts need to be developed for space warfare

(especially as military operations in space affect terrestrial campaigns) and for low intensity conflict.

The use of detailed computer simulations in contingency analyses should be confined to one-on-one and few-on-few models of engagement types that are not likely to change in their fundamental structure over the next several decades (e.g., armor/anti-armor engagements). At the same time, development of new types of engagement models should be initiated in mission areas where technology could change the basic structure of the engagements (e.g., stealthy air operations in a hostile air defense environment).

Actual evaluation of future force balances that differ in major ways from today's poses more difficult research challenges, even if the structural flexibility of combat models is improved. For at least the near term, such evaluations will have to depend heavily on the judgment of suitable experts, supported by concepts and techniques like critical engagements, war diagrams, and engagement analyses. Experts should focus on translating new military force balances into new Blue and Red operational concepts and into the implications for the structure, pace, duration, and critical engagements of future campaigns involving these forces. Research should address systematic methods for using experts in this capacity, the appropriate mix of expert judgment and analysis, and ways to build up the base of experience and analysis relevant to evaluating force balance regimes that are quite different from today's.

7.2.2 Reducing the Time and Funds Needed for Contingency Analysis

Historically, the analysis of the combat effectiveness of future forces can take months to years to organize and execute.

A certain amount of this is inevitable, given the complexity of the issues involved in competition planning. But, the Department of Defense spends large sums each year on studies and analyses, and research to improve the productivity of contingency analyses can help use these funds more efficiently. Moreover, research also should be directed at reducing the amount of time needed to organize and carry out contingency analysis, which probably is excessive relative to the time periods associated with other analytic support to competition planning.

Three general research approaches appear promising: to make better use of past analyses, to focus the analysis on the right issues at an early stage, and to carry out contingency analyses only in enough detail to support competition planning.

Perhaps the greatest marginal gains in improvement can be made by establishing an archiving system to provide an institutional memory for studies and analyses that may be relevant to competition planning, in order to reduce analysis time and costs by drawing on past work where appropriate. Such a system should provide for recall of past research, for integration of this past research with ongoing competition planning and analysis, and for awareness throughout DoD planning organizations of the availability of relevant past studies.

The Defense Nuclear Agency maintains such an institutional memory for nuclear effects data, research, and analysis through a contractor-operated archive, which provides one model for an institutional memory for contingency analysis and related studies. Applying this model to competition planning, there would be a small staff charged with collecting and maintaining relevant studies and data; indexing, keywording, and abstracting this material; identifying and documenting the assumptions of studies and the sources of data (for transparency);

distributing periodic surveys of material relevant to current competition planning issues; and facilitating the retrieval and use of relevant material for new contingency analyses.

The RAND Strategy Assessment System or other interactive campaign models may have a role to play in interfacing between this archive and its users. Scenarios, operational concepts, engagement results, critical engagements, and the like could be incorporated into these models and updated from time to time, based on material contained in the archive.

The time and funds required for contingency analysis in support of competition planning also can be reduced by ensuring that this analysis is focused on the correct issues at an early stage. The analysis sequence discussed in this report and depicted in Figure 6 is designed to achieve this result, but analysis experience and research are needed to refine the detailed methods for ensuring the relevance of contingency analyses.

Equal in importance to relevance is the conduct of contingency analysis in only as much detail as is needed to support competition planning, since excessive detail in the analysis almost always will translate into unnecessary costs and excessive time. Evaluating future military balances that are outputs from path games should not be any more precise or detailed than is consistent with the uncertainties in these projected future balances. Concepts and techniques like critical engagements and war diagrams can help to manage the level of detail in contingency analyses, but research and experimentation are needed both to develop additional methods and to understand best how to apply them.

7.2.3 Generalizing from the Details of Contingency Analyses

The kind of contingency analysis described here examines many operational details, even if the analysis is focused on theater-level campaigns. There potentially will be a large number of force engagements, the analysis will encompass several different war scenarios, and there will be significant uncertainties about future forces, their performance, and the operational concepts for their employment. Moreover, while combat models may be adequate to indicate how forces will perform in various situations, they are not reliable predictors of war outcomes.

Accordingly, methods for generalizing from the many details and uncertainties associated with contingency analyses in a number of different war scenarios to an evaluation and ranking of future military balances are not well developed. In fact, few analyses have addressed this problem to date. While the ranking of future force balances in some cases may be obvious from inspection of the contingency analysis, this will not normally be so. Even without a well-developed method for making these generalizations, contingency analysis will yield a more accurate ranking of future balances than will inspection of balances by experts. But, research on systematic methods to derive these rankings from contingency analysis should be pursued. One research approach could be to base these methods on critical engagements or mission areas that are common across many of the war scenarios.

7.2.4 Converting Simnet into a Contingency Analysis Tool

As discussed in chapter 3.10, the Simnet training system has the potential to be adapted for contingency analysis support to competition planning. This potential lies primarily in combat analyses of new weapon concepts in a realistic operational environment where the combat outcomes depend strongly on the

actions of human operators or the evolution of doctrine in response to new combat conditions and dynamics. Further, there may be utility in scaling up Simnet to theater-level campaigns provided the unique features of Simnet are exploited at this level:

- The integral role of human operators or commanders in this two-sided simulation.
- The realism of the combat environment in which the humans are placed.
- The realistic capability to disrupt and reconstitute C³I and surveillance in the Simnet combat environment.
- The ability of a properly programmed Simnet system to move people realistically into a regime of future force balances in future contingencies.
- Ease of programming new weapon concepts into a Simnet system.
- The capability of a Simnet system to zoom in on fine combat details when required for the analysis.

The distributed nature of Simnet systems also opens up the possibility of linking together operational commanders, policy makers, technologists, and competition planners in a single contingency analysis test bed on a routine basis.

However, development and operation of such a Simnet analysis and planning tool would be expensive. DARPA currently operates a Simnet-D facility for the purpose of supporting development of innovative Simnet applications, but the users of this facility must provide their own funds. Moreover, the Simnet concept sketched out above would eventually require its own facility and staff to support competition planning and other DoD long-range planning and analysis activities (e.g., development and evaluation of new weapon system requirements).

Whether the benefits would be worth the cost is not clear. The Department of Defense may want to carry out more detailed study of this concept, with development of a Simnet contingency analysis prototype if warranted by the study results.

ENDNOTES TO CHAPTER 7

1. See The Asia-Pacific Nuclear Balance (U), Draft Technical Report (San Diego, Calif.: Science Applications International Corporation, June 1, 1988), pp. 76-80, 82-87, 95-99, and Appendices B and C, SECRET-RD-NF-WN.
2. The figures are based on operational concepts outlined in Admiral James D. Watkins, "The Maritime Strategy," in The Maritime Strategy, Supplement to U.S. Naval Institute Proceedings, vol. 112, no. 1 (January 1986) and Robert S. Dudley, "Imperatives of the Pacific Frontier," Air Force Magazine vol. 71, no. 10 (October 1988).
3. See Commission on Integrated Long-Term Strategy, Discriminate Deterrence (Washington: U.S. Department of Defense, January 1988) and the reports of the supporting working groups.

8. CONCLUSIONS AND RECOMMENDATIONS

This volume sets forth a layered approach to planning for military competition and describes the kinds of analysis needed to support competition planning. The bulk of volume II consists of an evaluation of current analysis tools in terms of their ability to meet these analysis needs. The volume then goes on to discuss in more detail four of the most promising of these tools: military balance assessments, Soviet-style planning analysis, competition planning games, and military contingency analysis.

8.1 CONCLUSIONS

While we have covered considerable detail in this volume, the major conclusions can be summarized briefly.

To start, there has been little systematic research on the U.S.-Soviet military competition and on competition planning, so the area lacks even a standard terminology. Certain planning concepts are important for systematically analyzing and debating issues about the competition and for devising and implementing competition goals and strategies. These concepts are developed in volume I and applied the present volume. In brief, they are:

- The state of the military competition, embodying the U.S.-Soviet military balance, the competitive positions of the two sides, and the state of achievement of the more traditional U.S. peacetime political-military objectives such as deterrence, reassurance of allies, and the ability to resolve crises peacefully.
- A breakdown of the military competition into subareas for planning and analysis purposes. This breakdown should generally be regional in nature, but should also include at least one nonregional subarea: technology.

- The centrality of U.S., Soviet, and third player moves and countermoves over a period of two or more decades. This implies the need to focus strongly in competition planning on possible shifts in relative advantage over a long period of time and for use of Soviet-style analysis in competition planning.
- Portfolio management concepts to deal with future risks and opportunities in light of the considerable uncertainties associated with the future course of the military competition.

Such concepts as these are necessary for sound competition planning, but not sufficient. Given the complexity of the U.S.-Soviet competition and the multipolar environment in which it is carried out, and given the complex institutional nature of the Department of Defense, a layered process for competition planning is essential. This process can be organized in any of a number of ways, but it should provide for the following essential planning functions:

- Periodic surveys of the competitive environment to validate or revise the assumptions underlying U.S. planning for the competition.
- Development and periodic updating of a high-level strategic plan that would provide strategy guidance to competition planners and align U.S. commitments and resources in the competition.
- Statements (or periodic revisions) of more detailed goals and strategies in each subarea of the competition to which significant resources are to be committed.
- Formulation or updates of detailed actions to implement the strategies developed in higher layers. These actions would be developed and carried out through established DoD means such as the weapon system acquisition process or the operational planning process.

Our review of the kinds of analysis need to support military competition planning concludes that the following sequence of analyses should be carried out, with appropriate iterations:

- 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 analysis. 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.

Of the analytic tools surveyed in this volume, four have the greatest potential to support this analysis process: military balance assessments, Soviet-style planning analyses, competition planning games, and military contingency analysis. Military balance assessments should be the primary tool for diagnosing the current state of the military competition. Soviet-style planning analyses should be used to help understand what goals and strategies the USSR is pursuing, to determine the likely impacts of U.S. competition actions on the Soviet Union, and to identify a plausible range of future Soviet moves and countermoves in the military competition. Competition planning games and military

contingency analysis should be the primary tools for setting U.S. competition goals, for evaluating alternative U.S. competition strategies, and for evaluating portfolio management alternatives.

Other analysis tools also can contribute to competition planning, especially intelligence projections and assessments; regional political-military analyses; economic, demographic, technological, and military forecasting; logic and expert judgment; and operations analysis and engineering trade-off studies. These tools generally should be used in support of applications of the four major competition planning tools listed in the previous paragraph and discussed in detail in chapters 4 through 7.

It is natural to suppose that strategic planning tools used in business competition would be of value in supporting DoD competition planning. Our analysis indicates, however, their main utility lies in the broad concepts suggested by analogy with business strategic planning: the need to understand the strategic environment in which competition takes place; the use of analysis to identify the most important variables in the strategic environment and to formulate goals and strategies; the use of gaming to help understand what competitors might do; and the concept of portfolio management. We have incorporated these concepts into our recommended structure for DoD competition planning. We found more specific business planning and analysis tools to have little applicability to the military competition.

8.2 RECOMMENDATIONS

The foregoing conclusions and the research contained in this volume lead to several recommendations:

- The Department of Defense should take concrete steps to foster the competition planning concepts set forth in this report (state of the competition, the breakdown of the overall military competition into

regional subareas, the centrality of moves and countermoves, and portfolio management) through briefings, discussions, and requiring their use in devising and justifying competition goals and strategies.

- The Department of Defense should adopt the essential functions of our layered planning approach as the basic approach to competition planning. Initially, the functions embodied in these four layers should be introduced into existing mechanisms for competition planning. The Defense Department should, however, also study the advisability of instituting this layered planning process in a more formal way.
- Research should be initiated to improve military balance assessments, competition planning games, and military contingency analyses for competition planning purposes. Specific research recommendations are contained in chapters 4.3, 6.3, and 7.2.
- The recommendations of chapter 5.5 for institutionalizing the U.S. capability for Soviet-style planning analysis should be carried out.

GLOSSARY

Competition. A condition in which two or more rivals seek to gain the same object simultaneously; in which not all the rivals can gain this object, so there are winners and losers; and in which the vying of the rivals is governed by some sort of rules. In the context of the U.S.-Soviet competition, the term refers to the contest between the two superpowers for power and influence in world affairs.

Competition Planning. The process of analyzing the competitive environment, setting goals relating to pursuit of the competition, and developing strategies and plans of action for achievement of these goals.

Competition Planning Games. Planning games that specifically are focused on understanding the range of plausible U.S., Soviet, and third player moves and countermoves associated with a given set of U.S. competition goals and strategies. Competition planning games should also indicate the range of future states of the military competition that are likely to result from a given set of U.S. goals and strategies.

Competitive Action. An action taken in a specific subarea of the competition that is intended to achieve, or contribute to the achievement of, a specific competitive goal.

Competitive Advantage. A benefit attained in the long-term military competition by exploiting one's strengths or an adversary's weaknesses. Realizing a competitive advantage involves actions (e.g., the expenditure of resources) to convert strengths and weaknesses to tangible benefit in the competition. The concept of competitive advantage is dynamic. Such advantage can increase or diminish with time, and understanding the process of decline is an important analytical task.

Competitive Environment. All aspects of the world situation that (1) can affect the U.S.-Soviet military competition or other military competitions of interest to the United States and (2) are not controlled directly by the defense planning process within the executive branch of the U.S. government. Examples include economic, demographic, and technology trends; Soviet goals, strategies, and actions; and third player goals, strategies, and actions.

Competitive Goal. A specific objective in the long-term military competition to be achieved within a specific period of time. Such goals could involve influencing Soviet or third party investments or behavior in particular ways or achieving defined states in the future military balance in a particular region.

Competitive Initiatives. The ability to dictate the agenda or set the pace in a particular area of the competition, for

example by keeping an adversary reacting to one's actions instead of undertaking initiatives of his own.

Competitive Leverage. The ability to make disproportionately large gains in the competition in relation to the resources expended on a competitive action or strategy. Leverage may be measured in terms of an adversary's cost to respond, or the stresses imposed by an action or strategy on an adversary's military or industrial establishment.

Competitive Position. The ability of one side relative to the other to compete in the future. The concept of competitive position includes strengths, weaknesses, current competitive advantages, and who holds the competitive initiative in various subareas of the competition.

Competitive Strategies Initiative. An initiative by the secretary of defense to use the concept of competitive strategies as a long-range planning tool. This initiative was carried out through the competitive strategies council, which was chaired by the secretary of defense and consisted of top DoD civilian and military officials.

Competitive Strategy. A set of inter-related competitive actions which, pursued together, are designed to achieve competitive goals in one or more subareas of the competition or in the competition as a whole.

Contingency Analysis. Two-sided analysis of the performance of military forces in various military contingencies or war scenarios, with an emphasis on understanding how each side's forces affect the likely war outcome in each contingency. Combat outcomes in a contingency analysis can be used as a measure of the U.S. preference for future military balances and, therefore, the U.S. preference for future states of the military competition.

Critical Engagements. Those opposing force engagements in various war scenarios that most powerfully affect the course, pace, and outcomes of these wars.

Feedback. The process of monitoring a specific part of the competition planning process, adversary actions, or 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. Repetition of parts of the competition planning process or supporting sequence of analyses in order to take advantage of feedback.

Long-Term Military Competition. The military competition between the United States and the Soviet Union. This terminology is intended to highlight both the deep historical roots of this

competition and the need to look forward twenty years or more into the future in developing U.S. goals and strategies for competing effectively.

Military Balance Assessment. A net assessment of the balance of opposing military forces that consists of the analysis of past and projected future trends and asymmetries in this force balance and the evaluation of the relative combat capabilities of the sides in a range of plausible war scenarios.

Move/Countermove Games. Another term for competition planning games.

Planning Games. Politico-military games in which the simulated environment is a period in the future in which each side makes decisions about military research and development, acquisition, force deployments, arms control, and other aspects of peacetime force planning for the purpose of understanding the military force balances that are likely to result through a competitive process that plays out in a multipolar environment.

Politico-Military Gaming. Simulation of past, current, or future politico-military situations in which human players assume roles within the simulated environment. The players normally are organized into teams that may compete or cooperate with one another, within assumptions and constraints specified by the game scenario.

Portfolio Management. A set of planning techniques that is designed to limit or control the risks inherent in any one or more strategies or actions within a subarea of the competition or across several subareas. These techniques should also make it easier for the United States to exploit new opportunities for realizing competitive advantages when they appear. Examples of portfolio management techniques include multiple, partially overlapping, competitive goals and building into U.S. strategies and actions the ability readily to adapt to Soviet actions or other changes in the competitive environment.

Soviet-Style Analysis. Analysis by Americans (or other people not raised and trained in the Soviet system) that approximates as closely as possible the ways in which Soviet planners would analyze a given situation or problem, as a guide to understanding how they might act. The need for Soviet-style analysis in competition planning arises from the many important asymmetries between Soviet and Western analysis and planning methods that make it clear that a mirror-image approach to Soviet competitive initiatives and responses would be seriously misleading.

State of the Competition. The past, present, or future condition of the U.S.-Soviet competition. When used in reference to the military competition, descriptions of the state of the competition should include the state of the U.S.-Soviet military

balance, the competitive positions of the two sides, and the state of relevant elements of the competitive environment.

Subareas of the Competition. A component of the worldwide scope of competition planning that is suitable for detailed planning and implementation of competitive actions. Generally, subareas of the competition should be geographic regions, such as Europe or East Asia, but not exclusively so; technology is an example of a nonregional subarea.

Third Player. Any national actor that can affect significantly the U.S.-Soviet competition and that may also compete directly with the United States or the Soviet Union at times. Third players may be allies, friends, or adversaries of the United States or the Soviet Union, or may be neutral.

Third Player Leverage. The ability of a third player to influence excessively the ability of the United States or Soviet Union to compete with one another effectively. Examples of third player leverage are base access, diversion of superpower resources away from the superpower competition, or undue influence on superpower military doctrine or arms control positions.